The Combined Effects of Loneliness and Social Isolation on Mental Health in a National Sample of Older Adults

by

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Abstract

Social connections are important to maintain physical and mental health across adulthood. Loneliness and social isolation are global issues and are linked to negative mental health outcomes worldwide, especially among older adults. Past research focuses primarily on loneliness and isolation separately, though many older people experience them simultaneously. Also, there is a paucity of research examining the mechanisms through which combinations of loneliness and isolation result in poor mental health. My first objective examined how combined loneliness and social isolation affect psychological distress among a group of Canadian older adults, and how grouping this sample into four groups of loneliness (yes/no) and isolation (yes/no) may help identify which group(s) are at the greatest risk for distress. My second objective was to explore perceived social support and relationship satisfaction as potential mediators of the effects of combined loneliness and isolation on psychological distress.

I addressed these objectives with a cross-sectional national sample of 2,745 Canadian older adults, aged 55 to 101 years, who completed self-report measures of loneliness, social isolation, social support, relationship satisfaction, perceived physical health, and psychological distress. Those experiencing greater combined loneliness and isolation also experienced higher levels of psychological distress. For lonely older adults, experiencing isolation simultaneously led to clinically significant distress, but this was not true for those who were not lonely. Participants who were both lonely and isolated had the poorest mental health because they were less satisfied with their relationships, but not because they had less perceived social support. The present study has the potential to expand what we know about pathways through which combinations of loneliness and isolation may lead to poor mental health in older adults.

Keywords: older adults, mediation, mental health, loneliness, isolation, social support

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Strong social connections are integral to maintaining long-term mental and physical health (Holt-Lunstad et al., 2010; Martino at al., 2015). Their life-enhancing effects are as influential as a healthy diet and adequate sleep, and lead to reduced risk for depression, improved well-being, and longer life (Cornwell & Waite, 2009a). Conversely, loneliness and social isolation are linked to deleterious health and well-being outcomes worldwide (Fakoya et al, 2020; Hawkley & Cacioppo, 2010; Perissinotto et al., 2019), and older adults are among those most at risk for negative health outcomes related to social disconnection (Malcolm et al., 2019). Loneliness and social isolation have been identified as prevalent global issues (Holt-Lunstad, 2017; Yanguas et al., 2018); an estimated 10-50% of community-living older (65+) adults report feeling lonely (Freedman & Nicolle, 2020). Unfortunately, past research has focused on the effects of loneliness and social isolation independently, despite the fact that a subset of vulnerable adults experience them simultaneously. Further, relatively little is known about mechanisms or pathways through which combinations of loneliness and isolation result in poor mental health. The present study will address these research gaps to better understand, identify, and treat older adults suffering from varying levels of loneliness and social isolation.

Being socially connected has numerous physical and mental health benefits. Extensive evidence indicates satisfying social connections during adulthood are crucial contributors to good health, longevity (Holt-Lunstad, 2018; World Health Organization, 2018) and positive mental health outcomes (Shankar et al., 2015; Qualls, 2014). Positive social ties can lead to reduced risk for depression (Cornwell & Waite, 2009b), and reductions in unhealthy behaviors such as tobacco and alcohol use (Shankar et al., 2011). For older adults in particular, being well-

connected to social contacts can help protect against illness (Cohen & Wills, 1985; Santini et al., 2016; Steptoe et al., 2013) and reduce depression (Chang, et al., 2014).

In contrast to the benefits of social connection, research has documented clear physical and mental health risks among those who feel lonely or are socially isolated. This is concerning given the quantity and quality of social relationships appear to be declining over time. For example, the proportion of Canadian adults living in one-person households has quadrupled from 7% to 28% over the last three generations and it is estimated that one in four Canadians aged 65+ years lives alone (Tang, et al., 2018). Another study by McPherson and colleagues (2006) indicated that most commonly, people do not have a single person to confide in, down from an average of three confidants per person twenty years ago. This is of particular concern given the social benefits that we can receive from friendships and confidants in later life (McPherson et al., 2006) and because it is estimated that the Canadian older adult population aged 65+ years will grow by 68% over the next 20 years (Canadian Institute for Health Information, 2017). Therefore, considering that harmful health outcomes from social disconnection occur across the lifespan and especially among the aged, a thorough examination of loneliness and social isolation including their negative effects is crucial.

Loneliness and Social Isolation

Social isolation is broadly defined as an objective measure of social disconnectedness, a restricted social network, or a lack of social ties (De Jong Gierveld et al., 2006). This lack of social contact can lead to increased risk for cardiovascular disease, cognitive impairment, and mortality (Yanguas et al., 2018). Socially isolated adults tend to have poorer mental health and well-being and older adults have increased vulnerability for negative outcomes (Donovan & Blazer, 2020; Hawton et al., 2011).

Loneliness, as distinguished from social isolation, is generally understood as a subjective perception of being isolated, unsupported, or alone (Cornwell & Waite, 2009a; De Jong Gierveld, 2006; Rook, 1984a). It is associated with social frailty, which holds close ties with physical frailty and all-cause mortality (Yanguas et al., 2018). Individuals who experience frequent feelings of loneliness report elevated levels of negativity and anxiety (Hawkley & Cacioppo, 2011), depression (Heikkinen & Kauppinen, 2004), and cognitive decline (Barnes et al., 2004). The risk of loneliness seems to operate on a U-shaped curve in which the youngest and oldest adults are the loneliest (Luhmann & Hawkley, 2016; Nicolaisen & Thorsen, 2014; Pinquart & Sorensen, 2001).

Though separate concepts, loneliness and isolation have been linked to many similar and overlapping health outcomes (Hawton et al., 2011). For example, one landmark study examined mortality as a function of social relationships over an average of 7.5 years in more than 300,000 participants whose average age at the initial evaluation was 64 years (Holt-Lunstad et al., 2010). Results revealed that those with stronger social relationships, both in terms of structural (e.g., number of social contacts, living alone versus with others) and functional (e.g., perceived social support, perceived loneliness) supports, had a 50% greater likelihood of survival when compared to those with weaker relationships. This indicates that the influence of social relationships on mortality is comparable to significant health risk factors as obesity, smoking, and physical inactivity (Holt-Lunstad et al., 2010). Other research demonstrates that those who experience frequent loneliness or lack of social connections tend to suffer from higher rates of infections, cardiovascular disease, and cognitive decline (Cornwell & Waite, 2009b). Moreover, loneliness activates a physiological threat response leading to increased fatigue, fragmented sleep, and hostility (Yanguas et al., 2018). This perception of being alone reinforces negative thoughts and

feelings, resulting in a negative feedback loop which further isolates the individual (Cacioppo et al., 2009; Hawkley & Cacioppo, 2011).

While it is clear that loneliness and social isolation negatively influence health across adulthood, less is known about how they impact older adults' mental health (Newall & Menec, 2019). Research indicates that loneliness and isolation are key predictors of depression, anxiety, poor general mental health, and reduced well-being and quality of life among older adults (Cornwell & Waite, 2009b; Donovan & Blazer, 2020; Hawton et al., 2011; Horowitz, 1982). Those who are lonely in later life seem to experience higher levels of anxiety and negativity than lonely young and middle-aged adults (Hawkley & Cacioppo, 2011). Lonely older people experience elevated risks for hostility, and are at increased risk for dementia (Donovan & Blazer, 2020; Hawkley & Cacioppo, 2011; Yanguas et al, 2018). Further, social isolation seems to increase with age (Menec et al., 2019; Newall & Menec, 2020; Shankar et al., 2011) and isolated older people are at a greater risk for loneliness (Barnes et al., 2021; Dickens et al., 2011; Macleod et al., 2018). Therefore, loneliness and social isolation result in harmful mental health outcomes and given that many appear to overlap, a deeper investigation into the combined effects of loneliness and isolation is needed.

Integrating Loneliness and Social Isolation

Although earlier research has primarily examined the mental health consequences of loneliness and isolation separately, several theoretical models advocate for examining them together. According to the convoy model of social relations, we are embedded in social networks (i.e., convoys) giving and receiving support, which are an essential part of good health, and can serve as a protective function throughout life (Antonucci & Akiyama, 2012; Kahn & Antonucci, 1980). These convoys include: (a) the subjective elements of social relationships, including

closeness (intimate, distant), quality (positive, negative) and function (e.g., emotional, instrumental); and (b) the objective element of social relationships or their structure (quantity, composition, contact frequency). Both of these elements of social relationships typically change throughout the course of our lives (Kahn & Antonucci, 1980). For example, young adults seem to value relationship quantity over quality and have larger groups of social contacts, while older adults tend to prune their social networks, preferring a smaller number of close relationships (Charles & Carstensen, 2010).

The cognitive discrepancy model of loneliness postulates that loneliness results from a perceived discrepancy between our actual and desired level of social contact (De Jong Gierveld, 1987; Dykstra & De Jong Gierveld, 1994; Perlman & Peplau, 1981). This means we may not feel lonely with only a few close friends if this is what we want, yet we may feel subjectively lonely in a crowded room. This is important because social networks and expectations for relationships change as we age, and a perceived deficit in the level of social contact one maintains is central in creating a sense of loneliness. These theories highlight the importance of examining both subjective (i.e., loneliness) and objective (i.e., social isolation) aspects of social relations. However, combining loneliness and isolation has proven to be a challenge because of a lack of consensus about how to define and measure them independently, let alone together.

Measuring Loneliness & Isolation

It is well-documented that loneliness and social isolation are independently associated with deleterious mental health outcomes among older adults. However, the literature remains unclear about how loneliness and isolation should be operationally defined and measured. For example, in addition to being defined as an objective measure of social disconnectedness, social isolation has also been described as living alone, a lack of participation in social activities, or

social support that is minimal in quality and quantity (Cornwell & Waite, 2009a; Cornwell & Waite, 2009b; Dickens et al., 2011; Shankar et al., 2011). Similarly, definitions of loneliness are wide-ranging and have included simply 'isolation' (Weiss, 1973), a lack of social support (Shankar et al., 2011), or a sense of insecurity or social threat (Hawkley & Cacioppo, 2011). In one study by Cornwell & Waite (2009b), researchers combined a number of indicators (i.e., having a restricted social network, living alone, and lack of participation in social activities) to measure social isolation and labeled it 'social disconnectedness'. Similarly, they combined several indicators (i.e., loneliness, perceived lack of social support) to measure loneliness and labeled it 'perceived isolation'. Other research suggests living alone is a separate construct from isolation that may operate differently still from objective social isolation and the subjective experience of loneliness. For example, a recent study investigating health outcomes associated with loneliness, social isolation, and living alone determined that there are six typologies of varying levels of these three indicators that are associated with poor health in older adults (Smith & Victor, 2020). While these studies provide useful information about those who experience varying levels of loneliness and isolation and their associated health consequences, the conceptual ambiguity makes it difficult to parse out what is causing the negative outcomes and therefore how best to treat those who are experiencing social disconnectedness. I argue that while many researchers have identified that the physical state of being isolated from others and the emotional state of feeling lonely are separate constructs, there is need for additional research in which loneliness and isolation are evaluated in combination with one another, to differentiate their harmful effects.

