

The Relationship Between Social Isolation, Social Support, and Mental Health

by

Oksana Harasemiw

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Abstract

This study explored how the structural aspects of a social network (that is, number of social ties, frequency of contact, as well as social participation), along with the functional aspect (social support), relate to mental health. Using data from the baseline questionnaire for the tracking cohort of participants in the Canadian Longitudinal Study on Aging, community-dwelling older adults aged 65-85 years old were studied. Cluster analysis was used to group individuals into different clusters, based on their structural social network characteristics. Six clusters were found, ranging from most socially integrated, to moderately integrated, to socially isolated. Univariate analyses indicated that as level of social integration decreased, individuals fared increasingly worse in terms of their mental health outcomes. Furthermore, a series of mediation analyses showed that social support mediated the relationship between social integration level, and mental health, an effect that was strongest for the most socially isolated individuals.

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Chapter 1: Introduction and Objectives

1.1 Introduction

Throughout life, the distinct social ties that we develop with others become an integral part of the narrative of our lives. These individual ties string together, forming the structural framework of a social network. As individuals age, the accompanying functional component of the social network – namely social support – becomes increasingly important, and has a key role in helping individuals adapt to the challenges that aging presents (Martire, Schulz, Mittelmark, & Newsom, 1999). Conversely, considering how important the social network is for an individual, it follows then, that the absence of it – the phenomenon of social isolation – has the potential to have profound detrimental effects on the individual.

A large body of research has shown that social isolation is associated with poor mental health and well-being, such as an increased risk of depression, feelings of hopelessness, as well as impaired cognitive function, and decreased life satisfaction (Fiori, Antonucci, & Cortina, 2006; Fratiglioni, Paillard-Borg, & Winblad, 2004; Golden, Conroy, Bruce, et al., 2009; López García, Banegas, Pérez-Regadera, Cabrera, & Rodríguez-Artalejo, 2005; Saczynski et al., 2006; Wilson et al., 2007). Additionally, a meta-analysis by Holt-Lunstad, Smith, Baker, Harris, & Stephenson (2015) determined that socially isolated individuals had a 29% increased risk of death relative to those not socially isolated, while those individuals who reported being lonely had a 26% increased risk, relative to those who reported not being lonely. Therefore, the effect of poor social relationships on mortality risk can be compared to other risk factors, such as smoking, or lack of physical activity (Holt-Lunstad, Smith, & Layton, 2010).

Furthermore, research suggests that with increasing age, social networks become compressed. For example, results from Statistics Canada's General Social Survey on Social

Identity showed that although 51% of Canadians have at least five close friends, and 55% have at least 5 close family members, the clustering of social ties surrounding this core network decreased with age. Individuals 25 years of age and under had a median of 24 ‘other’ friends, a number that was 38% greater than that of the 45-54 age group, and more than double that of the 65 and up age group, although numbers varied by sex, province, education and income level. The study also showed that 56% of older adults with many close friends and family rated their physical health as good or excellent, compared to only 33% with no close friends (Sinha, 2014). In fact, the prevalence of social isolation among community-dwelling older adults ages 65 and up, has been shown to range from 17% to 20% in both Canadian and European studies (Cloutier-Fisher & Kobayashi, 2009; Kobayashi, Cloutier-Fisher, & Roth, 2009; Lubben et al., 2006).

Furthermore, in older adulthood, the exchange of support is one of the most important functional components of an individual’s social network (Fiori & Jager, 2011). Social support has shown to act as an important factor toward achieving better health and mental health outcomes, and an important aspect in promoting healthy aging (Uchino, 2009). Research among older adults has also indicated that an increased presence of social support is associated with better health outcomes, such as improved physical health and lower depression rates (Antonucci, Fuhrer, & Dartigues, 1997). Furthermore, an integrated social network – meaning that an individual is well embedded within a diverse set of social network ties – is thought to be associated with increased access to a diverse set of social support (Schweizer, Schnegg, & Berzborn, 1998).

In recent years, the topic of keeping older adults socially integrated and engaged, and reducing social isolation, has become part of a general discourse around improving the well-being of adults as they age (National Seniors Strategy, 2015; The National Seniors Council,

2014). Social isolation is a reality that affects many older adults, and has shown to be associated with poor mental health and well-being. It is, therefore, an important issue to examine. However, much of the literature around social isolation focuses on only one or two measures of social isolation, and often only looks at singular outcomes. Social network typology research takes a multidimensional approach to this problem. This type of research builds the social network around the individual, through the integration of a variety of structural social network variables. This allows the researcher to compare individuals who have different types of social networks, and therefore, compare different outcomes. This is especially important for older adults, for whom social networks may be heterotypic. However, a comprehensive social network typology study that incorporates a wide variety of structural components, as well as a wide variety of functional components, through social support, is missing from the literature. As well, very few social network typology studies have looked at a wide variety of sociodemographic factors, and health outcomes. Furthermore, no high quality social network typology studies have been conducted in Canada, an important point, since social networks may be nationally-bound.

Using secondary data analysis of a national-level sample of Canadian older adults, this study first examined whether individuals had different social network structures, and whether different social networks were associated with different sociodemographic factors, and physical health outcomes. Second, I examined whether social support type and frequency differed between different social networks. Lastly, by building on prior social network typology research, this study also looked at whether perceived social support was a mediator between degree of social integration, and mental health.

1.2 Objectives

Using baseline data from the tracking cohort of participants in the Canadian Longitudinal Study on Aging (CLSA), this thesis had three objectives:

- 1) to examine if individuals could be grouped into common clusters that reflected their level of integration within their social networks, reflecting a range of socially integrated to more socially isolated clusters;
- 2) to examine if and how the clusters differed in terms of sociodemographic, physical health, and mental health outcomes; and
- 3) to examine whether the type and frequency of social support differed between different clusters, and if social support mediated the relationship between level of social network integration, and mental health outcomes.

Chapter 2: Literature Review

2.1 Key Concepts

Research involving social relations and the impact they have in the lives of individuals of all ages has been examined from many different perspectives. There are, therefore, numerous concepts and definitions used in the literature. In the following section, some of the key concepts used in this thesis are described, including: social networks, social isolation and loneliness, as well as social support.

2.1.1 Social Networks

Social networks are defined as “the web of social relationships that surround an individual” (Berkman, Glass, Brissette, & Seeman, 2000, p. 847). A network is a representation of the direct social ties people develop over their lifetime (Dubouva et al. 2010), particularly with those with whom they are closely involved with, and that provide companionship, advice, help or other types of care (Wenger, 1991). Social networks have two dimensions – the structural, and the functional. The different types of relationships within the network, along with frequency of contact, constitute the structural dimension, whereas the qualitative and behavioural aspects of network ties constitute the functional dimension (Due, Holstein, Lund, Modvig, & Avlund, 1999). These two dimensions work together to represent both the ‘nature’ and the ‘extent’ of an individual’s social network (Litwin & Stoeckel, 2014), meaning who is in the network and how involved they are in supporting an individual. Ideally, individuals are embedded within their social network, and are surrounded by a variety of ties that influence their degrees of connectedness (Litwin & Shiovitz-Ezra, 2011b). Each of these ties within the network can potentially serve a different function, such as providing emotional, informational, or functional support (O’Reilly, 1988). Furthermore, both the structural and functional dimensions

of a network have an important role in determining how supported or potentially isolated an individual feels within their web of relationships (Antonucci, Ajrouch, & Birditt, 2013).

A related concept is that of social integration, which is defined as, and is characterized by, an individual's membership and degree of embeddedness within a diverse social network (Cohen & Janicki-Deverts, 2009). Social integration includes two components – a behavioural one (that is, through participation in a diverse set of activities and relationships), as well as a cognitive one (that is, the ability to identify with and feel a sense of belonging to the different social ties) (Brissette, Cohen, & Seeman, 2000). Therefore, as level of social integration decreases, social isolation (that is, a state in which an individual has a limited number of social ties) can potentially be expected to increase.

2.1.2 Social Isolation and Loneliness

Social isolation is defined as a “state where an individual has minimal contact with others and/or a generally low level of involvement in community life” (Grenade & Boldy, 2008, p. 469). Conversely, loneliness is “a situation experienced by the individual as one where there is an unpleasant or inadmissible lack of (quality of) certain relationships. This includes situations in which the number of existing relationships is smaller than an individual desires, as well as situations where the intimacy one wishes for is not achieved” (de Jong Gierveld, 1987, p. 120).

Social isolation occurs when the social network is lacking in proper structure and function, and is an objective measure (Golden, Conroy, & Lawlor, 2009). Conversely, the concept of loneliness is a subjective one – meaning that the perceived quality of the ties may be what drives the feelings of loneliness rather than the quantity of ties (Pinquart & Sörensen, 2003; Shiovitz-Ezra & Litwin, 2012). Individuals with a small number of relationships might be

considered socially isolated, but not necessarily lonely, or they might have many relationships, and still feel lonely. Therefore, with regards to loneliness, it is important to consider that being embedded in a social network that may be considered socially connected, meaning it has plenty of social ties, does not necessarily mean that an individual is not lonely (de Jong Gierveld, 1998). Researchers de Jong Gierveld, van Tilburg, & Dykstra (2006) argue that “where a person ends up on the subjective continuum depends on his or her relationship expectations and standards. Some people with a small number of social contacts might feel sufficiently embedded” (p. 486), whereas other may not. The opposite of loneliness would be feelings of embeddedness, or belonging, whereas for social isolation, the concept is opposite that of social participation, or of integration (de Jong Gierveld & Havens, 2004).

Ideally, older adults are part of interlocking social structures that include their partner, children, friends, and neighbours, but also include organizations and institutions that they are a part of. Each of these relationships that older adults are part of serve the function of social integration, the absence of which has the potential of resulting in social isolation (Knipscheer, Dykstra, de Jong Gierveld, & van Tilburg, 1995). However, it is important to note that a person can live with someone and still be social isolated. For example, in certain situations the presence of social ties may isolate an individual, such as when faced with a heavy caregiving responsibility, or in cases of abusive or negative social ties (Smith & Christakis, 2008). Additionally, those who have experienced social isolation throughout their lifetime, can view their social isolation as a norm, and might even prefer to live a solitary life (Cloutier-Fisher, Kobayashi, & Smith, 2011).

Weiss (1973) argues that loneliness has two main dimensions. The first is emotional loneliness, which is caused by the absence of other people with whom one can develop an

emotional attachment to. The second is social loneliness – and this occurs when the quantity of social network ties with family and friends that are deemed appropriate by the individual are absent. The former is addressed by developing more intimate relationships, and the latter, by developing a supportive network. Furthermore, researchers Hawkley, Browne, & Cacioppo (2005) discuss a third dimension of loneliness – that of connective loneliness. This is characterized when the connections an individual makes with others in a ‘collective space’ are absent. These are weaker ties, generally formed through group membership.

Although loneliness can have a detrimental impact in older adulthood, Golden, Conroy, Bruce, et al. (2009) counter that loneliness risk among older adults is not the result of an age effect per se, but rather that the risk factors influencing loneliness are more likely to be encountered in older adulthood. Savikko, Routasalo, Tilvis, Strandberg, & Pitkälä (2005) state that “loneliness seems to derive from societal life changes as well as from natural life events and hardships originating from aging” (p. 223). In particular, with the loss or absolute absence of social support, the overall risks of both social isolation and loneliness are more likely to be encountered with age (Wenger, 1997).

2.1.3 Social Support

Social support is defined as the “functions performed for the individual by significant others, and include emotional, instrumental and informational supports” (Thoits, 2011, p.146). Social support is a multidimensional concept that includes the type of support, the source of support, and whether the support is perceived or actually exchanged (Fiori & Jager, 2011). Social support can be measured both quantitatively, through the degrees to which an individual is connected, as well as qualitatively, by examining how individuals perceive they are connected and supported (Tomaka, Thompson, & Palacios, 2006). The social support that surrounds an

individual can be the result of ties with anyone in their network – family, friends, neighbours, or ties through organizations. However, research has shown that different individuals in a network provide different support to the individual. Close kin, for example, are expected to provide more instrumental support, as well as guidance for decision making, whereas friends would more likely provide companionship, and opportunities for socialization (Schweizer et al., 1998).