Previous research has primarily focused on either loneliness or social isolation separately. Studies that have included measures of subjective and objective isolation typically discuss them

separately in their findings, or compare them to determine which is the strongest predictor of negative health outcomes, leaving out those who suffer from both. This has been documented in research examining outcomes of health (Shankar et al., 2011), mortality (Holt-Lunstad et al., 2015; Steptoe et al., 2013; Tanskanen & Anttila, 2016), dementia (Rafnsson et al., 2020), depression (Ge et al., 2017), and well-being (Shankar et al., 2015).

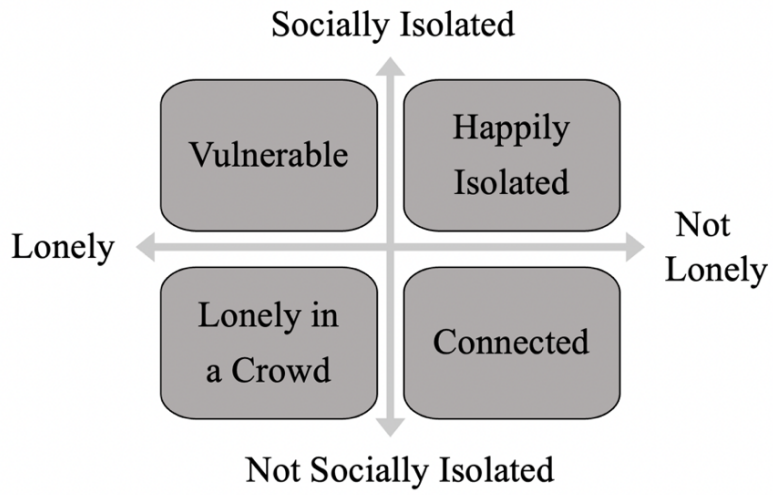
A small body of research has examined personal and environmental factors associated with loneliness and isolation (Cornwell & Waite, 2009b; Harasemiw et al., 2018, 2019; Menec et al., 2019). For example, in a nationally representative sample of older Canadians, feelings of loneliness and isolation were associated with personal characteristics (e.g., sex, income) while only social isolation was linked to geographic factors (rural/urban) and those who were isolated tended to be clustered into low-income groups. (Menec et al., 2019). For those older adults experiencing loneliness, personal characteristics and not geographic locations were significant, with not being married or having a significant other as a major factor linked to loneliness (Menec et al., 2019). Another study focused on how associative risk factors for harmful health may be different depending on if older individuals were lonely or socially isolated (Cornwell & Waite, 2009b). This and other research indicate that while loneliness and social isolation are indeed functionally separate concepts and operate along different pathways, it is important to study them together to examine differences between those who experience loneliness or isolation either separately or together.

Most recently, Newall and Menec (2019) proposed a simple, but compelling, method of combining loneliness (yes/no) and social isolation (yes/no) to create four groups. As shown in Figure 1, these are: (1) vulnerable (lonely, socially isolated), (2) lonely in a crowd (lonely, not socially isolated), (3) happily isolated (not lonely, socially isolated), and (4) connected (not

lonely, not socially isolated). All group names are from Newall and Menec's (2019) model with the exception of the 'happily isolated' group which I adapted from 'lone farmer/lifelong isolate' for the present study. Grouping loneliness and isolation together across the four groups allows for a clearer picture of older adults' social relationships and a framework with which to classify risk for negative mental health outcomes. Understanding the risk profiles of these four groups could be particularly useful for both prevention efforts and to inform future targeted interventions. For example, we might expect that the 'vulnerable' group would benefit most from increased social contact, but would this also be true for those who are 'happily isolated'? Identifying how these groups differ with respect to mental health is the first key step in understanding how best to help them.

Figure 1

Model of Four Loneliness and Isolation Groups



Note: Adapted from Newall & Menec (2019).

Potential Mechanisms

In addition to clarifying how combinations of loneliness and isolation affect older adults' mental health, research is also needed to begin to understand why the combination of these factors can result in mental health problems. Researchers examining the detrimental effects of loneliness and isolation in older adults have highlighted potential reasons for the unique vulnerabilities of this population. Some attribute the mental health risks at least partially to a shift in social goals (Cornwell & Waite, 2009b). Socioemotional selectivity theory (Carstensen et al, 1999) posits that we tend to focus on meaningful, long-term relationships with close friends and family and effectively prune peripheral, less important relationships in later life. This results in a smaller number of social contacts from which to draw support within older adults' networks, which may prove problematic if these relationships are lost. This motivational shift resulting in a decrease in social network membership may lead to poor mental health in later life, lessening life satisfaction, subjective well-being, and life quality (Chang et al., 2014; Cohen, 2004). In addition, retirement and bereavement may lead to changes or loss of social roles in relationships (Liu et al., 2016) and a greater risk for physical health disability may complicate participation in social activities, resulting in further isolation or feelings of exclusion.

Several studies indicate that among adults, perceived social support, the subjective sense of available support when needed (Siedlecki et al., 2014; Thoights, 1982), is linked to loneliness and social isolation (Fuller-Iglesias, 2015; Segrin & Domschke, 2011). High perceived support positively influences mental health, enhances life satisfaction, and helps maintain well-being (Chen & Feeley, 2014; Lakey & Cohen, 2000; Siedlecki et al., 2014). Conversely, low perceived social support is associated with loneliness and social isolation (Menec et al., 2020), major depression in younger (Lakey & Cronin, 2008) and older (Santini et al., 2016) adults, and lower

survival rates for those with cancer (Ikeda et al., 2013). High perceived social support may also be a safeguard against psychological distress (i.e., non-specific symptoms of stress, depression, and anxiety; Kessler et al., 2003) in later life (Michael et al., 2001).

Other research suggests relationship satisfaction, the subjective evaluation of the quality of relationships, may be associated with loneliness and isolation (e.g., Pinquart & Sorensen, 2001). Lonely individuals across the adult lifespan seem to be less satisfied in their personal relationships (Macleod et al., 2018; Mellor et al., 2008; Nicolaisen & Thorsen, 2017; Routasalo et al., 2006). Those who live alone may be less satisfied with their social relationships compared to those living with others (Mellor et al., 2008). Satisfaction in a romantic relationship can provide uniquely positive health benefits in later life: a review of the literature suggests a 9-15% decreased mortality risk (Manzoli et al., 2007). Also, although understudied, there is evidence to suggest older adults' relationships with friends and confidants are as much if not more important than romantic partners (Blieszner et al., 2019; Chopik, 2017; McPherson et al., 2006). When compared to younger age groups, older people perceive their relationships as more satisfying (Luong et al, 2011; Nicolaisen & Thorsen, 2017). The reason why we may become more satisfied with our relationships in later life could be due to our shift toward prioritizing emotionally meaningful and present-oriented goals, such as our current relationships, to maximize our satisfaction and happiness, as suggested in the socioemotional selectivity theory (Luong et al, 2011).

Though limited, some research indicates that social support and relationship satisfaction may mediate the relationship between social connectedness and mental health. Socially connected adults may experience reduced stress through higher levels of support (Cornwell & Waite, 2009b) and older adults may become more depressed when they are lonely due to reduced

social support (Liu et al., 2016). Less diverse social networks in older age may create social support gaps which can increase the risk for depression and reduce life satisfaction (Harasemiw et al., 2019). Within the general adult population, satisfaction with a romantic partner can buffer the effects of emotional distress (Røsand et al., 2012). Also, connected older adults may experience high levels of well-being when they are satisfied with their social relationships (Fuller-Iglesias, 2015).

Several theories also lend insight into understanding the process by which social relationships influence health. The stress buffering hypothesis (Antonucci, 2001; Cohen, 2004; Cohen & Wills, 1985; Holt-Lunstad et al., 2010) suggests that support from our social relationships may serve as resources (e.g., informational, emotional, tangible) to indirectly lessen or 'buffer' the negative effects of stress on mental health. Research guided by this model asserts that for social support to effectively reduce distress, the individual must perceive that at least one important social contact will provide sufficient support (Cohen, 2004; Cohen & Wills, 1985). When this occurs, it may bolster their perceived ability to cope with the stressor, or diminish their emotional response (Wills & Cleary, 1996) and weaken the stressor's negative effects (Cohen, 2004; Cohen & Wills, 1985). Relatedly, the main effects model posits that social relationships provide more direct support, regardless of stressors, through inherent qualities of social relationships (Cohen, 2004; Rook, 1984b). For example, positive relationships may encourage and model healthy social behaviors or lead to improved self-esteem and life purpose for individuals belonging to a strong social network (Holt-Lunstad et al., 2010; Rodriguez et al., 2018). There is therefore direct and indirect prior research and theory which suggests that social support and relationship satisfaction are likely mechanisms through which combinations of loneliness and social isolation may lead to psychological distress.

Objectives & Hypotheses

To my knowledge, this is the first study to examine psychological distress in association with combinations of loneliness and social isolation, including potential mediators. The first objective for the present study was to investigate: (a) how combined loneliness and social isolation are associated with psychological distress among a sample of Canadian older adults (aged 55+ years), and further, (b) how grouping this sample into the four groups of loneliness (yes/no) and social isolation (yes/no) may help identify which group(s) are at the greatest risk for psychological distress. I hypothesized that the 'vulnerable' group (lonely, socially isolated) would have the worst mental health outcomes and the 'connected' group (not lonely, not socially isolated) would have the best mental health outcomes. The 'lonely in a crowd' group (lonely, not isolated) was expected to have worse mental health outcomes than the 'happily isolated' group (not lonely, isolated), due to the strong link between loneliness and poor mental health and because the latter is more likely to be satisfied with a smaller social network (Menec et al., 2020; Newall & Menec, 2019).

The second objective of the present study was to explore perceived social support and relationship satisfaction as potential mediators of the effects of combined loneliness and isolation on psychological distress. I hypothesize that the reason why individuals high in both loneliness and isolation will have especially high distress, as outlined in my first objective, is because they will have the poorest perceived social support and relationship satisfaction.

Methods

Participants & Procedures

The Social Engagement and Mental Health Survey is an online survey of Canadians from each of the Canadian provinces and Nunavut which focuses on adult perceptions of

psychological factors that affect mental health, including social network size, loneliness, social support, relationship satisfaction, and distress. Participants were recruited using Qualtrics Panels which allows researchers to send their survey to a targeted group of participants through various sources including customer loyalty web portals, social media, and targeted email lists. After responding to an email invitation with a hyperlink, respondents provided informed consent and completed survey questions over an estimated 25 to 30-minute time period. The survey included numerous measures that are both brief and reliable as determined by Cicchetti (1994) who categorizes levels of reliability as unacceptable when Cronbach's coefficient alpha is below .70, as fair when it is between .70 and .79, as good when it is between .80 and .89, and as excellent when it is .90 and above. In total, 7,419 adults accessed the survey, 112 dropped out before completing the survey, and 1,328 were excluded because they were younger than 18 years, did not give consent, completed the survey too quickly, or did not provide quality answers to two reliability check questions. Namely, they responded negatively to the survey questions: "Are you being careful and honest in answering the questions in this survey", or "Do you commit to providing your thoughtful and honest answers to the questions in this survey". In sum, 5,712 individuals completed the survey, with a completion rate of 77%. The present study focused on older adults aged 55+ years, limiting the participant total to 2,745 older Canadians, and includes a subset of measures, described below.

Sociodemographics

Participants self-reported their age, gender, education, occupational status, income, race/ethnicity, and marital status (see Table 2; Appendix G*)*. For gender, participants were asked to identify, "Which best describes your current gender identity?" with the answer options being: male, female, Indigenous or other cultural gender minority identity (e.g., two-spirited), or

something else (e.g., gender fluid, non-binary; Bauer et al., 2017). For those who answered, "something else", participants were given the option to identify 'what gender (they) currently live as (their) day-to-day life' with the options of male, female, sometimes male sometimes female, and something other than female or male.

Predictor and Mediator Measures

Loneliness. The Three-Item Loneliness Scale is a shortened version of the Revised UCLA Loneliness Scale (R-UCLA; Hughes et al., 2004; Appendix A) that was adapted to measure loneliness in large-scale surveys. Participants responded to three questions, each rated as: 1 (hardly ever), 2 (some of the time), or 3 (often). Total scores therefore range from 3 to 9, with higher scores representing greater loneliness. In prior research, this scale has fair internal consistency ($\alpha = .72$), and validity has been supported via its positive association with social isolation in large-scale surveys of older adult community samples (Hughes et al., 2004). Internal consistency for this scale in the current sample is good ($\alpha = .85$).

Social Isolation. The Social Convoy Questionnaire (Kahn & Antonucci, 1980; Appendix B) measures the objective size of participants' social networks. For this version adapted for use online, participants identified three groups of contacts within their social network by listing the first names and the associated number of people they feel: (1) very close to, (2) close to (but not as close to), and (3) less close to (but still important). In cases where the number of listed names did not match the quantitative number, I used the former as the measure of social isolation. Data were coded as missing if participants did not answer, if they listed strange names (e.g., "the best, the boldest, the brightest"), or an extreme number of contacts (e.g., 100 contacts for each group). Consistent with theory (e.g., Antonucci et al., 2019) and prior research (English & Carstensen, 2014; Fung et al., 2001; Xing et al., 2017), I summed the number of people in the three groups as

an indicator of total network size and social isolation. The social isolation variable was positively skewed with 95% of participants indicating 0 to 37 contacts within their social network although the total range was 0 to 61 contacts. I therefore winsorized the variable by coding participants with scores greater than 37 as 37. Winsorization reduces the impact of extreme values on analyses that are impacted by non-normal, skewed distributions (Dixon, 1960).

There is no clear method to define isolation and no currently established cut-offs in the literature that define socially isolated individuals. Therefore, I defined isolation structurally (versus functionally; Valtorta, 2016), with a data-driven approach (i.e., isolation was defined and measured as an objective, quantitative measure of participants' social network size; Newall and Menec, 2020). I reviewed past studies that used similar definitions for isolation and large-scale population data which included older adults (e.g., Barnes et al., 2021; Lubben et al., 2006; Menec et al, 2019, 2020; Newall & Menec, 2020; Shankar et al., 2011; Steptoe, 2013). The literature search revealed one frequent practice is using structural factors to create a social isolation index in which points are assigned for indicators of isolation (e.g., if participants are unmarried/live alone, frequency of contact with family/friends, and social participation; Menec et al., 2019, 2020; Steptoe et al., 2013). Summed index scores are then dichotomized and those with low scores (e.g., 0 or 1) are coded as 'not isolated' and those with higher scores (e.g., 2+) are coded as 'isolated'. Another common tool is the Lubben Social Network Scale (LSNS; Lubben, 1988) which was developed specifically for use with older adults and has perhaps the most commonly used cut score for isolation (Newall & Menec, 2020). The revised and abbreviated LSNS-6 scale (Lubben et al., 2006) measures isolation by evaluating structural (e.g., How many relatives do you see or hear from at least once a month?) and functional (e.g., How often is one of your relatives available for you to talk to when you have an important decision to

make?) social ties. Higher scores indicate greater isolation and a cut score of 12 out of 30 classifies isolated from not isolated participants.

I chose a structural definition of isolation for the present study because the data on participants' social network groups was available from the Social Convoy Questionnaire, and it is easier to create and therefore replicate than index scores. Also, given that the social support mediator includes questions about functional support, the distinction between this mediator and my social isolation variable is clearer by defining social isolation strictly structurally. I chose a cut score nearest to the 20th percentile (i.e., the 20.8th percentile with 6 or fewer contacts) for two reasons. First, this cut score represents somewhere in the middle of the range of prevalence rates representing social isolation among older adults in the literature, ranging from 2% to 40% (Newall & Menec, 2020). Other researchers who have identified similar prevalence rates for isolated older adults include Lubben and colleagues (2006) who found that 20% of a German older adult sample aged 65+ years were isolated using the LSNS-6 scale, and Barnes et al., (2021) who identified 20.6% of older participants aged 65+ years as isolated when using an adapted social network index of summed social connection scores. Second, my cut-score of 6 is equivalent to Steptoe and colleagues' (2013) data-driven approach in which one fifth of individuals were defined as isolated. In the current study, participants with 0 to 6 contacts in their total social network were defined as 'isolated' and those with 7 to 37 contacts were defined as 'not isolated'. I used both dichotomized and continuous social isolation scores for analytic purposes. The continuous version is reverse scored so that higher scores indicate more isolation.

Perceived Social Support. The Medical Outcomes Study Social Support Survey (MOS-SS; Hays, 1994; Appendix C*)* is a 19-item scale measuring four functional support subscales (i.e., emotional/informational, tangible, affectionate, positive social interaction) and an overall

functional social support index. Participants rated how often each type of support is available to them ranging from 1 (none of the time) to 5 (all of the time). For the present study, I summed all items to create an overall social support index, with higher scores representing greater support. The MOS-SS has excellent reliability in previous research (α = .91-.97; Hays, 1994; Sherbourne & Stewart, 1991). Its validity has been demonstrated through associations between perceived support and depression (Sibalija et al., 2020) and well-being among older adults (Harasemiw et al., 2019). The internal consistency for this scale within the current sample is excellent (α = .97).

Relationship Satisfaction. The Perceived Relationship Quality Components Inventory (PRQC; Fletcher et al., 2000; Appendix D) measures components of perceived relationship quality across six constructs (i.e., satisfaction, commitment, intimacy, trust, passion, and love). The PRQC has good reliability (α = .85-.88) and validity measuring components of relationship quality and benefits of relationship satisfaction among couples (Overall et al., 2010). We used a modified version in which participants indicated how satisfied they are with the following four relationships: romantic partner, family, friends, and health providers, on a scale ranging from 1 (not at all satisfied) to 7 (extremely satisfied). Participants also had the option to choose 'not applicable' and I coded these responses as missing. I excluded satisfaction with romantic partner from the total score because 23% of my older adult sample was missing data on this variable. After excluding this variable, there was 5.8% missingness for the remaining three variables. To score, I summed these items, with higher scores indicating greater relationship satisfaction. Total sores ranged 1 to 21. The internal consistency for the current sample is fair (α = .71).

Outcome Measure

Psychological Distress. The Kessler Distress Scale (K6; Kessler et al., 2003; Appendix E) is a global measure of nonspecific distress. Participants rate how frequently they have

experienced symptoms of psychological distress (e.g., about how often did they feel nervous) over the past 30 days on a 5-point rating scale ranging from 0 (none of the time) to 4 (all of the time). Participant responses for the six items were summed, with higher scores indicating greater distress and a total score of ≥ 5 indicating moderate mental distress that impacts functioning (Prochaska et al., 2012). Total scores ranged 0 to 24. In prior research, the K6 has demonstrated good reliability ($\alpha = .89$; Kessler et al., 2002) and validity in terms of its associations with both moderate and severe mental health illness in adults across the lifespan using large-scale population health surveys (Prochaska et al., 2012). The internal consistency for this scale in the current sample is good ($\alpha = .88$).

Covariate

Perceived Physical Health. The Philadelphia Geriatric Center Multilevel Assessment Instrument (MAI; Lawton et al., 1982; Appendix F) assesses the well-being of older adults within seven domains, and each domain and subscale may be used independently. Perceived physical health was measured by the self-rated health subscale of the physical health domain, which includes three questions, each of which is rated on a 3-point scale. To score, results are summed with higher scores indicating greater perceived physical health. Total scores ranged 3 to 9. Prior research using the MAI indicates fair reliability ($\alpha = .74$; Lawton et al., 1982) and validity for use with older adults (Cohen-Mansfield & Frank, 2008). The internal consistency for this scale within our sample is excellent ($\alpha = .90$).