Measurements of perceived social support are sometimes considered to be the natural opposite of social isolation, since they are reflective of the feelings that one is benefitting positively from network membership (Tomaka et al., 2006; Victor, Scambler, Bond, & Bowling, 2000). Research has shown that connections and interactions with others shape daily behavioural choices, and promote better health and well-being (Shaw, Krause, Liang, & Bennett, 2007). This suggests that quality social support in older adulthood increases mental, physical and emotional well-being, and acts toward minimizing the health damaging effects that social isolation and loneliness inflict (Martire et al., 1999). Tomaka et al. (2006) investigated the role between social support from family and friends, and found a positive correlation between higher support and better physical health outcomes. High availability of social support has also been found to be inversely related to depression (Vanderhorst & McLaren, 2005), and protective against feelings of loneliness (Hawkey et al., 2008). Furthermore, results from Cloutier-Fisher & Kobayashi's (2009) study of socially isolated older adults in British Columbia showed that those who were socially isolated had significantly lower rates of social support when compared to less socially isolated older adults.

Social support is a multidimensional concept, and studying the different outcomes related to different levels of social support, is complicated by the idea of what constitutes 'good' social support. That is, quantity (actual) versus quality (perceived). Perceived support is related to how

individuals perceive their potential, or actual, contact with others, as well as their level of social support, whereas quantity of support is the actual level of support that was provided to the individual (Dunkel-Schetter & Bennett, 1990). Integrating and measuring both of these aspects of social support is essential in providing a holistic view of the social support that exists within a network. Both concepts are important in helping to determine vulnerability of poor physical and mental health outcomes – that is, quantity provides a measurement of how structurally sound a network is, whereas quality provides insight into how emotionally fulfilling and supportive the network is.

2.2 Theoretical Framework

This study was guided by the Social Convoy of Relations model as a theoretical framework. The model seeks to explain how the social ties surrounding an individual influence the way the individual navigates the challenges they are faced with, with an emphasis on the emotional bonds developed between different types of people (Antonucci & Wong, 2010). The convoy model allows the researcher to explore how the social bonds between individuals influence the availability of broader resources, as well as the outcomes that result from being in a socially integrated network, versus belonging to a less socially integrated network (Ajrouch, Blandon, & Antonucci, 2005).

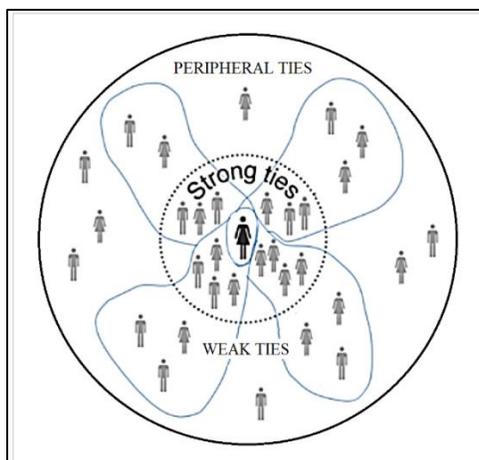


Figure 1: Conceptualization of an individual's social convoy.
(Adapted from Antonucci, 1986).

As seen in Figure 1, the model conceptually breaks apart an individual's network into three concentric circles with the individual at the center. The sum of the three circles is referred to as the 'social convoy', with the individual at the center. Kahn & Antonucci (1980) describe the individual-focused aspect of the model as each person "moving through the life cycle surrounded by a set of people to whom he or she is related to by the giving or receiving of social support" (p. 269). However, the individuals within the different circles have varying degrees of involvement within the individual's life. The inner circle (emotionally strong ties) would include people with whom the central individual "feels so close that it is hard to imagine life without them" (Antonucci, 1986, p.10). The middle circle (weak ties) includes those that the central individual may not feel as close to, but that are still important to him or her. The outer circle (peripheral ties) is made up of people with whom ties are not strong, but are still subjectively important enough that the individual feels they should be placed within the social convoy (Antonucci, 1986).

Furthermore, in Figure 1, the four segments that span both strong ties, and weak ties, are meant to illustrate that individuals within different categories – for example, children, siblings,

friends, or neighbours, can have different degrees of connection to the central individual. In theory, kin who are closest to the individual generally provide instrumental support, a sense of security and belonging. Conversely, strong ties with non-kin provide high emotional support, and positively influence an individual's self-esteem and social integration (Felton & Berry, 1992; Litwak, 1985). However, not all kin will necessarily be placed within the innermost circle. Likewise, some non-kin may rank differentially in terms of emotional closeness.

Research has indicated that even those individuals at the periphery of a network are important, even though they may not be as intimately connected (Berkman et al., 2000). For example, for individuals who have small networks lacking ties in the central circles, peripheral ties can potentially moderate the negative effects that social isolation and loneliness have (Cloutier-Fisher et al., 2011). As Fingerman (2004) argues, "peripheral ties add something more to quality of life" (p. 74).

The social convoy is dynamic, and is shaped over the course of an individual's lifetime, reflecting different life trajectories, social positions and social memberships. The Socioemotional Selectivity Theory (SST) developed by Laura Carstensen supports the Convoy model, by providing an elaboration of how social networks change over the life course. The SST proposes that over the course of a lifetime, social goals change, and individuals try to restructure their networks in order to maximize their emotional well-being (Luong, Charles, & Fingerman, 2011). Macro-level influences, such as family, cohort, and socioeconomic status, influence the shape and composition of the convoy, which in turn influences the development, utilization and effectiveness of support (English & Carstensen, 2014; Fuller-Iglesias, Webster, & Antonucci, 2015). Life changes and losses experienced in the life of an individual (e.g. loss of function, evolving life roles and stages, and evolving social goals), as well as changes within an

individual's network (e.g. experiencing loss of network members) cause the convoy to evolve, so that the individual can be better supported.

According to the SST, older adults actively separate themselves from certain relationships, in order to increase beneficial social and emotional experiences gained from their relationships, and decrease potential social and emotional threats (Carstensen, 2001), thereby, leading to the social convoy shrinking in older adulthood (English & Carstensen, 2014). Generally, however, the loss experienced occurs with the contacts at the periphery of the network, not with the core social ties that provide the greatest degrees of affection and assistance (Martire et al., 1999). Consequently, the focus in older adulthood shifts toward developing quality relationships, rather than quantity of relationships, resulting in relationships that are better, stronger, and more emotionally fulfilling (Antonucci et al., 2011).

The SST theorizes that there are two goals that motivate much of human behaviour – goals related to information and knowledge acquisition, and goals related to emotional states and meaningful activities (Charles, 2010). According to the SST, although both of these goals remain important in older adulthood, the perception of a shrinking temporal horizon impacts individual's goals by placing a greater focus on emotional satisfaction and less of a priority on expanding social networks and acquiring knowledge (English & Carstensen, 2014; Luong et al., 2011). The SST argues that older adults engage in an active pruning of their networks, as part of an emotional regulation process, distinct from any normative age related losses that may simply just occur (Charles & Luong, 2013). In other words, as people approach death, their life goals change. When time is perceived as 'open-ended', the focus shifts to knowledge-acquisition, and social network expansion. However, when time is perceived as limited, the focus shifts to satisfying emotional goals. In this theory, age is only a proxy for a shrinking time horizon. As

such, young people who are close to their end of life as a result of a terminal illness, for example, would also be expected to change their life goals (Carstensen, Isaacowitz, & Charles, 1999).

Susan Charles' Strengths and Vulnerability Integration (SAVI) Model builds upon the SST model, by incorporating external situations to help explain that although there are strengths associated with aging that help individuals be emotionally well, there are also certain vulnerabilities that may make modulating emotional experiences more difficult. Whereas the SST argues that the narrowing of networks in older adulthood is an active process, SAVI acknowledges that this process is not always purposeful. Age-related events, such as bereavement and loss of close family and friends can reduce network size not by choice, but rather as an outcome of time and normative experiences. Furthermore, the model argues that social isolation and the loss of social belonging are among the circumstances that place older adults in emotionally vulnerable positions, therefore, indicating that emotional well-being in older adulthood is influenced by individual circumstances, by other people, as well as from the environmental level (Charles & Luong, 2013). Furthermore, SAVI argues that without adequate support, these experiences place individuals at risk of having greater difficulties regulating their emotions during distressful situations (Charles & Luong, 2013). In other words, the SAVI model argues that people's networks shrink due to different reasons (purposeful or not), and it explores how people emotionally deal with their shrinking networks.

In addition to changing perceptions related to diminished temporal horizons, SAVI incorporates a life-course approach, acknowledging that individuals are provided with the social experiences and the self-knowledge to be aware of the kinds of daily situations that they are either emotionally capable of managing, or should rather avoid (Charles, 2010). The model also argues that older adults, because of shifting motivational goals, increase their use of cognitive-

behavioural strategies, which are the thoughts and behaviours aimed at regulating one's emotions before, during, and after exposure to negative experiences in daily life. These strategies enhance positive experiences, allowing older adults to have greater levels of affective well-being than younger age cohorts (Charles, 2010). That is, cognitive-behavioural strategies employed by older adults help increase emotional well-being, despite the vulnerabilities that exist in their lives. However, it is important to note that these strategies used by older adults to maintain levels of affective well-being are not always sufficient in preventing all individuals from becoming emotional distressed. Therefore, the increase in emotional well-being that is accrued with age can attenuate or disappear, since the cognitive-behavioural strategies that are otherwise used to protect older adults from distressful situations and increase well-being are not as effective or as easily applied.

Another theory that can help elaborate on the Social Convoy theory is Weiss' theory of the functional specificity of relationships (Fiori et al., 2006). Weiss' theory proposes that different relationships and social ties serve different functions for an individual, including emotional attachment, social integration, reliable alliance, guidance, reassurance of worth, and opportunity for nurturance, and that generally these supports are each fulfilled by different members of an individual's network (Weiss, 1974). For example, spouses are expected to provide the most support, including emotional and instrumental support. Adult children are also expected to provide emotional and instrumental support, and to maintain close contact. Siblings and friends are sources of affection and companionship. Other ties, such as those with neighbours, play a less important role in terms of the provision of social support. However, certain relationship can become more important over time, depending on the absence or strength of other ties within the network (Wenger, 1997). It follows, then, that with age particularly,

changes in the availability of ties could change the composition of the network, and ultimately, support availability (Gurung, Taylor, & Seeman, 2003).

An individual who has a network that is comprised of very diverse social ties, and therefore receives a variety of support types, is expected to have better mental and physical health outcomes than a person who has a network that is restricted (Fiori et al., 2008). In their study of older adults aged 75 years and up, Litwin & Landau (2000), found that social support (particularly emotional support), varied by network type. The most diverse networks were found to be the most supportive, versus the friend- or family-focused networks, which were least so. For example, having a wide and diverse network inclusive of family, friends and neighbours, may have a positive influence on meeting both physical and emotional needs. Conversely, a network of very tight-knit family may be conducive in allowing someone to live in place for longer by supplying instrumental support, but may be detrimental with regards to emotional well-being (Cheng, Lee, Chan, Leung, & Lee, 2009). Ultimately, this suggests that well-being is a balance between quantitative and qualitative elements of networks, which in turn influence the types of social support received (Cheng et al., 2009).

In sum, within the social convoy, there is both an objective component - represented by network structure, and a subjective component – perceived function and quality of relationships (Fiori, Smith, & Antonucci, 2007). Each individual's social convoy is “shaped by personal and situational factors, and empirical evidence suggests that individuals' social convoys can be grouped into certain types of social networks that have implications for well-being” (Fiori et al., 2006, p.26).