Analytic Plan

For the majority of study variables there was very little missing data, ranging from 0 to .3%, with the exception of relationship satisfaction at 5.8% missingness and social isolation at 5.7% missingness. Therefore, for those scales in which at least at least 75% of items were

available, I replaced missing item data with the mean of the available items as suggested by Cheema (2014). Checking the data for skewness and outliers, I ran descriptive statistics analyses in SPSS.

To identify which sociodemographics to include and to confirm use of perceived physical health as a covariate in the analyses, I first examined a correlation matrix to determine where the significant correlations occurred with relation to the psychological distress dependent variable. Significant correlations ranged from .04 to .1, with the exception of perceived physical health at .41 (see Table 1). I then reviewed past studies that investigated loneliness, isolation and/or distress among older adults (e.g., Cornwell & Waite, 2009b). Guided by advice to limit models to only a small number of relevant covariates so as not to 'overfit' the model (Wang et al., 2017), I chose a single covariate to include in the models – perceived physical health. Overfitting can occur when too many variables are included in the model which can inflate Type I error as well as make it difficult to differentiate which covariates are relevant for the model and which may actually be noise variables.

Table 1

Sample Variable Correlation Matrix

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Total Sample (N = 2,745)																
1. Gen-F	—															
2. Gen-M	-.99**	—														
3. Gen-I	-.05*	-.05*	—													
4. Gen-S	-.05*	-.05*	-.00	—												
5. Sex	.99**	-.99**	.00	.05*	—											
6. Edu	-.09**	.09**	-.01	-.05*	-.09**	—										
7. Occu	.09**	-.08**	-.01	-.02	.08**	-.09**	—									
8. Income	-.22**	.22**	-.05*	-.02	-.22**	.34**	-.29**	—								
9. Marital	.21**	-.21**	-.00	-.01	.22**	.02	.04*	-.24**	—							
10. R/E	.01	-.01	-.08**	.02	.02	-.05*	.07**	-.03	.01	—						
11. Health	-.01	.01	.00	-.02	-.01	.11**	-.08**	.14**	-.03	.01	—					
12. Dist	.06**	-.06**	.01	.03	.07**	-.08**	-.07**	-.10**	.04*	-.06**	**-.41****	—				
13. Rel Sat	.04	-.03	-.02	.01	.04	-.01	.07**	.01	-.04*	.02	.27**	-.43**	—			
14. Soc Sup	.00	-.00	-.03	.02	.00	.01	.05*	.17**	-.16**	.07**	.24**	-.34**	.52**	—		
15. Lone	.10**	-.10**	-.00	.01	.10**	-.04*	-.03	-.16**	.16**	-.01	-.33**	.54**	-.58**	-.55**	—	
16. Soc Iso	-.08**	.08**	.01	.00	-.08**	-.12**	-.09**	-.07**	-.02	-.04	-.14**	.22**	-.29**	-.32**	.25**	—

Note. **Gen-F** = gender identity as female; **Gen-M** = gender identity as male; **Gen-I** = gender identity as Indigenous or other cultural gender identity; **Gen-S** = gender identity as some other gender identity; **Edu** = highest level of education completed; **Occu** = current occupation status; **Marital** = current marital status; **R/E** = racial or ethnic heritage; **Health** = perceived physical health; **Dist** = psychological distress; **Rel Sat** = relationship satisfaction; **Soc Sup** = social support; **Lone** = loneliness; **Soc Iso** = social isolation. * $p < .05$, ** $p < .01$.

With respect to exploring associations between combined loneliness and isolation with distress, I first conducted a moderation analysis using Hayes' PROCESS macro v3.5 for SPSS (2018) with loneliness as the independent variable (IV), social isolation as the moderator (W; because combined effects of loneliness and isolation were being examined, they were arbitrarily

coded as IV and W), and psychological distress as the dependent variable (DV), with perceived physical health as the covariate (CV). Both the IV and the W were mean-centered, continuous variables.

Second, to identify sub-groups of older adults at-risk for clinically significant distress as a result of loneliness and isolation, I created four groups by dichotomizing loneliness and social isolation (Newall & Menec, 2019; see Figure 1). Loneliness was dichotomized according to previous research, grouping those who scored 3 to 5 as 'not lonely' and those who scored 6 to 9 as 'lonely' (Steptoe et al., 2013). Social isolation was dichotomized according to rationale listed in the Measures section such that those who scored 0 to 6 were coded as 'isolated' and those with higher scores of 7 to 37 were coded as 'not isolated'.

To assess how redefining the threshold may change observed effects and appraise robustness of the analyses, I conducted sensitivity analyses with cut scores of 4 (10.7^{th} percentile) and 8 (32.4^{th} percentile) contacts (Thabane et al., 2013). That is, I conducted univariate analysis of covariance (ANCOVA) analyses with the number of social contacts determining 'isolated' participants at 4 and 8 contacts to compare with my initial cut score of 6 contacts. Results were similar to the primary analysis, supporting my use of the 20.8^{th} percentile cut score. As results were similar in both sensitivity analyses with no additional extreme scores, and given that past research supports cutoffs within the moderate range close to the 20^{th} percentile, I kept my original cut score of 6. I conducted a 2 (lonely, not lonely) by 2 (isolated, not isolated) ANCOVA with continuous distress as the dependent variable, controlling for perceived physical health. Post-hoc analyses determined which of the four loneliness and social isolation groups differed on the dependent variable. This analysis adds to the previous regression analysis with continuous variables by indicating the number of participants who were

categorized into the four groups in Figure 1 and allowing an examination of mental health risk associated with membership in them (i.e., does the average score of individuals in each group fall above or below the cut score of 5 indicating clinically significant distress on the K6?).

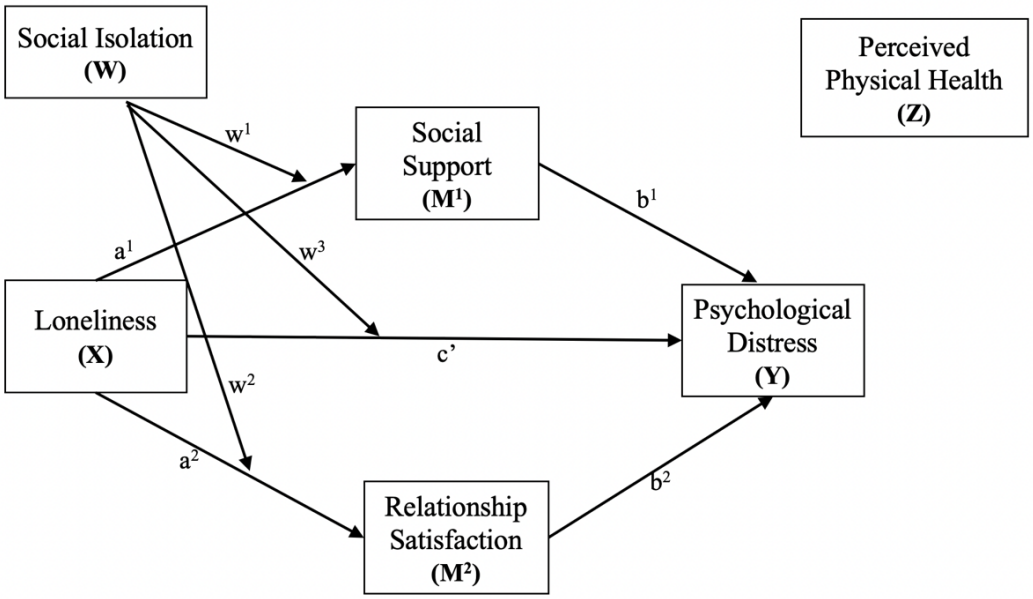
To address my second hypothesis, that the combined effects of loneliness and isolation on distress are mediated by social support and relationship satisfaction, I conducted a moderated mediation analysis with continuous loneliness as the independent variable (IV), and continuous social isolation as the moderator (W; because combined effects of loneliness and isolation were being examined, they were arbitrarily coded as IV and W), mean-centering each of these variables. Psychological distress was the dependent variable (DV), and social support and relationship satisfaction were continuous mediators (M), with perceived physical health as the covariate (CV).

I used PROCESS macro for SPSS (Hayes, 2018), which tests for mediation with ordinary least squares regression, and chose Model 8 (see Figure 2) to test the hypotheses that combined loneliness and isolation indirectly lead to distress through their influence on social support and perceived relationship satisfaction (the w^1 and w^3 pathways in Figure 2, respectively). Parallel moderated mediation analyses allowed me to examine the relationship between the two mediators to compare their relative predictive power. Using a resampling method called bootstrapping, PROCESS tests the mediation analysis thousands of times to create higher and lower-bound confidence intervals around the examined effects. When zero is not contained between these intervals, indirect mediation effects are assumed significant with 95% confidence. I also seeded the analysis to allow other researchers to replicate my results which is otherwise not possible due to the random nature of bootstrapping. Although I am aware of methodological concerns associated with mediational modeling of cross-sectional data, I used theory and

cautious interpretation to support my causal mediation hypothesis, as recommended by Hayes (2018).

Figure 2

Moderated Mediation Model



Note. Hayes' PROCESS Model 8.

Results

Descriptive statistics for the sociodemographic and variable characteristics for my sample are presented in Table 2 and Table 3.

Table 2

Sample Sociodemographic Characteristics (N = 2,745)

Variable	*N*	(%)
Age in Years		
55-64	915	(33.3)
65-74	915	(33.3)
75-84	849	(31.0)
85-101	66	(2.4)
Gender Identity		
Female	1,321	(48.1)
Male	1,412	(51.4)
Indigenous or other cultural gender identity	6	(.2)
Something else	6	(.2)
Sex		
Female	1,327	(48.3)
Male	1,418	(51.7)
Education	2,740	
Less than high school	61	(2.2)
High school or equivalent	555	(20.3)
Some college, no diploma	261	(9.5)
College diploma or trade/technical diploma	687	(25.1)
Some university, no degree	264	(9.6)
Some university, currently attending	4	(.2)
Bachelor's degree	602	(22)
Postgraduate degree	306	(11.1)
Marital Status	2,743	
Single	201	(7.3)
Married or common law	1,745	(63.6)
Widowed	403	(14.7)
Separated or divorced	394	(14.4)

Variable	***N***	**(%)**
Occupation Status	2,743	
Full-time	433	(15.8)
Part-time	248	(9.0)
Retired	1,957	(71.4)
Unemployed/on disability	101	(3.7)
Student	4	(.1)
Income (N = 2,701)	2,701	
Less than $30,000	431	(16.0)
$30,000-$49,999	598	(22.1)
$50,000-$69,999	562	(20.8)
$70,000-$89,999	386	(14.3)
$90,000-$149,999	563	(20.8)
$150,000 and over	161	(6.0)
Race/Ethnicity		
Arab	3	(.1)
Black	16	(.6)
Chinese	57	(2.1)
Filipino	6	(.2)
Indigenous	19	(.7)
Japanese	14	(.5)
Korean	2	(.1)
Latin American	4	(.1)
South/West/Southwest Asian	37	(1.4)
White	2,526	(92)
Other	61	(2.2)
Canadian Province/Territory	2,744	
Alberta	217	(7.9)
British Columbia	326	(11.9)
Manitoba	93	(3.4)
New Brunswick	118	(4.3)

Variable	*N*	(%)
Newfoundland & Labrador	73	(2.7)
Nova Scotia	194	(7.1)
Nunavut	1	(.0)
Ontario	1,351	(49.2)
Prince Edward Island	32	(1.2)
Quebec	262	(9.5)
Saskatchewan	77	(2.8)

Table 3

Sample Variable Characteristics

Variable	*N*	*M*	(%)	*SD*
Loneliness (ranges 3 to 9)	2,743	4.6	—	1.8
Lonely	772	—	(28.1)	—
Not lonely	1,973	—	(71.9)	—
Social Isolation (ranges 0 to 37)	2,588	13.9	—	9.1
Isolated	538	—	(20.8)	—
Not Isolated	2,050	—	(79.2)	—
Social Support (ranges 1 to 5)	2,743	3.8	—	1.0
Relationship Satisfaction (ranges 1 to 21)	2,585	17.1	—	3.5
Perceived Physical Health (ranges 3 to 9)	2,743	2.3	—	0.6
Psychological Distress (ranges 0 to 24)	2,744	3.4	—	3.9

Note. SD = standard deviation. *M* = mean.

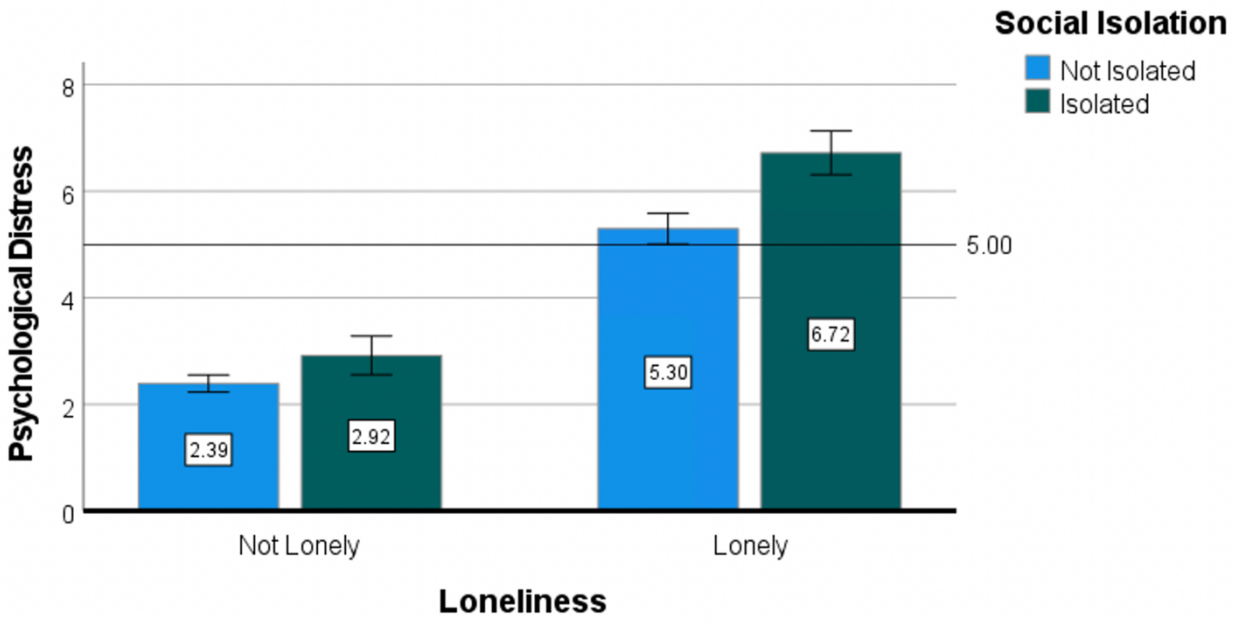
The moderation analysis to test my first objective resulted in a significant main effect of loneliness on distress (β = .92, *SE* = .04, *t* = 23.15, *p* < .001), of social isolation on distress (β = -.04, *SE* = .007, *t* = -5.21, *p* < .001), and a significant interaction between loneliness and isolation (β = -.02, *SE* = .004, *t* = -3.71, *p* < .001). To understand the nature of this interaction, I explored the effects of loneliness on distress at values of isolation one standard deviation (*SD*) below the

mean (β = .77, 95% *CI* = .65; .90, $p < .001$), at the mean (β = .92, 95% *CI* = .84; .99, $p < .001$ and one *SD* above the mean (β = 1.06, 95% *CI* = .97; 1.15, $p < .001$). In each case the beta coefficients are positive, but moreso at higher levels of the moderator, indicating that those experiencing greater combined loneliness and isolation are also experiencing higher levels of psychological distress.

The univariate analysis of covariance (ANCOVA) to test my first objective also resulted in significant main effects for loneliness, $F(1, 2582) = 407.54$, $p < .001$, and isolation, $F(1, 2582) = 36.08$, $p < .001$, as well as a significant interaction between them, $F(1, 2582) = 7.69$, $p < .01$. As shown in Figure 3, both 'lonely' groups scored above 5 on the psychological distress scale, indicating clinically significant distress (Prochaska et al., 2012) and there was a statistically significant difference between the 'vulnerable' group (lonely, isolated; $M = 6.72$) and the 'lonely in a crowd' group (lonely, not isolated; $M = 5.30$). For the 'not lonely' groups, mean distress scores were well below 5, and there was no statistically significant difference between the 'happily isolated' group (not lonely, isolated; $M = 2.92$) and the 'connected' group (not lonely, not isolated; $M = 2.39$ as indicated by overlapping confidence intervals; see Figure 3). This suggests that for those older adults who are lonely, experiencing isolation simultaneously can lead to clinically significant distress, but this is not true for those who are not lonely. Although both 'lonely' groups (representing more than 25% of the sample) are at risk for psychological distress, those who are lonely and isolated are particularly at risk.

Figure 3

Univariate Analysis of Covariance (ANCOVA)



Note. Psychological distress scale ranges 0 to 24, scoring ≥ 5 indicates significant distress. **'Lonely' Groups**: Vulnerable, 95% *CI* [6.31, 7.13], Lonely in a Crowd, 95% *CI* [5.01, 5.59]. **'Not Lonely' Groups**: Happily Isolated, 95% *CI* [2.55, 3.28], Connected, 95% *CI* [2.23, 2.56].

The moderated mediation analysis partially supported my second hypothesis. For the first mediator, social support, the combined effects of loneliness and isolation on social support were significant (w^1 pathway in Figure 2 and Table 4). However, the effect of social support on distress when controlling for other variables in the model was not significant (b^1 pathway). Therefore, neither the indirect effect of loneliness on distress through support (Indirect Effect[a] in Table 4), nor the moderation of this indirect effect by social isolation (Indirect Effect[c] in Table 4), were significant.

Table 4

Moderated Mediation Analysis

Predictor	Support (M_1)				Satisfaction (M_2)				Distress (Y)			
	path	**β**	***SE***	**(95% *CI*)**	**path**	**β**	***SE***	**(95% CI)**	**path**	**β**	***SE***	**(95% *CI*)**
Loneliness (X)	*(a^1)*	**-.26**	**.01**	**(-.280, -.240)**	*(a^2)*	**-.93**	**.04**	**(-1, -.860)**	*(c')*	**.83**	**.05**	**(.730, .920)**
Support (M_1)			—				—		*(b^1)*	.07	.09	(-.100, .240)
Satisfaction (M_2)			—				—		*(b^2)*	**-.13**	**.02**	**(-.170, -.080)**
Isolation (W)		**-.02**	**.00**	**(-.017, -.024)**		**-.07**	**.00**	**(-.060, -.080)**		**.03**	**.00**	**(.050, .020)**
X × W	*(w^1)*	**-.00**	**.00**	**(-.000, -.005)**	*(w^2)*	**-.03**	**.00**	**(-.030, -.040)**	*(w^3)*	**.01**	**.00**	**(.020, .004)**
Indirect Effect[a]	X on Y through M_1						—			.18	.02	(-.060, .030)
Indirect Effect[b]			—		X on Y through M_2					**.12**	**.03**	**(070, .170)**
Indirect Effect[c]	X and W on Y through M_1						—			-.00	.00	(-.000, .000)
Indirect Effect[d]			—		X and W on Y through M_2					**.00**	**.00**	**(.007, .002)**
Model R^2	**.350, $F(4, 2430) = 325.41^{***}$**				**.380, $F(4, 2430) = 376.12^{***}$**				**.370, $F(6, 2428) = 240.65^{***}$**			
Interaction ΔR^2	**.002, $F(1, 2430) = 6.28^{*}$**				**.020, $F(1, 2430) = 68.57^{***}$**				**.002, $F(1, 2428) = 7.74^{**}$**			