2.3 Measuring Social Networks

In order to characterize an individual's network, social network typology research examines the structural components of a social network, as well as the social resources and ties that exist within it. These studies apply a “construct that allows for the identification of differing meaningful interpersonal environments”, by initially identifying a “series of unique characteristics of sets of social ties”, in a sample of individuals (Litwin, 2001, p. 516). This ultimately allows the researcher to identify clusters of individuals who have similar networks, and therefore, compare outcomes of different clusters.

Social network typology studies generally take an individual-centric approach, meaning that the individual is placed at the center, which allows the researcher to measure the various ways social ties affect the individual (Berkman et al., 2000). That is, by adopting a person-centered approach, rather than a variable-centered one, the researcher is able to examine the multiple relationships within a network, their complexities, as well as each social ties' functional capacity (Fiori et al., 2008, 2006). Networks are multidimensional social constructs that involve the interaction and involvement of multiple social ties and relationships that can have an effect on an individual's physical and psychological well-being. Social network typology studies integrate “composite measures that reflect several aspects of one's social network, (providing) added value for understanding the interpersonal environment in which older individuals are embedded” (Shiovitz-Ezra & Litwin, 2012, p. 2). One type of social network typology approach, is that proposed by Wenger, which takes into account multiple relationships and network characteristics, allowing for an in-depth understanding of relationships in older adulthood (Wenger, 1991).

2.3.1 Using the Wenger Typology to Define Different Network Clusters

The Wenger Typology clusters individuals into different support networks, based on structural network components (for example, number of members, proportion of family, friends, and neighbours, as well as the frequency, and proximity of contact), and on functional components (such as the type of support provided) (Wenger, 1989). Categorizing individuals into different social network clusters allows practitioners and researchers to conduct assessments for determining how vulnerable an individual is for becoming socially isolated, and thus, allows for assessments of the related risks and consequences on well-being (Wenger, 1997). This is meant to encourage researchers and practitioners to consider the impact that different social environments have on the individual, and their health (Litwin, 2001).

Wenger postulates that it is possible to identify five main network cluster types in older adults, which can be categorized into two broad categories – integrated social network cluster type, and restricted network cluster type. The former composed of the locally integrated (diverse) cluster, as well as the wider-community focused support cluster, and the latter composed of the local self-contained support cluster, the family dependent cluster, and the private (very restricted) cluster (Wenger, 1991). Each network type is characterized by certain properties, and certain benefits. The following is a characterization of the expected network clusters from the Wenger typology.

Integrated social network types:

1. **Locally integrated support network (diverse):** This is the most robust support network. Informal help is given and received from local family, friends and neighbours.

Involvement with friends and family is high, as well as involvement with neighbours and community groups is high. Social support is optimal in this network

2. **Wider-community focused support network:** Local kin are absent. High contact is had with friends and neighbours; contact with family is limited, for example, with children who live a distance away. High level of involvement in community groups.

Restricted social network types:

1. **Local self-contained support network:** Reliance for support is generally on neighbours, but involvement of distant kin is also common. Life-style is private, with involvement in community groups low.
2. **Family dependent support network:** Heavy reliance on local family – they are the source of the greatest contact. There is some neighbour contact, but very limited. Low levels of community group involvement. This type of network is often characterized by a shared household with adult children or siblings, and becomes more common as adults age.
3. **Private support network (very restricted):** Localized family and local sources of support are absent. They have little contact with community, as well as limited contact with friends, and neighbours however they may rely on distant kin (Golden, Conroy, & Lawlor, 2009; Wenger, 1989; Wenger, 1991).

The typology was developed from a longitudinal study based in England and Wales (Wenger, 1991). A number of social network typology studies have been conducted in multiple countries, a summary of which is discussed in the following section.

2.3.2 The Types of Social Network Clusters Found in the Literature

Social network typology research has been conducted in multiple countries, using different social network comparison variables. Key studies, and their social network clusters, are reviewed below.

A study in the United States assessing mental health outcomes across different social network clusters discovered two very restricted network clusters, rather than just the one. They had a nonfamily-restricted cluster (individuals who were unlikely to be married, unlikely to have kids, but had high contact with friends) which had the most limited number of social ties, followed by the non-friends-restricted (those individuals who were moderately likely to have children, and have lots of contact with them, but had very low numbers of friends) (Fiori et al., 2006). The discovery of multiple restricted clusters may be reflective of a Western cultural context, since generally, European and Israeli studies have found only one restricted network (e.g. Litwin, 2001, 2003, 2004).

In a United States study, researchers found a unique (restricted) congregant network. This network was characterized by a high attendance rate at religious services, and low attendance at any other sort of social meetings or gatherings. Most of their social exchanges occurred with individuals at their place of worship, and therefore they were considered to be a moderately socially integrated cluster, since ties were otherwise limited (Litwin & Shiovitz-Ezra, 2011a). Authors Medvene et al. (2015) found four network clusters – family, diverse, restricted, as well as a religion-centered group, the latter of which was also a moderately socially integrated group.

In Mexico, Dubouva and colleagues (2010) discovered a unique widowed (restricted) network cluster, constituted mostly of women without membership to any community groups,

with the majority of main contacts being friends and family. The absence of both a life partner and participation in the community were related to negative self-rated health, higher depression and dependency rates. The authors credited this to an absence of quality government social policies and programming targeting this population.

In addition to social structure, societal values also have a role to play in social typology studies. For example, a society which values voluntary ties would have higher proportions of individuals in the diverse or friend-focused networks, in comparison to societies that value familial ties, which would result in higher numbers of family-focused (restricted) groups. A study in China found the five core networks - diverse, friend-focused, restricted, family-focused, and distant family (Cheng et al., 2009). This latter group of high contact and support exchange with distant (horizontally extended) family, and low contact and support exchange with vertically extended family and non-kin. In terms of well-being, this group was comparable to the friend-focused network. These results, therefore, reflect the strong importance that Chinese society places on obligatory kinship with regards to extended family, particularly in the absence of immediate kin and friends.

However, despite the differences in clusters, the mental health, as well as physical health outcomes resulting from belonging to different network clusters is evident throughout the social network typology literature. This literature is reviewed below.

2.3.3 Do Different Types of Social Networks Have Different Physical and Mental Health Outcomes?

Among social network typology studies, the general consensus is that individuals in the most diverse networks have the best physical health, and mental health outcomes. Research has

shown that the more socially integrated an individual is, the greater health benefits they can potentially incur (Litwin, 2001). Additionally, research has shown that these individuals have fewer reports of depression, negative self-rated health, and functional dependency (Doubova et al., 2010; Fiori et al., 2006).

Conversely, people who have networks that reflect the poorest social ties generally present the poorest mental health (for example, higher levels of loneliness, of anxiety, and lowest levels of measured happiness) (Litwin & Shiovitz-Ezra, 2011a), as well as lower levels of physical activity (Litwin, 2003), and highest mortality risk (Litwin & Shiovitz-Ezra, 2006). Fiori et al. (2006) noted that people with less diverse networks had worse mental health (measured by depressive symptoms). It has also been found that, in a sample of depressed older adults, those who engaged in self-harming behaviour were more likely to have a poorly integrated social network than those who had no history of self-harm (Dennis, et al., 2005). Shiovitz-Ezra & Litwin (2012) found that subjects within network clusters that had low numbers of social ties were at greater risk for negative health behaviours, such as lower frequencies of health-seeking and health promotion behaviours, than those with more social ties.

Research has stressed the importance of having diverse networks for reducing loneliness and depression risk (Jenny de Jong Gierveld, 1998). After controlling for a variety of factors, one study found that roughly 20% of the prevalence of depressed mood in the population was associated with non-integrated social networks, and among those individuals in that network, 40% of their depression risk was attributable to belonging to that social network (Golden, Conroy, Bruce, et al., 2009). Additionally, Fiori et al. (2008) conducted a survival analysis in the US, and after controlling for age, sex, race, education, and number of chronic illnesses, individuals in the network types that were structurally restricted showed a higher risk of dying

during the follow-up interval than those in the functionally restricted type. They postulate that the higher mortality risk may be due to the isolation of the individuals. Similar results were also found in a study out of Israel by researchers Litwin & Shiovitz-Ezra (2006). Studying home care clients in Kansas, researchers Medvene and colleagues (2015) conducted a cluster analysis using the variables: frequency of contact with children, family and friends, as well as involvement in social and religious organizations. They found that those in the restricted networks had fewer positive relationships, had the highest measured social isolation rates (using the Lubben Social Network Scale), and were lonelier, when compared to individuals in the other, more diverse networks.

Additionally, researchers Golden, Conroy, Bruce, et al. (2009) found that non-integrated social networks were associated with decreased odds of being satisfied with life, even with depression accounted for. A study of American business managers found that those in high-density networks reported higher life satisfaction, versus those in low-density networks, suggesting that support from social networks was acting as an underlying mechanism for this relationship (Zou, Ingram, & Higgins, 2015). As a positive mood state, satisfaction with life has been shown to be a related concept to depression, although with significantly divergent properties (Nes et al., 2013). For example, Collins, Glie, & Goldman (2009) showed that satisfaction with life and depressive symptoms were each independent predictors of mortality. Positive well-being is more than the absence of negative well-being (Diener, Scollon, & Lucas, 2003), but rather, these two concepts act in parallel.

The studies that were discussed above were all cross-sectional in nature. Within this literature base, there is one longitudinal social network typology study. Researchers Fiori & Jager (2011), studied individuals who were in their mid-50s, and followed them for ten years.

They found that social network membership at time one predicted changes in depression and over time. Overall, with age, there was a general decline in depressive symptomatology. The individuals who were in the restricted network at time one, had the second highest depression rates at time one, and highest depression rates at time two. Conversely, the family-focused cluster had slightly higher depression rates than the restricted cluster at time one, but they experienced the greatest decline from time one to time two, having lower depression rates than those in the restricted cluster at time two. The authors suggested two explanations for this – first, this network ranked high to begin with, and so had more “room” to decline; second, following Carstensen’s Socioemotional Selectivity Theory, with age, it may be more adaptive in terms of mental health for adults to focus on close emotional ties with family, thereby helping to increase well-being.

In sum, the literature suggests that structural elements of networks (such as the number of kin, or frequency of contact) are important factors influencing the well-being of older adults, and that those who have structurally less well-endowed networks, when compared to people with more endowed networks, have worse mental health outcomes. However, no one study has looked at different types of social support, and whether social support is a potential mediator of this relationship between socially integrated versus less socially integrated network clusters, and mental health outcomes. This mediation hypothesis is illustrated by the pathway model below.

Social networks → Social Support → Mental Health Outcomes
(e.g. structural elements) (e.g. perceived support availability) (e.g. depression, loneliness)

2.4 Research Questions and Hypotheses

This study was designed to determine:

1. Based on various structural characteristics, can individuals be placed into different social network clusters, reflecting their level of social integration?
2. Do clusters that are socially integrated differ from clusters that are less socially integrated (i.e. socially isolated), in terms of different sociodemographic and physical health characteristics, as well as in terms of mental health outcomes, including self-rated mental health, depression, diagnosed mood disorder, loneliness, as well as satisfaction with life?
3. Comparing the different network clusters, do levels and types of social support differ? And does social support mediate the relationship between degrees of social integration, and mental health outcomes?

I hypothesized that I would find different clusters of individuals, with varying levels of social integration consistent with Wenger's typology. I also hypothesized that people grouped into social network clusters reflecting greater social isolation, would score worse on the mental health measures, than those in more integrated social network clusters. I also hypothesized that the most socially isolated clusters would have the least amount of social support, and that social support would be a mediator between level of social integration, and mental health, with lower social support associated with worse mental health outcomes.

Chapter 3: Research Design and Methods

3.1 Dataset

Data for this study were from the baseline questionnaire for the tracking cohort of participants in the Canadian Longitudinal Study on Aging (CLSA). The CLSA is a unique research initiative launched in order to longitudinally study the aging process of Canadians. The survey is a source of rich data to researchers, allowing for an in-depth examination and understanding of the different paths and factors that interact with each other, and that are associated with healthy aging (Raina et al., 2009). The CLSA's tracking cohort consists of a national-level sample of 21, 241 community-dwelling Canadians ages 45 to 85 years old. The baseline data were collected between September 2011 and May 2014 through a 60-minute computer-assisted telephone interview. The survey included questions on demographics, social, physical/clinical, psychological, and economic aspects. Participants will continue to undergo data collection waves in intervals of three years, for a total of at least twenty years.