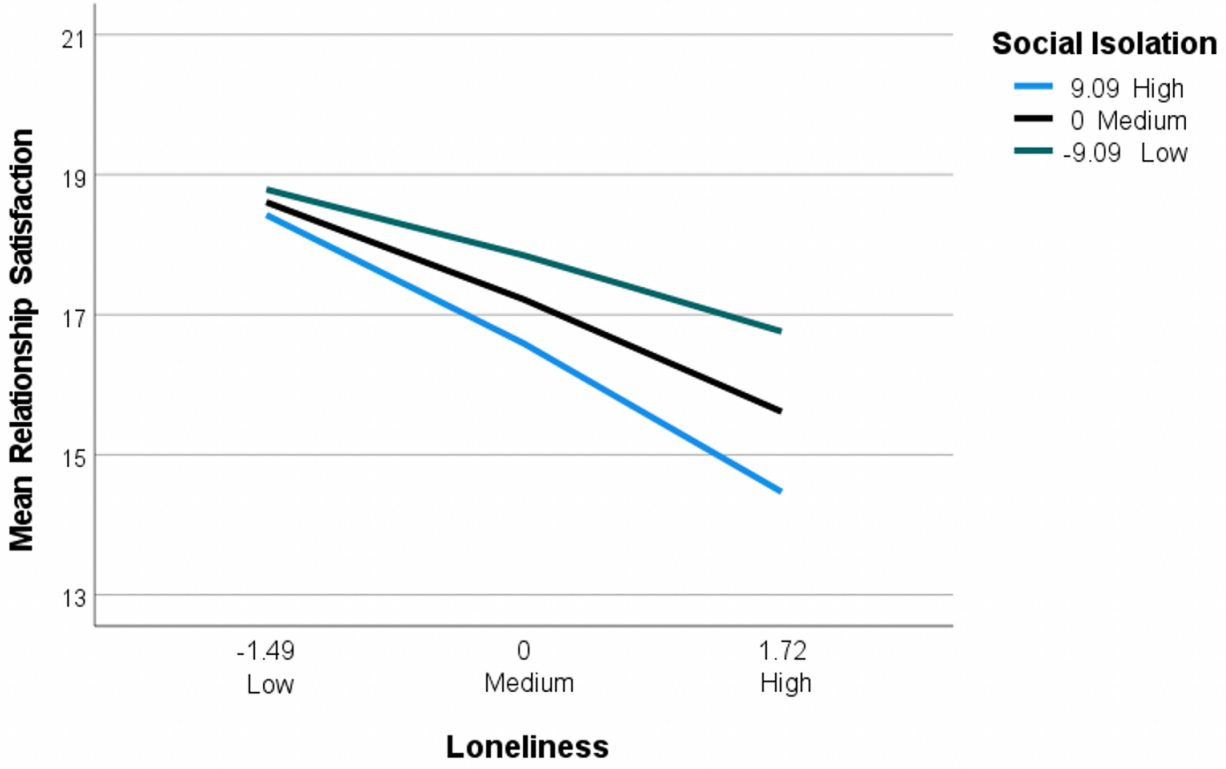
Note. **Support** = social support; **Satisfaction** = relationship satisfaction; **Distress** = psychological distress; **β =** unstandardized regression coefficient; ***SE* =** standard error; **95% *CI* =** 95% confidence interval lower and upper limits, respectively; **Model R^2** = amount of variance. **Bolded text =** significant interactions. Letters *a*, *b*, *c′* and *w* represent mediation pathways in Figure 2.

For the second mediator, relationship satisfaction, the combined effects of loneliness and isolation on relationship satisfaction were significant (w^2 pathway in Figure 2 and Table 4), and the effect of relationship satisfaction on distress when controlling for other variables in the model was significant (b^2 pathway). As a result, the indirect effect of loneliness on distress through relationship satisfaction was significant (Indirect Effect[b] in Table 4) as was the moderation of this indirect effect (Indirect Effect[d] in Table 4). I teased apart the moderation effects using the 'pick-a-point' approach that examined the conditional effects of loneliness on relationship satisfaction at values of isolation at the mean and one standard deviation (*SD*) above and below the mean. Results revealed that the negative effect of loneliness on relationship satisfaction is strongest for those who are most isolated (conditional effects were -.63, -.93, and -1.23 at low,

medium, and high values of isolation, respectively; see Figure 4). Overall, these results suggest that those who are both lonely and isolated have the poorest mental health because they are less satisfied with their relationships, but not because they have less perceived social support.

Figure 4

Conditional Effects of Loneliness on Relationship Satisfaction at Values of Social Isolation



Note. Relationship Satisfaction scale ranges 1 to 21.

Discussion

Several key findings emerged from the present study. First, as predicted, those who were lonely and socially isolated experienced the highest level of psychological distress when compared with those who experienced neither or one of these variables independently. Second, those who experienced both loneliness and isolation had the greatest distress due to relationship

dissatisfaction, but not because of a perceived lack of social support. I discuss these two key findings, in turn.

My first finding that the combined effects of loneliness and isolation led to the greatest distress is reasonable given that loneliness and isolation independently predict risk for psychological distress. This result is in alignment with past research indicating that the adverse health outcomes of loneliness and isolation seem to overlap (e.g., Barnes et al., 2021). Conversely, being socially engaged can serve as a protective function throughout life (i.e., the convoy model of social relations; e.g., Antonucci & Akiyama, 2012; Antonucci et al, 2019). This makes sense given that social engagement is a key reason why social participation benefits older adults' mental health (Mackenzie & Abdulrazaq, 2021).

With regard to the four loneliness and isolation groups, while both 'lonely' groups experienced significant distress, the 'vulnerable' group (lonely, isolated) was especially distressed. Neither the 'connected' group (not lonely, not isolated), nor the 'happily isolated' group (not lonely, isolated), reported clinically significant distress. This is consistent with past research which indicates that those older adults who experience combined loneliness and isolation are at the greatest risk for negative health outcomes in comparison to those who experience none or one of them (Barnes et al., 2021; Beller & Wagner, 2018; Menec et al., 2020; Smith & Victor, 2020).

An important contribution of the current study is to identify groups who are at risk for mental health problems and to better understand the prevalence of these at-risk older adults. Prevalence rates for the four loneliness and isolation groups were 60.9%, 18.3%, 11.4%, and 9.4% for the 'connected', 'lonely in a crowd', 'happily isolated', and 'vulnerable' groups, respectively. Given that the 'vulnerable' group was at the highest risk for poor mental health, one

might argue that interventions should focus solely on these individuals. However, there is also an argument for including the 'lonely in a crowd' group as a high-risk group, considering they also scored above 5 on the K6 scale (Kessler et al., 2002), indicating significant distress. Doing so broadens my high-risk group to include more than a quarter (28%) of the participant sample. Although the 'happily isolated' group was not currently distressed, their social networks consisted of six or fewer contacts, and losses to these small social networks could result in future loneliness and distress (e.g., Newall & Menec, 2019). These isolated older adults might therefore be targets of prevention or early intervention efforts.

In the current study, social isolation was only helpful in determining risk for psychological distress when combined with information about loneliness. The 'connected' group was not distressed as they did not feel lonely and were not isolated. The 'happily isolated' group (not lonely, isolated) was not distressed because although they had a limited social network, they were not lonely. This is interesting given the many isolated older adults who suffer from distress and other deleterious health consequences (Barnes et al., 2021; Hawton et al., 2011; Landeiro et al., 2017). However, the present study's results as well as past research (e.g., Cornwell & Waite, 2009b; Newall & Menec, 2019) indicate that these harmful outcomes may not occur for those who choose a smaller network of social contacts versus those older people who may become isolated not by choice (e.g., they are widowed, newly retired, or struggle with mobility limiting their involvement in social activities). This suggests that a purely structural definition for social isolation is missing something important – reasons why older people have small social networks.

Research focused on why some isolated older adults may not experience poor mental health outcomes is limited. One possible explanation is offered by the cognitive discrepancy model of loneliness in which the subjective feeling of loneliness is caused by a perceived

disparity between the social contact one wants and receives (De Jong Gierveld, 1987; Perlman & Peplau, 1981). Thus, older adults who desire a larger social network than they have or would like more social contact than they are receiving are at risk for loneliness and distress. However, this may not be true for those who prefer to have a smaller social network, engage in less frequent contact with friends or family, or enjoy living alone (e.g., Newall & Menec, 2019). There is also the possibility that the older adults in the present study who were isolated, but not lonely or distressed (i.e., the 'happily isolated' group) had always maintained a restricted social network that served them well, which is supported by the social convoy theory (Antonucci et al, 2019; Fiori et al., 2006). Therefore, although the 'happily isolated' group in the present study had smaller social networks, it is possible that they did not experience loneliness or distress because this is what they wanted. On the other hand, the 'vulnerable' group experienced a discrepancy between the social contact they wanted versus what they had, resulting in significant distress.

Another possible reason why some isolated older individuals are not lonely or distressed may be a change in social expectations or goals. For example, some may adjust their expectations for social contact according to past experiences or to align with structural constraints, which implies less of a choice to be disconnected, but rather an acceptance of their current circumstances (Newall & Menec, 2019). This change may also occur as part of a natural shift in later life toward emotionally meaningful goals. Namely, according to the socioemotional selectivity theory, we become more selective about our social networks as we age, and shift our focus toward a smaller number of important contacts, resulting in less social contacts overall (e.g., Carstensen et al., 1999). In the present study, perhaps the 'happily isolated' group became accustomed to a smaller social network or filtered out those social contacts who did not meet their socioemotional goals and because their personal preferences for social engagement were

met, they did not experience distress. In comparison, perhaps the 'vulnerable' group was unable to adjust their expectations or meet their social goals (e.g., they lost the few social contacts they had in their network due to death, geographic location, etc.), leading to significant distress. Therefore, it appears that loneliness is the key component which elevates risk for psychological distress among disconnected older adults.

Supporting the rationale that the subjective experience of loneliness is the driver for negative mental health outcomes, there is evidence that loneliness operates through a negative feedback loop (e.g., Cacioppo et al, 2009). Namely, negative thoughts and feelings are reinforced which leads to isolation and negative mental health effects, such as distress. In addition, some studies that have compared the negative effects of loneliness and isolation on health have found loneliness to be the stronger predictor for poor mental health (e.g., Coyle & Dugan, 2012). Therefore, experiencing negative health consequences from isolation may have more to do with whether the older individual has the number of social network members and frequency of contact that they desire, not just if they are physically separate from others. For example, an older person who falls into the 'lonely in a crowd' group (lonely, not isolated) may identify many social contacts in their network, but may not employ these contacts because they are socially anxious, so they feel lonely, which leads to psychological distress. An older person who falls into the 'vulnerable' group (lonely, isolated) could have lost social contacts due to a move and retirement, leaving them isolated and feeling lonely, triggering the greatest level of psychological distress. In comparison, a 'happily isolated' (not lonely, isolated) older adult who lives in a rural area by choice, only occasionally connecting with a friend or family member when they want to, may have the same number of social contacts in their network as those in the other groups, but

would likely not become distressed because their preferences for social contact and actual contact matched.