3.2 Participants

The 21, 241 CLSA tracking cohort participants were recruited from three sources. First, CLSA partnered with Statistics Canada to recruit 3,923 participants from a pool of individuals who had previously participated in Statistics Canada's Canadian Community Health Survey (CCHS) – Healthy Aging 4.2. Second, CLSA partnered with provincial ministries of health, with 3,810 participants recruited through provincial health ministry mail-outs. Third, CLSA recruited 13,508 participants through random digit dialing. Eight recruitment strata were formed, based on age (45-54, 55-64, 65-74, 75-85), and sex (male or female). Due to under-representation of individuals with lower education levels, additional over-sampling occurred in dissemination areas known to have high proportions of individuals with lower education levels, resulting in a

survey sample size that was greater than the initial goal of 20,000 individuals (Canadian Longitudinal Survey on Aging, 2015b).

Participant exclusion criteria were as follows: individuals who could not communicate in English or French; cognitively impaired individuals at time of contact; residents of the three territories; full-time members of the Canadian Armed Forces; individuals in long-term care institutions; and individuals living on reserves or other Aboriginal settlements. For this thesis, I included only older adults, defined as those between the ages of 65 to 85 years old, inclusive, resulting in a study sample size of 8,782, representing 4,264,276 individuals.

In order to estimate the parameters of interest at the level of the population, it was necessary to apply weights to the data for some of the analyses in this thesis. The weights used were calculated by the CLSA. Each of the survey participants was assigned a weight, so that they would represent themselves, as well as individuals from their province who were not sampled. For calculation of test statistics, analytic weights were used, whereas for descriptive statistics, the trimmed weights were used. Trimmed weights are combined and re-calibrated sample weights, meaning that extreme values were trimmed to prevent inflated sampling variances of the survey estimates (Canadian Longitudinal Survey on Aging, 2015a, 2015b).

3.3 Measures

3.3.1 Social Network Variables

In order to cluster individuals, variables were chosen based on Wenger's typology, as well as previous research. There were three main sets of social network variables included in the cluster analysis. The first set of variables focused on determining the number of individuals each person had in her or his social network, the second set focused on the frequency of contact had

with these individuals, and the third set involved questions about social participation, to determine the level of community involvement. These three sets of variables were included to structurally characterize each individual's social network.

The number of people in the social network. The following questions were asked in order to determine the number of individuals within a participant's network.

- “How many children do you have?” This included biological, adopted, as well as stepchildren.
- “How many living siblings do you have?”
- “Not counting family members, how many people do you consider close friends – that is, people you can confide in and talk over personal matters with?”
- “How many of your neighbours do you know?”

I categorized and coded responses variable, as follows: 1= 1 network member; 2= 2 network members; 3= 3 or 4 network members; 4= 5 or 6 or 7 or 8 network members; 5= 9 or more.

“Don't know”, or “refused” were coded as missing values. Category cut-offs were based on the Lubben Social Network Scale, a tool used to measure social isolation in older adults (Lubben, 1988).

Frequency of contact. With regards to frequency of contact, participants answered the following questions:

- “When did you last get together with any of your children who live outside of your household?”
- “When did you last get together with any of your siblings who live outside of your household?”

- “When did you last get together with any of your close friends who live outside of your household?”
- “When did you last get together with any of your neighbours?”

I coded responses as: 6= “within the last day or two”, 5= “within the last week or two”, 4= “within the past month”, 3= “within the past 6 months”, 2= “within the past year”, 1= “more than 1 year ago”. “Not applicable”, “don’t know”, or “refused” responses were coded as missing values.

Social Participation. Social participation questions were also included within the cluster analysis, in order to determine how involved the participants were within their broader networks, and communities. It is important to include a wide variety of social participation activities, in order to capture the diverse nature of interests within the sample population.

For each of the following questions, I coded responses as follows: 4= “at least once a day”, 3= “at least once a week”, 2= “at least once a month”, 1= “at least once a year”, or 0= “never”. “Not applicable”, “don’t know”, or “refused” responses were coded as missing values.

Questions asked were as follows:

- “In the past 12 months, how often did you participate in family or friendship based activities outside the household?”
- “In the past 12 months, how often did you participate in church or religious activities such as services, committees or choirs?”
- “In the past 12 months, how often did you participate in sports or physical activities that you do with other people?”

- “In the past 12 months, how often did you participate in educational and cultural activities involving other people such as attending courses, plays, or visiting museums?”
- “In the past 12 months, how often did you participate in service club or fraternal organization activities?”
- “In the past 12 months, how often did you participate in neighbourhood, community or professional association activities?”
- “In the past 12 months, how often did you participate in volunteer or charity work?”
- “In the past 12 months, how often did you participate in any other recreational activities involving other people, including hobbies, gardening, poker, bridge, cards, and other games?”

For each participant, a new variable was created by summing the participation responses from all eight questions, into one score. This new variable had a possible range of scores of 0 to 32, with a higher score indicated greater social participation frequency. If a participant was missing a response to one of the questions, she or he was eliminated from analyses using this index.

3.3.2 Social Support Variables

The social support variables in the CLSA dataset were based upon the Medical Outcomes Study (MOS) – Social Support Survey, which assesses perceived social support (Sherbourne & Stewart, 1991). The survey includes 19 social support questions, measuring the availability of social support for the participant. It includes four functional sub-scales of support – tangible support; positive social interactions; affection; and emotional support. The responses to the MOS Scale questions were coded as follows: 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”. “Do not know”, or “refused” were coded as missing.

Four summary scores were created, one for each sub-scale, by summing responses for questions in each sub-category. Additionally, a global scale, with a sum of the responses from all 19 MOS questions, was created. For each sub-scale, as well as for the global scale of all 19 variables, if participants skipped one question, then they were removed from the sum, and were not included in analyses using that particular scale.

Tangible Support. To measure tangible support, the questions asked were as follows:

“How often is each of the following kinds of support available to you if you need it?”:

- “Someone to help you if you were confined to bed?”
- “Someone to take you to the doctor if needed?”
- “Someone to prepare your meals if you were unable to do it yourself?”
- “Someone to help with daily chores if you were sick?”

Cronbach’s alpha= 0.81; responses were summed, with a range of possible scores from 0-16.

Due to missing values, 333 individuals were excluded from analyses using this variable.

Positive Social Interactions. To measure positive social interaction, the questions asked were as follows:

“How often is each of the following kinds of support available to you if you need it?”:

- “Someone to get together with for relaxation?”
- “Someone to do something enjoyable with?”
- “Someone to have a good time with?”
- “Someone to do things with to help you get your mind off things?”

Cronbach's $\alpha=0.88$; responses were summed, with a range of possible scores from 0-16. Due to missing values, 189 individuals were excluded from analyses using this variable.

Affectionate Support. To measure affectionate support available, the questions asked were as follows:

“How often is each of the following kinds of support available to you if you need it?”:

- “Someone who shows you love and affection?”
- “Someone who hugs you?”
- “Someone to love you and make you feel wanted?”

Cronbach's $\alpha=0.84$; responses were summed, with a range of possible scores from 0-12. Due to missing values, 112 individuals were excluded from analyses using this variable.

Emotional Support. To measure emotional support available, the questions asked were as follows:

“How often is each of the following kinds of support available to you if you need it?”:

- “Someone you can count on to listen to you when you need to talk?”
- “Someone to confide in or talk to about yourself or your problems?”
- “Someone to share your most private worries and fears with?”
- “Someone who understands your problems?”
- “Someone to give you advice about a crisis?”
- “Someone to give you information in order to help you?”
- “Someone whose advice you really want?”
- “Someone to turn to for suggestions about how to deal with a personal problem?”

Cronbach's alpha= 0.91; responses were summed, with a range of possible scores from 0-32. Due to missing values, 456 individuals were excluded from analyses using this variable.

For objective #2, univariate analyses indicated that for each of the sub-scales, cell sizes in the lower three response categories were very small, and the distribution highly skewed. I, therefore, made the decision to dichotomize responses within each sub-scale into 0= "none, a little, or some of the time", and 1= "most, or all of the time".

For objective #3, since the analytic technique used did not allow for dichotomous mediators (Hayes, n.d.), a continuous, global scale with all 19 variables summed was used in the mediation analyses. This scale had a range of possible scores of 0 to 76, and Cronbach's alpha= 0.95. Due to missing values, 766 individuals were excluded from analyses using this variable.

3.3.3 Mental Health Variables

A variety of mental health variables were examined, as part of objective #2. The following variables were also independently entered as outcome variables in five separate mediation analyses, to address objective #3.

Self-Rated Mental Health (SRMH). The question was asked: "In general, would you say your mental health is excellent, very good, good, fair, or poor?" Responses included 5= excellent, 4= very good, 3= good, 2= fair, 1= poor. Univariate analyses indicated that for each of the sub-scales, cell sizes in the response categories for "fair" and "poor" were very small, and the distribution highly skewed. I subsequently dichotomized the measure into two categories, such that the "fair" and "poor" categories were combined, and coded as 0. "Excellent", "very good" and "good" responses were combined, and coded as 1. Due to missing values, 9 individuals were excluded from the analyses using this variable.

Depression. Depression was measured using the 10-item Centre for Epidemiologic Studies Depression scale. The original scale is composed of twenty items, meant for use as a survey instrument for screening depression, and is widely used to screen community-dwelling older adults. A shorter 10-item version was developed, and has demonstrated close agreement with the full 20-item version ($\kappa = 0.97$ and a test-retest reliability of 0.71) (Andresen, Malmgren, Carter, & Patrick, 1994). Cronbach's alpha for this sample was 0.73.

The questions in this scale asked for the frequency that the respondent felt the following, within the past week: "I was bothered by thing that usually don't bother me", "I had trouble keeping my mind on what I was doing", "I felt depressed", "I felt that everything I did was an effort", "I felt hopeful about the future", "I felt fearful", "My sleep was restless", "I was happy", "I felt lonely", "I could not 'get going'". Possible responses were: 3= "all of the time" (5-7 days), 2= "occasionally" (3-4 days), 1= "some of the time" (1-2 days), 0= "rarely or never" (less than 1 day). Two positive affective items – "I felt hopeful about the future", and "I was happy" were reverse coded, so that: 0= "all of the time" (5-7 days), 1= "occasionally" (3-4 days), 2= "some of the time" (1-2 days), 3= "rarely or never" (less than 1 day). The responses to all 10 items were summed, allowing for a participant to have a score range of 0 to 30 points. Survey participants – 345 individuals – who answered 'don't know', or who refused to answer at least one item off the scale, were coded as missing, did not have a sum calculated, and were excluded from analyses using this scale.

The measure was dichotomized applying a common cut-off value used in the literature – scores of 10 or more were used to indicate that individuals were depressed, and 9 and under, not depressed (Andresen et al., 1994). Furthermore, univariate analyses indicated that for this measure, the distribution was highly skewed toward lower summed values.

The cut-off point used identifies suspected cases of depression, and those at risk of having a mood disorder, rather than a diagnosis. In fact, the CES-D scale is recommended for use as a screening tool, not as a diagnostic test (Lewinsohn, Seeley, Roberts, & Allen, 1997). It is of value to note that community surveys may overestimate depression prevalence within their sample populations, and tend to identify a large number of false positives, although they include few false negatives (Wakefield & Schmitz, 2010). They are, however, likely to identify long-term cases, as well as cyclothymic disorders (Blazer, 1989). Additionally, inflated prevalence rates may be due to higher somatic symptoms among older adults; Andresen et al. (1994), for example, found a correlation between depressed mood and poor health and physical pain in this population.

Diagnosed Mood Disorder. The question was asked: “Has a doctor ever told you that you have a mood disorder such as depression (including manic depression), bipolar disorder, mania, or dysthymia?” This self-reported measure was coded as 0= “no”, and 1= “yes”. Sixteen individuals who answered “don’t know”, or refused to answer, were coded as missing and were excluded from analyses using this variable.

Loneliness. Loneliness was part of the CES-D 10 depression scale, however, it was also separately analyzed. Univariate analysis demonstrated that this measure was highly skewed to the left, with cell sizes in the “occasionally”, and “all of the time” response categories being very small. The decision was therefore made to dichotomize the variable into 0= not lonely (“never”, or “some of the time”), and 1= lonely (“occasionally”, or “all of the time”). Individuals who refused to answer, or answered “don’t know”, were coded as missing, and excluded from analyses using this variable; the number of individuals who were coded as missing was 16.

Loneliness, as compared to depression, are the feelings that individuals have about their social connections, whereas depression is how they feel generally (Weiss, 1973). It is, however, important to note that this question directly used the word 'lonely', which may have resulted in underreporting by participants, because of social stigma (Hawkley, 2015). Additionally, single-item measures cannot be assessed in terms of their internal reliability. That being said, this single-item loneliness measure has been widely used within the literature, and correlates well with multifaceted loneliness scales (for a review, see Pinquart & Sörensen, 2001).

Satisfaction with Life (SWL). Satisfaction with life was measured using the Satisfaction with Life Scale (SWLS) (E Diener, Emmons, Larsen, & Griffin, 1985), which consists of five statements asking:

- “In most ways, my life is close to my ideal”
- “The conditions of my life are excellent”
- “I am satisfied with my life”
- “So far, I have gotten the important things I want in life”
- “If I could live my life over, I would change almost nothing”

Agreement with each item was ranked on a 7-point Likert scale: 1= strongly disagree, 2= disagree, 3= slightly disagree, 4= neutral, 5= slightly agree, 6= agree, 7= strongly agree.

Responses were added across the questions, resulting in a range of a minimum 5 points to a maximum of 35. Based on the literature (Diener, 2006), I categorized the SWLS into the following categories: 5-9= “extremely dissatisfied”, 10-14= “dissatisfied”, 15-19= “slightly below average”, 20-24= “average”, 25-29= “high”, 30-35= “very high (extremely satisfied)”. “Do not know”, or refused to answer, were coded as missing. If individuals had a missing

response on one question, they were excluded from analyses using this scale. Overall, due to missing values, 169 individuals were excluded. Univariate analyses showed that this variable was very highly skewed toward the positive, with a relatively small number of individuals in the lower categories. Therefore, I made the decision to dichotomize categories into: 0= “Extremely dissatisfied, dissatisfied, slightly below average”, and 1= “Average, high, or very high”. The SWLS has been shown to have high test-retest reliability ($.50 \leq r \leq .84$) (Blais, Vallerane, Palletire, & Briere, 1989).

3.3.4 Covariates

A set of seven variables were chosen as variables of interest to examine differences between clusters in objective #2, as well as to use as covariates within the mediation model (objective #3). There were two general types of variables - sociodemographic variables (age, sex, marital status, education, income), and physical health variables (number of chronic diseases, and functional status). These seven variables were chosen based on previous literature showing links between each of them with the predictor variable (social integration), with the mediator (social support), as well as with the outcomes (mental health measures).

3.3.4.1 Sociodemographic Variables

Age was calculated by subtracting the date of birth from the date of the interview. Age was dichotomized into the following categories – younger: 0= 65-74 years old, and older: 1= 75-85 years old. Age has been shown to be negatively related to network size (Cornwell, Laumann, & Schumm, 2008). With age, adults have shown to have declining levels of satisfaction with support, as well as in anticipated support levels, which is thought to be related to changes in the size of networks (Shaw et al., 2007). Loneliness is also related to advanced age, and tends to be a U-or J shaped function across adulthood, although other studies have found it to decline with age

(Pinquart & Sörensen, 2003; Savikko et al., 2005). It has also been noted that depressive symptoms are greatest in the oldest age groups (Litwin & Shiovitz-Ezra, 2011a; Litwin, 2012).

Sex was coded as 0= male and 1= female. In a meta-analysis of 300 studies, researchers Pinquart & Sörensen (2003), found that women were more likely to report lower subjective well-being than men, whereas another study by the same authors, reported that women are more likely to report feelings of loneliness, as well (Pinquart & Sörensen, 2001). However, in other studies, males have shown to be at higher risk for loneliness (Hawkley et al., 2008). However, males are more prone to underreport loneliness when asked directly, a trend potentially related to higher stigma levels among males. Females have also shown to have a higher likelihood of social isolation (Kobayashi et al., 2009).

Marital Status was coded as 0= single (including divorced or separated, never married, never lived with a partner), 1= married/living in a common-law relationship, and 3= widowed, for the second objective. For objective #3 (the mediation analysis), marital status was dichotomized into 0= single (including either never married, never lived with a partner, divorced or separated, and widowed), and 1= married/living in a common-law relationship.

Marital status has shown to positively influence general mental well-being (Hawkley et al., 2008; Pinquart & Sörensen, 2003; Savikko et al., 2005), and reduce social isolation risk (Kobayashi et al., 2009). Widowhood was also found to be the most important predictor influencing loneliness in one study (Golden, Conroy, Bruce, et al., 2009), as well as negatively influencing self-rated health, and depression (Doubova et al., 2010). Since exclusive widower network clusters have been found in the literature (e.g. Doubova et al., 2010), widower status was examined separately in objective #2.

Education was a categorical variable, measured as 0= secondary school or less, and 1= at least some post-secondary education. Higher levels of education are predictive variables of lower loneliness levels (Savikko et al., 2005), and depression (Litwin & Shiovitz-Ezra, 2011a). Those with higher education levels have also shown to have larger friendship and kinship networks, an effect that is strongest for women (Cable, Bartley, Chandola, & Sacker, 2013).

Household Income was measured as total yearly household income, and was a categorical variable, coded as follows: 1= “less than \$20,000”, 2= “\$20,000 or more, but less than \$50,000”, and 3= “\$50,000 or more”. Greater income has been shown to be inversely related to feelings of loneliness (Savikko et al., 2005), as well as social isolation (Kobayashi et al., 2009). Please see section 5.2: Strengths and Limitations, for a discussion on limitations related to the income variable.

3.3.4.2 Physical Health Variables

Studies have shown that older adults who are in poor physical health are prone to report higher levels of loneliness (de Jong Gierveld, van Tilburg, & Dykstra, 2006; Pinqart & Sörensen, 2001a; Victor et al., 2000), and social isolation (Kobayashi et al., 2009). Functional status has been shown to negatively correlate with depression (Greenglass, Fiksenbaum, & Eaton, 2006). Socially isolated individuals have also been shown to have more chronic illnesses than those not socially isolated (Cloutier-Fisher & Kobayashi, 2009), whereas Doubova et al. (2010) found that older adults in more structurally restricted (i.e. socially isolated) networks were more likely to be functionally dependent.

Chronic Diseases. A Self-Reported Chronic Disease Index was created by summing affirmative responses from 34 questions, stemming from 9 different broad categories of conditions:

- osteoarthritis (in the knee; the hip; in one or both hands);
- arthritis (rheumatoid; or other);
- respiratory conditions (asthma; smoking-related conditions, including: emphysema, chronic bronchitis, COPD or chronic changes in the lungs);
- cardiac/cardiovascular conditions (high blood pressure (not due to pregnancy); diabetes; heart disease; angina; heart attack or myocardial infarction; peripheral vascular disease; stroke; mini-stroke or transient ischemic attack);
- neurological (memory problem; dementia or Alzheimer's; Parkinson's; multiple sclerosis; epilepsy; migraine headaches);
- gastrointestinal (intestinal or stomach ulcers; bowel disorder; bowel incontinence; urinary incontinence);
- vision (cataracts; glaucoma; macular degeneration);
- cancer;
- other conditions (osteoporosis; back problems; hypothyroidism; hyperthyroidism; kidney disease or failure).

This index, therefore, had a possible range of 0-34. If respondents refused to answer one question on this list, they were coded as missing, and not included in analyses using this variable; 555 individuals were classified as such.

Functional Status was measured using the Older Americans' Resources and Services (OARS) Multidimensional Functional Assessment Questionnaire (Fillenbaum & Smyer, 1981). The OARS scale includes 7 individual questions related to the Activities of Daily Living (ADLs), including getting out of bed, dressing, eating, bathing, taking care of one's appearance, walking, and going to the bathroom. The scale also includes 7 additional questions related to Instrumental Activities of Daily Living (IADLs), including the ability to use the telephone, travel, shopping, prepare meals, do housework, take medicine, as well as handle money. Each of these questions had yes or no responses, with follow-up questions asking whether they could handle a task with help, or were completely unable to do said task.

The 14 questions were summed and individuals categorized into: "No Functional Impairment", "Mild Impairment" (some help is required, but not necessarily everyday), "Moderate Impairment" (needs assistance with at least 4 items on scale, or needs help with meals), "Severe Impairment" (needs help each day with ADLs, but not necessarily throughout the day or night), or "Total Impairment" (need help throughout the day and/or night with ADLs). Univariate analyses for this variable indicated that it was very highly skewed toward no functional impairment, and the proportion of individuals in each of the other categories was very small. Therefore, I dichotomized the scale into the following: 0= "no functional impairment", and 1= "at least some functional impairment", combining the "mild", "moderate", "severe" or "total" categories into one comprehensive category. The OARS scale has been shown to have high test-retest reliability and high inter-rater reliability for both ADLs (Spearman $r = 0.84$), and IADLs (Spearman $r = 0.87$) (Fillenbaum, 1985), and has also shown to be highly correlated with measures of self-care capacity by physical therapists (Pearson $r = 0.89$) (Fillenbaum, 1988).

3.3.5 Additional Variables for Exploratory Analysis

The following variables were used to further explore the differences between clusters, within objective #2. These variables were not used in the mediation analyses, but rather were chosen to help characterize the clusters, and were included either based on previous research within the social network typology literature base, or due to components of Wenger's typology.

Self-Rated General Health was measured by asking the question: "In general, would you say your health is excellent, very good, good, fair, or poor?" This variable was coded as 1= "poor", 2= "fair", 3= "good", 4= "very good", and 5= "excellent". A univariate analysis was conducted, that revealed a distribution skewed to the right, with very small cell sizes in each of the "poor" and "fair" categories. Therefore, the measure was subsequently dichotomized into two categories, such that the "fair", and "poor" categories were combined, and coded as 0. "Excellent", "very good", and "good" were combined, and coded as 1.

Measures of self-rated health have been shown to be reliable predictors of objective health status, predicting functional status (Hubbard, Inoue, & Diehr, 2009), and mortality (Idler & Benyamini, 1997; Singh-Manoux et al., 2007). Furthermore, being socially isolated has been reported to increase the odds of reporting one's health as fair/poor (Coyle & Dugan, 2012; Holt-Lunstad et al., 2010).

Number of People Living in the Household was measured as 0= "live alone" or 1= "live with one or more other people". This variable is often used in clinical settings to evaluate social isolation risk in older adults (Blozik et al., 2009).

Generations Living in the Household was measured as 0= “1 generational-household” or 1= “2 or more generational-household”. This variable has been shown to have high prevalence in clusters that are family-focused, with increasing prevalence as age increases (Wenger, 1997).

Participant Provided Caregiving Assistance to Someone Else was measured as 0= “did not provide assistance” or 1= “did provide assistance”. This variable is a potential risk factor for social isolation, particularly for those who are in social networks that are already structurally vulnerable (Smith & Christakis, 2008).

3.4 Data Analyses

All data were analyzed with SAS 9.3. The following sub-sections describe the types of data analyses that were performed.

3.4.1 Cluster Analysis

A cluster analysis was conducted to answer research question one. Cluster analysis is a statistical technique that takes into account a number of different variables at once, in order to group individuals with the same types of characteristics and who are similar to one another, apart from others who are dissimilar (Huberty, Jordan, & Brandt, 2005). The goal is to maximize heterogeneity between clusters, and homogeneity within individual clusters. For this thesis, a non-hierarchical (aka *k*-means clustering) approach was undertaken, meaning that I chose the number of clusters (*k*), and the procedure separated individuals into that number of clusters. The *k*-means method, as opposed to the hierarchical method, is ideal when the sample size is relatively large (i.e. greater than 100).