The differences found among the four loneliness and isolation groups in the present study suggest that both lonely groups who experienced distress may require targeted interventions to best meet their social needs. For example, the 'lonely in a crowd' group might benefit from psychological interventions aimed at getting them to activate already existing social contacts within their network, whereas the 'vulnerable' group may need more structural support to develop new social connections and supports. In addition, the 'vulnerable' group may require more urgent support, given that being both lonely and isolated resulted in the greatest distress. Current research is being conducted on interventions that can be implemented for disconnected older people (e.g., Fakoya et al., 2020; Landeiro et al., 2017), but that is beyond the scope of this thesis. Future research examining the effects of loneliness and isolation on older adults' mental health should assess whether individuals are experiencing loneliness, are isolated, or a combination of the two, to determine the urgency and type of intervention best suited to their needs. To improve and focus intervention efforts, researchers must direct greater attention to the mechanisms through which loneliness and isolation result in poor mental health among older adults, which was the second objective of this thesis.

The second key finding from the current study was that those who experienced combined loneliness and isolation were the most distressed as a result of relationship dissatisfaction, but not because of a lack of perceived social support. This is interesting because there is a long-standing link between the perceived availability of social support and health among older adults (e.g., Cornwell & Waite, 2009; Kim & Thomas, 2017; Santini et al., 2015), but the literature on later life relationship satisfaction is limited. Although the majority of studies are focused on

marital satisfaction, other evidence suggests friendships are of equal or greater importance (Blieszner et al., 2019; Chopik, 2017; Huxhold et al., 2014; McPherson et al., 2006), and a small body of research indicates that we become more satisfied with our social relationships overall as we age (e.g., Luong et al., 2011). This is at least partially due to a motivational shift towards goals that optimize our emotional well-being in response to a more limited time horizon (i.e., how much time we have left in our life; the socioemotional selectivity theory; Carstensen et al., 1999). This shift can drive a 'positivity effect', where we tend to pay more attention to positive versus negative information as we age, resulting in greater relationship satisfaction (Reed & Carstensen, 2012).

Although we are intuitively driven toward emotionally gratifying relationships, there are several possible explanations for why dissatisfaction may occur. One reason may be that, as discussed earlier, the older individual may not have the quantity of social contacts and quality of relationships that they desire, and this incongruence can lead to the dissatisfaction. They could also be dissatisfied because they are not able to access opportunities to form the relationships that they desire due to factors such as challenging socioeconomic circumstances or physical limitations. For those who are lonely, but not isolated, perhaps they do not have the necessary interpersonal skills to maintain meaningful relationships. Alternatively, the dissatisfaction could be due to relationship(s) which are meaningful, but also ambivalent (i.e., emotionally close, yet problematic), which is an issue given the correlation between ambivalent relationships and poor health and distress (Rook et al., 2012; Rook & Charles, 2017).

Linking to the current study, it would then make sense that the 'vulnerable' group (lonely, isolated) would experience the greatest distress because they are dissatisfied with both the quantity and quality of their relationships. For example, perhaps an older person who was

once very socially active fell ill and was then physically limited from leaving their home to socialize, which both restricted their social network and led to feelings of loneliness. This could result in dissatisfaction, as this would not align with their social needs, and subsequent distress. For those who were 'lonely in a crowd' (lonely, not isolated), consider that perhaps an older man lives near family and has an active social life, but his wife dies, and because she was responsible for their social planning, he finds himself surrounded by people, but disconnected, triggering feelings of loneliness and later distress.

Although those older adults in the present study who were lonely, isolated, dissatisfied, and distressed are indeed the most 'vulnerable', some research indicates these may also be the most motivated to reconnect with others (Newall & Menec, 2019; Qualtar et al., 2015). They may therefore benefit from accessible community or group-centered interventions which may both enhance their social network and give them opportunity to form new relationships that align with their social needs. Those who were lonely, dissatisfied, distressed, and not isolated (i.e., the 'lonely in a crowd' group') may respond most effectively to interventions which focus on interpersonal skills development, conflict resolution (for potentially ambivalent relationships), or strategies which can address their expectations and cognitions about social relationships (Newall & Menec, 2019) to improve satisfaction. Not only would it be more difficult to reach those who are isolated, but not lonely (i.e., the 'happily isolated' group), the findings from the present study indicate that they may not need additional support because they are not distressed. However, it may prove fruitful to examine if these older people are at risk for developing loneliness or if they are satisfied with their current social contact to potentially prevent future distress. I controlled for perceived physical health in the present study, teasing out the possibility that the psychological distress from dissatisfaction was due to poor physical health. However, considering that physical

health difficulties tend to increase in later life (e.g., Colón-Emeric et al., 2013), it would be prudent for future researchers to consider how poor physical health may act as a barrier against satisfying social relationships.

The current study suggests that relationship dissatisfaction is one reason why lonely and isolated older adults are psychologically distressed. However, more research is needed to explore other mechanisms that operate between combined loneliness and isolation and older adults' mental health. For instance, what types of social relationships are most important in later life and are there specific types of social support that, when lost, will negatively impact older adults' mental health? Might these results impact younger versus older adults differently? Longitudinal analyses would be useful to support directionality of results and better understand how long-term effects of combined loneliness and isolation may uniquely impact older adults. For example, it would be advantageous for other population-based surveys, such as the Canadian Longitudinal Study on Aging (CLSA), to include a broader range of social and psychological factors which impact older adults' mental and physical health

Limitations

Although the present study employed a national sample, participants were recruited online so results may not be generalizable because not everyone has access to the Internet and there tend to be sociodemographic differences between those who have access and those who do not. People with lower incomes, less education, and who are older are less likely to be online (Perrin & Atske, 2021). This leaves potential for some members of the population to be inadequately represented and may lead to a nonresponse bias in which our participants' survey answers may differ significantly from the general population. For example, in the present study, the majority of our older adult sample had a college/university degree (58.2%) and an income of

at least $50k/year (61.9%). In addition, participants' ages ranged from 55 to 101 years. While the number of participants aged 55 to 84 years are well-distributed (see Table 2), there were only 66 participants aged 85 to 101 years, representing just 2.4% of the sample. Therefore, our results may generalize to older participants aged 55 to 84 years, but may be less likely to be relevant for oldest-old adults. Future research should ensure adequate sampling of older adults with more diverse demographic characteristics including those who may not have internet access, people of color, those with lower incomes, less education, and which include the oldest-old.

There were also some limitations with regard to measurement in the present study. First, the moderated mediation effects were small (Cohen, 1988; see Table 4) and given that the large sample size provided significant power to detect even small effects, the significance of these results may be called into question. However, my use of bootstrapped confidence intervals is an effective method of indicating the reliability of effects. I also used the Johnson-Neyman technique to determine significance regions for the moderator (i.e., floodlight analysis; illuminates the entire range of moderator values to see at what level(s) of the moderator X had a significant conditional effect on Y) alongside the traditional 'pick-a-point' approach to teasing apart moderation effects (Hayes, 2018). Finally, effect sizes from moderation and mediation analyses tend to be small as competing indirect effects can 'cancel each other out'. For example, Indirect Effect[d] in Table 4 was significant, but small, due to competing effects along the a^2, b^2, and w^3 pathways (X and W on Y through M_2; Kenny, 2016; Preacher & Kelly, 2011).

Also, care must be taken when interpreting causal order using moderated mediation analyses from cross-sectional data. As indicated by Hayes & Rockwood (2019), statistical methods provide information about relationships between variables, but are unable to infer causation alone. However, cause-effect claims can be inferred using conditional process

modeling, even in the absence of experimental or longitudinal designs, if the statistical argument is grounded in theory and prior research. My research design for the current study is guided by theory (e.g., Cohen, 2004; De Jong Gierveld, 1987; Kahn & Antonucci, 1980) and prior evidence (e.g., Hawkley & Cacioppo, 2010; Malcolm et al., 2019) which supports that loneliness and isolation together negatively affects older adults' mental health, and this can occur because individuals are dissatisfied with their social relationships.

Although the current study provides evidence that the combination of loneliness and isolation predicts psychological distress in older adults due to relationship dissatisfaction, it is important to consider that these effects may be bidirectional. Namely, those who are distressed may become dissatisfied with their relationships, dissatisfaction may lead to loneliness and social isolation, and distress may lead to loneliness and isolation. While there is a paucity of research about loneliness and isolation together, the mental health risks associated with both the subjective and objective aspects of social disconnection are well-known (e.g., Newall & Menec, 2019). Examining bidirectional effects in the literature, findings indicate depression is a strong predictor of loneliness in later life (McHugh Power et al., 2020; Routasalo et al. 2006) and depression can also lead to social disconnectedness (i.e., isolation defined as a lack of contact with others; Cornwell & Waite, 2009; Santini et al., 2020). Also, older adults who feel dissatisfied with their social contacts may become lonely (Holmén et al., 1992a; Routasalo et al. 2006), which aligns with the cognitive discrepancy model of loneliness (i.e., loneliness is caused by a discrepancy between the social contact one wants and receives; De Jong Gierveld, 1987). Finally, while research on relationship satisfaction and mental health among older adults is scarce, there is evidence to suggest that depression can predict subsequent declines in marital dissatisfaction (Goldfarb & Trudel, 2019), and given that later life friendships seem to be at least

as important as family ties (e.g., Blieszner et al., 2019), it is reasonable to suggest that depression or distress may result in dissatisfaction with these contacts as well. Therefore, the current study provides strong evidence for the detrimental effects of loneliness and isolation on the mental health of older adults through relationship dissatisfaction, however future research using longitudinal and experimental designs is needed to confirm my findings.

In addition to potential limitations due to generalizability and measurement, the present study was based on secondary analyses of an observational study with self-report surveys. While this is a valuable way to gather a large sample of participant perspectives, this can also be threatened by one or more aspects of self-report bias. For example, participants may have over-estimated their current health status, number of social contacts, or satisfaction in their social relationships for fear of social disapproval. In addition, recall bias (i.e., providing incorrect responses on questions as a result of recall error) may have occurred. For example, participants may be unable to accurately estimate the total number of social contacts in their network, or may not remember how often they felt psychological distress symptoms (e.g., During the past 30 days, about how often did you feel nervous?).

Also, secondary data can be limiting as it may not provide all the information of interest. For example, for the present study I was unable to account for whether participants perceived their relationships as positive or negative, which is an important aspect of social networks (e.g., Antonucci et al., 2014). Further, I excluded 'satisfaction with a romantic partner' from the relationship satisfaction variable because 23% of the sample were missing this data. Although one might assume this missing data is due to participants being widowed or divorced given that this is an older adult sample, it would be helpful to know this for sure or determine if there was another reason for the incomplete data (e.g., perhaps participants felt this information was too

personal to share). Including information about satisfaction with a romantic partner would have been useful to understand the associations more fully between social relationships and psychological distress among older adults, and it could have informed future research that sought to determine which types of relationships are most important in later life.