For the cluster analysis, three sets of variables were used as cluster comparison variables – number of people in the network (children, siblings, friends, and neighbours), frequency of

contact (with children, siblings, friends, and neighbours), and social participation (sum of frequency of participation in eight different activities). First, all cluster comparison variables were standardized, so that the mean= 0, and standard deviation= 1. This was done in order to eliminate any potential effects due to scale differences. In the procedure, during the first data pass, initial cluster centers are generated randomly, and individuals segregated and placed into random clusters. Following this, the method then goes through each individual and relocates them into a different cluster, based on their Euclidean squared distance (which is the distance from the individual to the centroid of the cluster). Ideally, this distance should be as small as possible, so that individuals are in the most optimal cluster (Coussement, Demoulin, & Charry, 2011). Relocation continues until reassigning and moving individuals around does not further lower the sum of squared distances, and therefore, the clusters are considered to be ‘stable’ (Garson, 2014). It is important to note that the SAS procedure for cluster analysis did not allow for weighted data to be used. All individuals should have equal weight in the analysis, so that they are each contributing equally toward the computation of Euclidean distances during cluster reassignment (Garson, 2014; SAS Institute Inc., 2015).

In order to determine the ‘correct’ number of clusters, an exploratory approach was undertaken that involved conducting an exhaustive number of cluster analyses. With a strong theoretical framework to work off of, I ran cluster analyses that included $k= 4, 5, 6, 7,$ and 8 clusters – cluster numbers that were the most commonly found in the literature. As well, it was not clear from the literature whether the inclusion of two specific variables – number of relatives, as well as frequency of get-togethers with relatives, would impact the distribution of individuals within the clusters. Therefore, cluster analyses were run in a step-wise fashion, including $k= 4, 5, 6, 7,$ and 8 for the original nine variables, $k= 4, 5, 6, 7,$ and 8 clusters, for ten variables (that is,

nine variables + frequency of getting together with relatives), and finally $k= 4, 5, 6, 7,$ and 8 clusters, for eleven variables (that is, nine variables + frequency of getting together with relatives + number of relatives).

The following criteria were used to determine which k was optimal:

- Cubic Clustering Criteria (CCC), which needs to be above 2 or 3; the larger the CCC, the better the cluster is, although multiple ‘peaks’ can exist, and should be looked at.
- The Pseudo F Statistic (the ratio of the mean sum of squares between the clusters, to the mean sum of squares within the clusters); the larger the number, the better (SAS Institute Inc., 2015).
- Overall R-squared (one wants the point of levelling-off, since this value will continue to increase with increasing k clusters) (Garson, 2014).

The criteria discussed above each quantify between-cluster variation, and are indicators of overall measure-of-fit for a particular k . However, using only the statistical criteria to determine which cluster is ideal, involves taking a data-driven approach. A better approach, and one that was undertaken in this thesis, involves taking both the statistical criteria, as well as conceptual findings from the literature base, into consideration when choosing the ‘best’ k (see discussion in section 4.2 for further clarification).

3.4.2 Descriptive Statistics

A series of univariate analyses were conducted, in order to first describe the study population, and second, to study if social network clusters differed on a variety of characteristics, namely sociodemographic characteristics, health variables, as well as mental health outcomes,

and social support frequency. Trimmed weights were applied for the descriptive analyses, whereas analytic weights for calculating the test statistics.

After the clusters that emerged from the cluster analysis were analyzed, clusters were grouped together into three umbrella clusters that reflected the cluster's overall level of social integration. They were labelled as follows: 1) socially integrated, 2) moderately socially integrated, and 3) socially isolated. For further clarification, see discussion in section 4.7.1.

3.4.3 Mediation Analyses

A series of mediation analyses were conducted to determine whether the relationship between social network structure (that is, the number of social network ties, frequency of contact, and level of social participation), and five different mental health outcomes was mediated by social support, in order to address objective #3. A mediator is a variable that can be shown to account for the relationship between the predictor variable and the outcome variable. That is, it is a third variable that explains how or why the predictor and the outcome variables are related. Conversely, a moderator is a third variable that changes the relationship between the predictor and the outcome variables. That is, by acting as an 'interaction' variable, it can affect the direction and/or strength of the relationship between the independent variable and the dependent variable. Mediators generally answer questions of *how* processes occur (i.e. the mechanism), whereas moderators answer questions of *when* certain effects occur (i.e. the interaction) (Hayes, 2013).

The mediation analyses for this thesis were conducted using the PROCESS macro (model 4) (Hayes, 2013), for SAS. PROCESS is a computational tool for path analysis-based mediation, and estimates model equations, by estimating unstandardized model coefficients,

standard errors, p-values and confidence intervals, by conducting maximum likelihood regression-based analyses (Hayes, 2013).

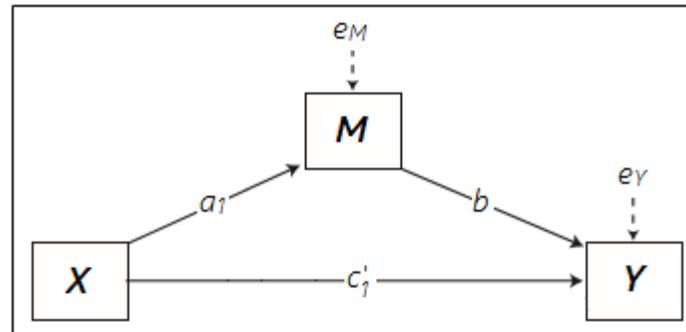


Figure 2: Conceptual diagram of a simple mediation model (Hayes, 2013)

In a simple mediation model (figure 2), an independent variable (X) transmits its effect on a dependent variable (Y), through an intermediary variable (M). The PROCESS macro measures both indirect ($X \rightarrow M \rightarrow Y$) and direct pathways ($X \rightarrow Y$), to determine whether the relationship is either fully mediated (i.e. the direct pathway is not significant), or partially mediated (i.e. both indirect and direct pathways are significant), by the intermediary variable. The statistical model presented in Figure 2 is represented by two equations:

$$\text{Equation 1.1: } M = i_1 + aX + e_M$$

$$\text{Equation 1.2: } Y = i_2 + c'X + bM + e_Y$$

where i_1 and i_2 represent the regression intercepts, e_M and e_Y the errors in the estimation of M and Y , respectively, and a , b , and c' are the regression coefficients given to the antecedent variables in the model. The model coefficients are treated as estimates of the assumed influence that each individual variable has on the other variables (Hayes, 2013).

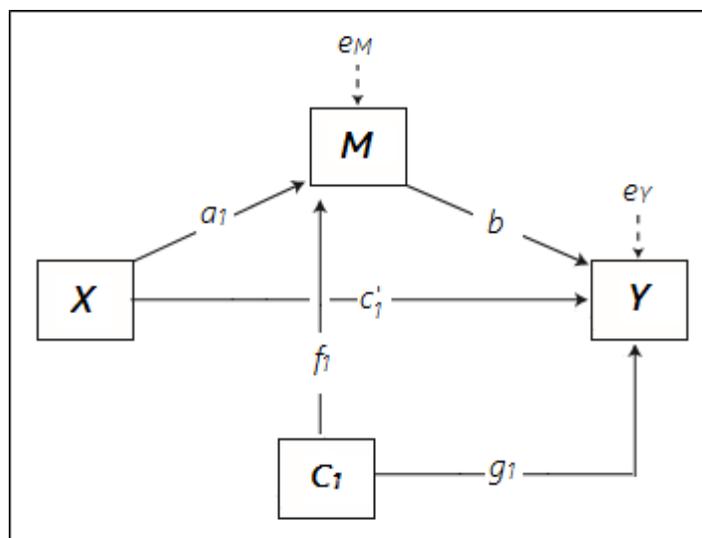


Figure 3: Conceptual diagram of a simple mediation model with one covariate (C_1)

Figure 3 Illustrates a simple mediation model with one covariate added, and is represented by the following equations 2.1 and 2.2, and where C_1 is a covariate, and f_1 and g_1 are the regression coefficients given to the covariate.

$$\text{Equation 2.1: } M = i_1 + aX + f_1C_1 + e_M$$

$$\text{Equation 2.2: } Y = i_2 + c'X + g_1C_1 + bM + e_Y$$

However, when X is a multicategorical variable (Figure 4), the equations 2.1 and 2.2 need to be altered. In this thesis, X has three levels, representing 3 umbrella clusters of differing levels of social integration. Indicator coding was used, so that the most socially integrated were the 'reference category', whereas the most socially isolated were the first level of X, and the moderately socially integrated the second level of X. Equations 3.1 and 3.2 are shown below, where D_1 represents the first level of X, D_2 the second, and D_3 the reference category.

$$\text{Equation 3.1: } M = i_1 + a_1D_1 + a_2D_2 + a_3D_3 + f_1C_1 + e_M$$

$$\text{Equation 3.2: } Y = i_2 + c'X + g_1C_1 + bM + e_Y$$

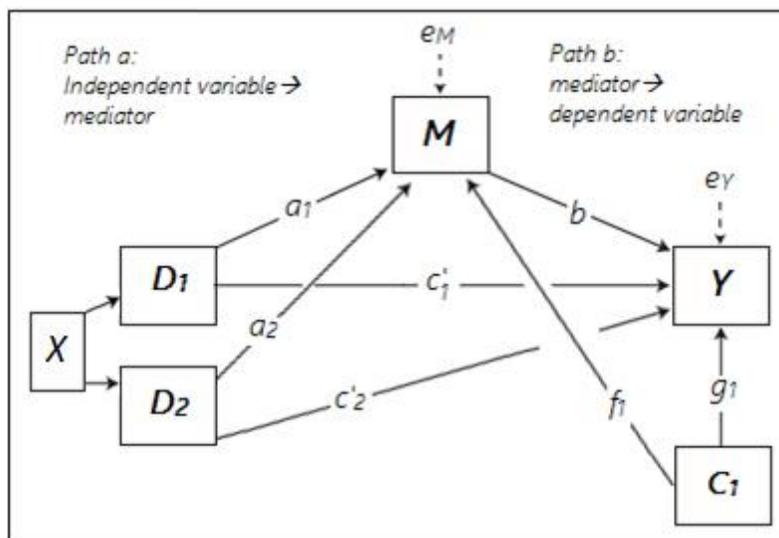


Figure 4: Conceptual diagram of a mediation model with a multicategorical X that has 3 categories (D_3 is the reference category), and one covariate

Using the PROCESS macro, two independent regressions were conducted:

- 1) Pathway a: Independent variable \rightarrow Mediator

Regression coefficients a_1 and a_2 were determined using ordinary least squares regression. These coefficients represented the relationship between the two levels of the independent variable, and the mediator, independent of the outcome.

- 2) Pathway b: Mediator \rightarrow Outcome

Since the outcome variables were all dichotomized, coefficient b was determined using logistic regression. This regression coefficient represented the relationship between the mediator, and the dependent variable, independent of X .

The coefficients from these two regressions were used to determine whether a mediating effect was present between level of social integration, and mental health outcomes. Two *relative* effects were determined:

1) Indirect Effect: ab

For each level of social integration, the coefficient from path a was multiplied by the coefficient from path b , in order to determine whether there was an indirect effect present. In other words, whether social support mediated the relationship between level of social integration, and the mental health outcomes. Therefore, for the socially isolated umbrella cluster (in reference to the most socially integrated cluster), the indirect effect = a_1b . For the moderately socially integrated cluster (in reference to the most socially integrated cluster), the indirect effect = a_2b .

2) Direct Effect: c'

The direct effect is equal to c' . That is, the coefficient determining whether there is a direct relationship between levels of social integration, and the mental health outcomes, independent of the mediating variable. This effect was determined using logistic regression.

The PROCESS macro constructs percentile bootstrap confidence interval, in order to estimate all the coefficients in the mediation model, and calculate the size of the relative indirect and direct effects (Hayes & Preacher, 2013). Mediation is confirmed if zero falls outside the 95% confidence interval based on 10,000 bootstrap samples of the unstandardized beta weights.

Five mediation analyses were conducted, one for each of the five different outcome variables – self-rated mental health, depression, diagnosed mood disorder, loneliness, as well as satisfaction with life. For these analyses, missing values in one variable (including all covariates, outcomes, and mediator), were removed from analyses for the remaining variables, resulting in an $n=6624$, across all five analyses. All of these five variables were dichotomized. For each of the five analyses, X was a multicategorical variable – representing 3 umbrella clusters of varying degrees of social integration, with the socially integrated category acting as the reference. The

mediating variable was social support, it was kept continuous, and was the summed value of all 19 individual social support variables. A univariate analysis for this social support variable revealed that the distribution was not normal, but rather a negative binomial distribution. The log of this variable was determined, and it did not result in a normalized distribution. A comparison of a simple mediation analysis with the original variable, versus the log was conducted, and resulted in regression coefficients that were almost identical. The decision was therefore made to use the original, non-transformed variable.

Covariates were also used in the five mediation models. They were added into the model in a hierarchical fashion. First, the baseline model of X, M and Y was conducted. Then, a second model with the sociodemographic variables added in was run. These were: age, sex, marital status education, and income. Finally a third model was run with the health covariates included (the chronic morbidity index, and the OARS scale).

Of importance to note, is that weights were not applied within the mediation analyses, since the PROCESS model can not handle sampling weights (Hayes, n.d.).

3.5 Ethics

Ethical approval for this study was obtained from the Health Research Ethics Board (HREB) at the Faculty of Health Sciences, University of Manitoba (H2015:351). I also completed the TCPS 2 Course on Research Ethics (CORE). To ensure the privacy and security of all information, data were stripped of names, and participants were identified only by a unique study number. Data was stored in a locked room, accessible by card access only.

Chapter 4: Results

4.1 Sociodemographic Characteristics for the Study Sample

Table 1 displays the sociodemographic characteristics for the study sample. The majority of individuals fell into the younger age category (60.96%), and 39.04% into the older age category; 53.30% are females, 46.70% males. In terms of marital status, the majority (65.04%) were married, 18.09% widowed, and 16.87% single/divorced/separated. For education level, 73.90% had at least some post-secondary education, 26.10% a high school diploma or less; 7.85% of the sample had a yearly household income less than \$20,000, 39.78% fell within the middle category of \$20,000 to less than \$50,000, and 52.37% were in the highest income bracket of \$50,000 and up. Lastly, the average number of chronic diseases was 4.19 ± 2.78 , and in terms of functional status, 84.14% had no functional impairment.

Table 1: Sociodemographic characteristics for the study sample
(Sample n= 8782; Weighted n= 4,264,276). Weighted percentiles are presented in brackets.

Age Groups	
65-74 years old	52.77% (60.96%)
75-85 years old	47.23% (39.04%)
Sex	
Male	49.83% (46.70%)
Female	50.17% (53.30%)
Marital Status	
Single/ Divorced/ Separated	16.71% (16.87%)
Married/ Common-law	61.37% (65.04%)
Widowed	21.92% (18.09%)
Education Level	
High School or Less	28.41% (26.10%)
At Least Some Post-Secondary	71.59% (73.90%)
Household Income	
< \$20,000	8.96% (7.85%)
\$20,000-\$50,000	43.69% (39.78%)
\$50,000 +	47.35% (52.37%)
Chronic Disease Index *	
Mean Number of Chronic Diseases	4.19 ± 2.78, range 0-21

Functional Status

No functional impairment 83.06% (84.14%)

Mild, moderate, severe or total 16.94 % (15.86%)

*= Index of 34 summed chronic disease variables

4.2 Cluster Analysis

Three sets of cluster analyses were run in a step-wise fashion. First, $k= 4, 5, 6, 7,$ and $8,$ for the original nine variables. Second, $k= 4, 5, 6, 7,$ and $8,$ for ten variables (that is, nine variables + frequency of getting together with relatives), and third, $k= 4, 5, 6, 7,$ and 8 clusters, for eleven variables (that is, nine variables + frequency of getting together with relatives + number of relatives). Test statistics for each of the sets are presented in table 2, as shown below.

Table 2: Cluster analyses test statistics

Number of Variables	Number of Clusters	F-Statistic	Cubic Clustering Criteria (CCC)	Overall R ²
9	4	1060.08	65.56	0.202
	5	1063.02	79.54	0.246
	6	988.76	74.08	0.285
	7	889.05	57.75	0.319
	8	804.33	40.65	0.349
10	4	993.82	81.47	0.181
	5	946.17	86.57	0.222
	6	826.03	67.24	0.257
	7	770.22	60.96	0.287
	8	751.82	64.44	0.315
11	4	866.78	78.31	0.165
	5	867.53	97.07	0.202
	6	733.19	70.37	0.233
	7	796.98	106.89	0.261
	8	757.42	106.25	0.286

For determining whether 9 variables vs. 10 vs. 11 should be used, both the F-statistic, and the CCC were looked at. For both of these test statistics, the greater the value for each, the more statistically ‘correct’ that solution is. Overall, the higher values were in the 9 variable clusters.

Furthermore, when the variables ‘number of relatives you know’, and ‘frequency of getting together with relatives’ were added in, each of the clusters had relatively high means for these variables. Therefore, they did not add any information with regards to further defining or characterizing the clusters. Conversely, I did not feel that by removing these variables I was losing any valuable information. Hence, the decision was made to stay with the 9 variable solution.

To decide between $k=5$ or $k=6$, the clusters were tested statistically, as well as conceptually, since, for the F-Statistic, as well as the CCC, these two clusters looked like the most promising. For the overall R^2 value, I wanted the point of ‘levelling-off’, so that indicated the $k=6$ cluster. Conceptually, the results indicated that $k=6$ included all of the clusters in the Wenger typology, whereas with $k=5$, one of the socially isolated clusters would not have been present. Therefore, the decision was made to go with 6 clusters. An important note about cluster analysis, is that this statistical procedure requires a balance to be struck between having a minimum number of clusters to be able to detect differences between clusters, but also having a number of clusters that is manageable for the researcher, especially in regards to naming and studying the clusters. Labelling of clusters was based on the empirical literature, as well as on analysis of the means for the cluster comparison variables, both within the cluster, as well as comparisons between clusters.

Table 3, as shown below, presents the results for the social network variables for the 9 variable: 6 cluster solution.

Table 3: Cluster analysis results. Presented for each cluster are the means for each of the social network variables, standard deviations (in brackets), as well as variable ranges

Cluster	Locally Integrated	Structurally-Balanced	Family-Friend Focused	Wider-Community Oriented	Private	Local Self-Contained
n^a	2224 (988,975)	2064 (988,335)	1326 (723,950)	1218 (548,361)	1072 (577,275)	878 (437,381)
% of sample population^a	25% (23.19%)	24% (23.18%)	15% (16.98%)	14% (12.86%)	12% (13.54%)	10% (10.26%)
Mean Number of Network Members						
Children	2.79 (0.84), 0-5	2.75 (0.83), 1-5	2.58 (0.97), 0-5	1.04 (1.10), 0-4	2.40 (1.09), 0-5	2.36 (1.13), 0-5
Siblings	3.04 (1.06), 1-5	1.13 (1.01), 0-4	2.40 (1.37), 0-5	1.95 (1.39), 0-5	2.02 (1.41), 0-5	1.97 (1.36), 0-5
Close Friends	3.78 (1.07), 0-5	3.75 (1.05), 0-5	3.12 (1.30), 0-5	3.48 (1.17), 0-5	1.36 (1.41), 0-5	2.80 (1.49), 0-5
Neighbours	4.53 (0.74), 1-5	4.46 (0.76), 2-5	3.81 (1.01), 1-5	4.26 (0.96), 0-5	3.95 (1.16), 0-5	0.71 (0.87), 0-3
Overall Mean Network Size^b	14.14 (1.94), 7-20	12.08 (1.89), 7-19	11.89 (2.32), 3-19	10.72 (2.35), 3-17	9.73 (2.49), 2-17	7.83 (2.48), 0-14
Mean Frequency of Last Get Together						
With children	5.20 (0.85), 2-6	5.17 (0.86), 2-6	5.03 (0.95), 1-6	2.37 (0.92), 1-4	4.89 (1.13), 1-6	4.89 (1.13), 1-6
With siblings	4.68 (1.07), 1-6	2.01 (1.01), 1-4	3.51 (1.55), 1-6	3.38 (1.69), 1-6	3.23 (1.65), 1-6	3.30 (1.66), 1-6
With friends	5.31 (0.74), 3-6	5.38 (0.68), 2-6	4.96 (0.86), 3-6	5.25 (0.82), 2-6	2.44 (0.97), 1-5	5.01 (0.94), 2-6
With neighbours	5.19 (0.90), 1-6	5.15 (0.98), 1-6	1.37 (0.75), 1-5	4.78 (1.51), 1-6	4.10 (1.78), 1-6	4.27 (1.65), 1-6
Mean Social Participation Frequency^c	12.99 (4.69), 0-28	12.33 (4.72), 0-27	9.75 (4.51), 0-25	11.22 (4.85), 0-25	7.71 (4.49), 0-22	8.44 (4.69), 0-22

^a= Values presented in brackets are weighted

^b= A cumulative index of social network ties, including children, siblings, friends, and neighbours. Missing values on one or more measures resulted in an individual being excluded from this summed measure

^c= A cumulative index of the frequency of participation of 8 individual social activity variables

The cluster analysis resulted in six clusters, based on nine cluster comparison variables. They were labelled as follows: locally integrated (23.19% of the sample), structurally-balanced (23.18%), family-friend focused (16.98%), wider-community oriented (12.86%), private (13.54%), and local self-contained (10.26%). The clusters: locally integrated, family-friend focused, wider-community oriented, private, and local self-contained compared very well with

the Wenger typology. The structurally-balanced was an 'extra' cluster found, that did not fit into the Wenger typology.

The 'locally integrated' cluster, and the 'structurally-balanced' cluster represented the greatest proportion of individuals from the sample, and were also the most socially integrated clusters. The locally integrated cluster individuals, compared to individuals from the other clusters, had the greatest number of network members. This included children, siblings, friends, and neighbours. They also had very high frequency of contact with all of their members. In terms of social participation, this cluster ranked as the most socially active cluster. This group had a very diverse array of people in their network, and they frequently had contact with these people.

The structurally-balanced cluster was very similar to the locally integrated cluster. They had many network members, they saw them often, and they ranked very high in social participation. Compared to the other clusters, however, they had the lowest number of living siblings, and therefore it made sense that their mean frequency of get-together with siblings would also be low.

The family-friend focused cluster (16.98% of the sample) concentrated on their ties with their children, siblings, and close friends. Their number and contact with friends was moderately high, and although they knew a number of their neighbours, they had very low contact with them. Compared with the other clusters, their social participation level was moderately low.

The wider-community cluster (12.86% of the sample) was seemingly the opposite of the former cluster. These had very few family members – both children and siblings, and, it follows, that they would rank low in frequency of seeing these individuals. Conversely, they seemed to compensate for the lack of family relationships, by having a high number of friends, and

neighbours, as well as by having a high frequency of contact with these two groups of individuals often. Their social participation level was also moderately high.

The private cluster (13.54%) individuals focused on their localized family – that is, their children. They did not have very many friends, and had relatively few neighbours, and contact with them was low. Social participation was the lowest among all of the clusters.

The local self-contained (10.26%) network was made up of relatively few people, especially very few neighbours (they knew a mean of 0.71 ± 0.87 neighbours, with a low range of 0-3), however their mean frequency of neighbour contact was comparatively quite high (4.27 ± 1.65). Their social participation levels were also very minimal, when compared to the other clusters.