Another limitation is the lack of consensus on how social isolation should be measured and appropriate clinical cut scores for those who are isolated versus not isolated. Although careful consideration was given to deciding cut scores based on past research as outlined earlier in this thesis, it is possible that some participants who were identified as isolated were not, in fact, isolated and vice versa. In the future, it would be beneficial if a single definition and measurement scale was defined to assess and compare social isolation across different populations more accurately. Given the relatively straightforward approach I took in determining socially isolated participants for the present study (i.e., summed the total number of important social contacts for each participant, determined those with 0 to 6 contacts as 'isolated' and those with 7 or more contacts as 'not isolated'), this could be easily replicated in future research.

Finally, this data was collected in 2017, before the Covid-19 pandemic, so special care must be taken when extrapolating these results into a post-pandemic world. Given the social restrictions and increased health risks for older adults, it is reasonable to expect that changes may have occurred with regard to the prevalence rates of loneliness and/or social isolation, as well as associated mental health outcomes, and potentially the processes by which these variables lead to distress. For example, a recent study using data from the U.S. Health and Retirement Study examined not only loneliness and isolation, but also digital isolation [defined as less than monthly digital contact (telephone, email/written contact, or social media) with family members or friends]. Researchers found that although physical isolation increased, many were able to

remain digitally connected, thus serving as a protective factor against loneliness (Peng & Roth, 2021). Peng & Roth's (2021) study results illustrate another understudied aspect of isolation and although these early results are promising, long term effects from the Covid-19 pandemic are still unknown. Future research on loneliness and social isolation among older adults should include information on digital connectedness and evaluate potential changes which have occurred due to the Covid-19 pandemic.

In conclusion, the present study extends what we know about how combinations of loneliness and social isolation impact the mental health of older adults. This is a critical issue given the growing numbers of older adults worldwide (United Nations, 2017). In Canada, 23% of the population is expected to be aged 65+ years by 2030 with an average lifespan of 86.2 years (Visconti & Neiterman, 2021), indicating a need to mitigate risk for factors which may lead to social disconnection. By examining loneliness and social isolation together, the present study takes an important step toward better understanding distress according to varying levels of loneliness and isolation, including which group(s) may be at the greatest risk for poor mental health outcomes. Identifying mechanisms that help explain pathways through which loneliness and isolation affect older adults' mental health can help inform future targeted interventions to prevent and treat these important outcomes.

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Appendix A

Three- Item Loneliness Scale

Hughes, M. E., Waite, L. J., Hawkley, L. C., & Cacioppo, J. T. (2004). A short scale for measuring loneliness in large surveys. *Research on Aging, 26*(6), 655-672. doi:10.1177/0164027504268574

The next questions are about how you feel about different aspects of your life. For each one, indicate how often you feel that way.

Hardly ever	Some of the time	Often
1	2	3

How often do you feel:

1. that you lack companionship?
2. left out?
3. isolated from others?

Appendix B

Social Network Size (Social Convoy)

Kahn, R. L., & Antonucci, T. C. (1980). Convoys over the life course: Attachment, roles and social support. In P. B. Baltes & O. G. Brim (Eds.), *Life-span development and behavior* (pp. 254–283). San Diego, CA: Academic Press.

Fung, H. H., Carstensen, L. L., & Lang, F. R. (2001). Age-related patterns in social networks among European Americans and African Americans: Implications for socioemotional selectivity across the life span. *International Journal of Aging & Human Development*.

This modified (for use online) form of the Social Convoy Questionnaire (Kahn, R. L., Antonucci, 1980) measures the size and proportion of very close individuals in participants' social networks.

- Please list the first names of all of the people you feel **very close to** in this first text box. Please use a comma to separate the names (e.g., Ken, Jamil, Sunny).
    - Please indicate the number of people you named in the above text box that you feel very close to (*numerical*)

- Please list the first names of all of the people you are **close to (but not as close)** in this second text box.
    - Please indicate the number of people you named in the above text box that you feel **close to (but not as close)**. (*numerical*)

- Please list the first names of all of the people you are **less close to (but still important to you)** in this third text box.
    - Please indicate the number of people you named in the above text box that you feel **less close to (but still important to you)**. (*numerical*)

To calculate total network size, sum the number of people in all three groups. To calculate the proportion of very close individuals, we divide the number of individuals listed in the first (very close) group by the total number of individuals in all three groups, and multiplied this number by 100 (Fung et al., 2001).

Appendix C

Social Support Survey (MOS)

Hays, RD (1994). The *Medical Outcomes Study (MOS) Social Support Survey.* Retrieved August 18, 2017, from the RAND Corporation web site: https://www.rand.org/health/surveys_tools/mos/social-support/survey-instrument.html.

People sometimes look to others for companionship, assistance, or other types of support. How often is each of the following kinds of support available to you if you need it? Choose one number from each line.

None of the time	A little of the time	Some of the time	Most of the time	All of the time
1	2	3	4	5

Emotional/informational support

1. Someone you can count on to listen to you when you need to talk
2. Someone to give you information to help you understand a situation
3. Someone to give you good advice about a crisis
4. Someone to confide in or talk to about yourself or your problems
5. Someone whose advice you really want
6. Someone to share your most private worries and fears with
7. Someone to turn to for suggestions about how to deal with a personal problem
8. Someone who understands your problems

Tangible support

9. Someone to help you if you were confined to bed
10. Someone to take you to the doctor if you needed it
11. Someone to prepare your meals if you were unable to do it yourself
12. Someone to help with daily chores if you were sick

Affectionate support

13. Someone who shows you love and affection
14. Someone to love and make you feel wanted
15. Someone who hugs you

Positive social interaction

16. Someone to have a good time with
17. Someone to get together with for relaxation
18. Someone to do something enjoyable with

Additional item

19. Someone to do things with to help you get your mind off things

Appendix D

Perceived Relationship Quality Components Inventory

Modified from Fletcher, G. J. O., Simpson, J. A., & Thomas, G. (2000). The measurement of perceived relationship quality components: A confirmatory factor analytic approach. *Personality and Social Psychology Bulletin, 26*, 340-354. doi: 10.1177/0146167200265007

Please indicate what your current relationships are like. Using this scale, how satisfied are you with your relationship with your:

Not at all						Extremely	Not Applicable
1	2	3	4	5	6	7	11

1. romantic partner?
2. family?
3. friends?
4. health providers?

Appendix E

Kessler Distress Scale (K6)

Kessler, R.C., Barker, P.R., Colpe, L.J., Epstein, J.F., Gfroerer, J.C., Hiripi, E., Howes, M.J, Normand, S-L.T., Manderscheid, R.W., Walters, E.E., Zaslavsky, A.M. (2003). Screening for serious mental illness in the general population *Archives of General Psychiatry*. 60(2), 184-189.

0 none of the time	1 a little of the time	2 some of the time	3 most of the time	4 all of the time

Q1. During the past 30 days, about how often did you feel …

a. …nervous?
b. …hopeless?
c. …restless or fidgety?
d. …so depressed that nothing could cheer you up?
e. …that everything was an effort?
f. …worthless?

Appendix F

Perceived Physical Health

Lawton, M. P., Moss, M., Fulcomer, M., & Kleban, M. H. (1982). A research and service oriented multilevel assessment instrument. Journal of Gerontology, 37(1), 91-99. doi:10.1093/geronj/37.1.91

1. How would you rate your overall health at the present time?

Excellent	Fair	Poor
1	2	3

2. Do your health problems stand in the way of you doing things that you want to do?

Not at all	A little	A great deal
1	2	3

3. How would you say your health compares with most people your age?

Better	About the same	Not as good
1	2	3

Appendix G

Background Sociodemographic Information

What is your age? (drop down menu)

What sex were you assigned at birth, meaning on your original birth certificate?
- Male
- Female

Which best describes your current gender identity?
- Male
- Female
- Indigenous or other cultural gender minority identity (e.g., two-spirited)
- Something else (e.g., gender fluid, non-binary)

*Participants who answered "something else" also answer:
What gender do you currently live as in your day-to-day life?
- Male
- Female
- Sometimes male, sometimes female
- Something other than male or female

Which province or territory do you live in? (drop down menu)

What is the highest level of education you have achieved? (drop down menu)

Current occupational status:
( ) Full-time
( ) Part-time
( ) Retired
( ) Unemployed/on Disability
( ) Student

**Only participants that respond Retired to the above question will also see:*
If you are currently retired, approximately how many years ago did you retire? ____

Approximately what is your current household income before taxes?
( ) $0 - $9,999
( ) $10,000 - $19,999
( ) $20,000 - $29,999
( ) $30,000 - $39,999
( ) $40,000 - $49,999
( ) $50,000 - $59,999
( ) $60,000 - $69,999
( ) $70,000 - $79,999
( ) $80,000 - $89,999
( ) $90,000 - $99,999

( ) $100,000 - $149,999
( ) $150,000 - $199,999
( ) $200,000 - $249,999
( ) $250,000 - $299,999
( ) $300,000+

8. Marital status:
( ) Single
( ) Married or Common law
( ) Widowed
( ) Separated or Divorced

9. In the past year, have you been a caregiver (i.e., had to provide assistance) for a spouse, parent, friend, or neighbour?
( ) Yes
( ) No

10. Who have you provided care to?
( ) Spouse
( ) Parent
( ) Friend or neighbour

11. Approximately how many hours of care did you provide per week? _____

12. Population Group:
_____ Arab
_____ Black
_____ Chinese
_____ Filipino
_____ Indigenous (First Nations, Métis, Inuit)
_____ Japanese
_____ Korean
_____ Latin American
_____ South Asian (e.g., East Indian, Pakistani, Sri Lankan, etc.)
_____ Southeast Asian (e.g., Vietnamese, Cambodian, Malaysian, Laotian, etc.)
_____ West Asian (e.g., Iranian, Afghan, etc.)
_____ White
_____ Other – Specify: _____

13. What is your religion:
____ Christian (e.g., Catholic, Protestant)
____ Muslim
____ Jewish
____ Buddhist
____ Hindu
____ Sikh

____ No religious affiliation
____ Other