Figure 5 is a graphical display of the mean frequencies for each of the nine cluster comparison variables, per each of the six clusters. The figure displays how each cluster ranked in terms of mean frequency, for each of the social network variables. For example, for the first variable presented (number of living children), the wider-community cluster had the lowest mean number of children, and fell well below the rest. In comparison, the locally integrated cluster had the greatest number of children, with the other clusters ranking slightly lower than it.

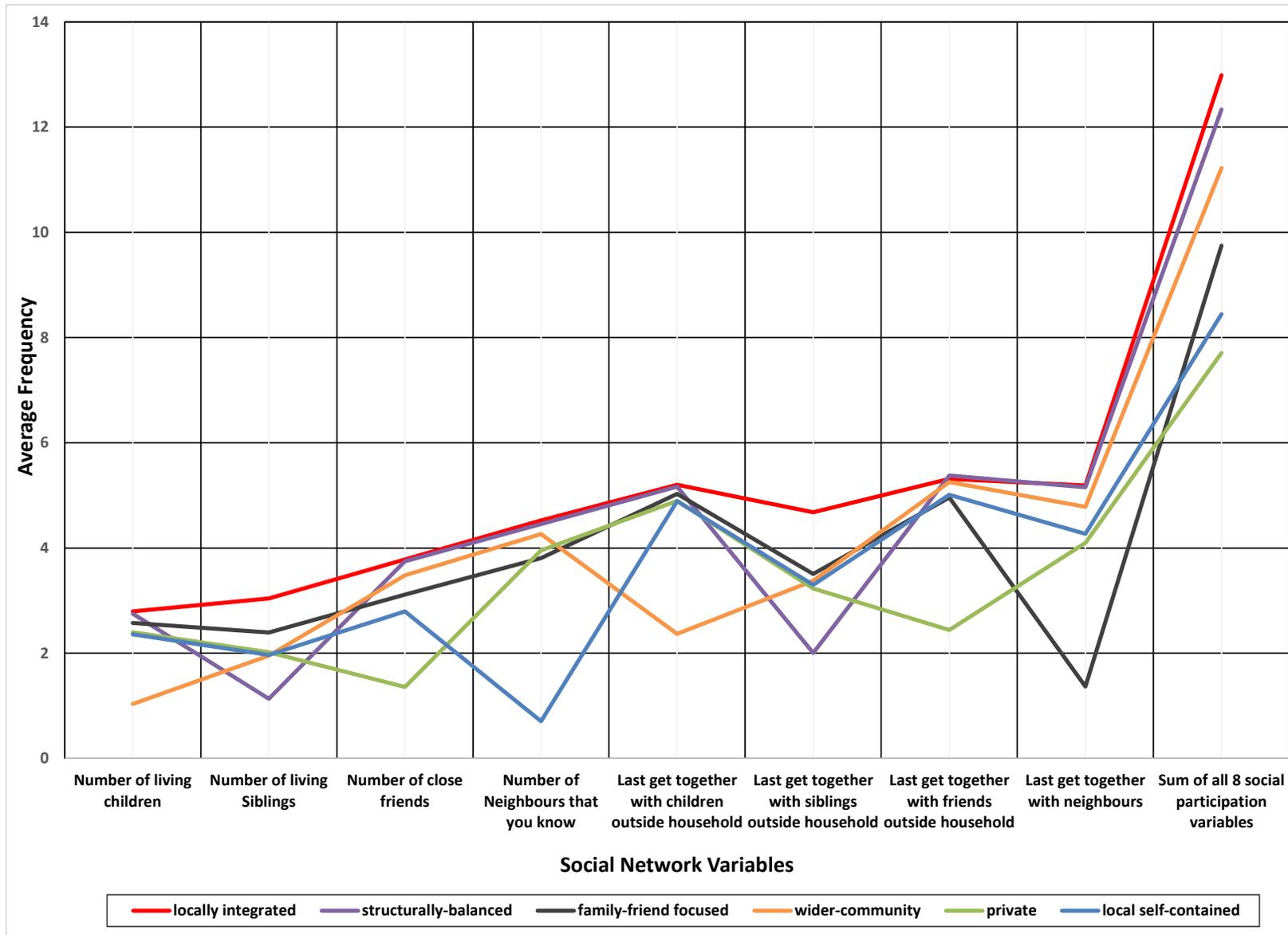


Figure 5: Mean frequency for each cluster comparison variable, per each of the six social network clusters

4.3 Covariates – Sociodemographic and Physical Health Variables

The covariates, which included both sociodemographic, as well as health variables, are displayed in Table 4. Chi-square analyses between clusters showed significant differences at the $p < 0.0001$ level for each of the study measures.

Table 4: Sociodemographic, and physical health variables for each cluster. Weighted values are presented in brackets.

Cluster	Locally Integrated	Structurally-Balanced	Family-Friend Focused	Wider-Community Oriented	Private	Local Self-Contained
Age Groups						
65-74 years old	58.81% (67.72)	44.82% (53.26)	54.15% (62.49)	59.36% (66.90)	49.72% (57.41)	48.63% (57.76)
75-85 years old	41.19% (32.28)	55.18% (46.74)	45.85% (37.51)	40.64% (33.10)	50.28% (42.59)	51.37% (42.24)
Chi-Square Statistic	$\chi^2 (5, N = 8782) = 117.24, p = <.0001$ [$\chi^2 (5, N = 6848.51) = 96.05, p = <.0001$]					
Sex						
Male	47.8% (44.35)	50.44% (47.91)	46.83% (44.24)	49.51% (46.33)	59.14% (55.79)	47.15% (41.77)
Female	52.2% (55.65)	49.56% (52.09)	53.17% (55.76)	50.49% (53.67)	40.86% (44.21)	52.85% (58.23)
Chi-Square Statistic	$\chi^2 (5, N = 8782) = 48.50, p = <.0001$ [$\chi^2 (5, N = 6848.51) = 34.37, p = <.0001$]					
Marital Status						
Single/ Divorced/ Separated	10.3% (11.25)	10.62% (10.11)	14.78% (15.52)	36.4% (36.61)	14.46% (13.84)	25.66% (26.37)
Married/ Common-law	66.82% (70.12)	65.44% (70.21)	64.03% (66.72)	47.25% (49.46)	66.32% (70.48)	47.55% (51.46)
Widowed	22.89% (18.63)	23.95% (19.69)	21.19% (17.76)	16.35% (13.93)	19.22% (15.67)	26.8% (22.17)
Chi-Square Statistic	$\chi^2 (10, N = 8779) = 555.59, p = <.0001$ [$\chi^2 (10, N = 6845.62) = 397.74, p = <.0001$]					
Education Level						
High School or Less	30.55% (26.46)	23.71% (21.29)	31.56% (30.15)	22.41% (20.25)	31.57% (29.44)	33.75% (32.41)
At Least Some Post-Secondary	69.45% (73.54)	76.29% (78.71)	68.44% (69.85)	77.59% (79.75)	68.43% (70.56)	66.25% (67.59)
Chi-Square Statistic	$\chi^2 (5, N = 8737) = 72.76, p = <.0001$ [$\chi^2 (5, N = 6813.49) = 50.50, p = <.0001$]					
Household Income						
< \$20,000	7.88% (6.34)	5.81% (4.82)	8.09% (7.37)	10.83% (8.83)	10.83% (9.68)	15.8% (15.65)
\$20,000-\$50,000	44.29% (38.95)	40.99% (37.27)	44.14% (40.76)	42.95% (39.96)	45.45% (42.54)	46.76% (41.86)
\$50,000 +	47.84% (54.72)	53.2% (57.91)	47.77% (51.87)	46.22% (51.21)	43.72% (47.78)	37.44% (42.49)
Chi-Square Statistic	$\chi^2 (10, N = 8004) = 111.62, p = <.0001$ [$\chi^2 (10, N = 6242.83) = 80.16, p = <.0001$]					
Chronic Disease Index*						
Mean Number of Chronic Diseases	3.96 ± 2.75	4.24 ± 2.75	4.19 ± 2.67	4.20 ± 2.85	4.47 ± 3.01	4.30 ± 2.67
ANOVA	F (5, 8227) = 5.39, p = <.0001					
Functional Status						
No functional impairment	86.68% (87.18)	82.19% (83.33)	84.10% (85.55)	83.03% (83.60)	78.75% (80.85)	79.66% (81.76)
Mild, moderate, severe or total	13.32% (12.82)	17.81% (16.67)	15.90% (14.45)	16.97% (16.40)	21.25% (19.15)	20.34% (18.24)
Chi-Square Statistic	$\chi^2 (5, N = 8536) = 32.67, p = <.0001$ [$\chi^2 (5, N = 6833) = 26.43, p = <.0001$]					

*= Index of 34 summed chronic diseases

The locally integrated cluster group was made up of younger (67.72% were between the ages of 65-74 years old) women (55.65%) who were married (70.13%). This cluster contained the lowest frequency of single/divorced/separated individuals. Consequently, they had fairly high household incomes, and slightly higher than average education levels.

The structurally-balanced cluster had the highest proportion of individuals in the 75-85 years old category (53.26%), and were almost split in terms of males (47.91%) versus females (52.09%). In terms of marital status (70.21%), they were quite similar to the locally integrated cluster. They were, however, highly educated – and had the second highest post-secondary rate (78.71%). They were also the cluster that had the highest proportion of individuals in the above \$50,000 a year income group (57.91%), 37.27% fell within \$20,000-\$50,000, and only 4.82% made less than \$20,000, making it the cluster with the smallest proportion of individuals who fell within this latter category.

The family-friend focused cluster was female-dominated (62.49% females versus 37.51% males), and the figures for marital status were similar to the former two clusters, albeit with slightly less married and widowed individuals, and a higher frequency of single/divorced/separated individuals. In terms of education and household income, this cluster showed frequencies very similar to that of the locally integrated cluster.

The wider-community cluster was a younger cluster (66.90% fell within the 65-74 year old group), and had slightly more females than males (53.67% versus 46.33%, respectively). In terms of marital status, they had – when compared to other clusters – the highest proportion of individuals in the single/divorced/separated group (36.61%), and had the lowest rates of

widowed individuals (13.93%) They were the most educated group (79.75% had at least some post-secondary education), however, they were about average in terms of income.

The private cluster group was a younger age group (57.41% versus 42.59%), and was a male-dominated group (55.79% versus 44.21%). The vast majority (66.32%) were married. In terms of education and household income, they fell close to the sample average.

The local self-contained groups were similar to the last cluster in terms of age (57.76% were in the 65-74 year old group, versus 42.24% in the 75-85 year old), the majority were female – 58.33% versus 41.77%. This cluster had the second-highest percentage of single/divorced/separated individuals – 26.37%, and the highest percentage of widows – 22.17%, and consequently, second lowest percentage of married individuals – 51.46%. They also had the lowest rate of post-secondary education – at 67.59%, and the highest frequency of individuals who had a household income of less than \$20,000 a year – 15.65% of the cluster fell in this category.

In terms of the health variables, the locally integrated cluster had the least number of chronic diseases (average 3.96 ± 2.75), and the lowest frequency of individuals with at least a mild functional impairment (12.82%). The structurally-balanced cluster had a mean of 4.24 ± 2.75 chronic diseases, and 16.67% had at least a mild functional impairment. The family-friend focused dependent cluster and wider-community oriented cluster each had an average of 4.19 ± 2.67 and 4.20 ± 2.85 , respectively, mean chronic diseases. They also have frequencies of 14.45% and 16.4, respectively, of individuals in their clusters who had functional impairments. The private cluster had the greatest mean number of chronic diseases (4.47 ± 3.01) and greatest frequency (19.15%) of functional impairment. Lastly, the local self-contained cluster had a mean

of 4.30 ± 2.67 chronic diseases, and 18.24% of the cluster had at least a mild functional impairment.

4.4 Variables for Exploratory Analysis

Table 5 displays the frequencies for the variables used for exploratory analysis.

Table 5: Variables for exploratory analysis. Weighted values are presented in brackets.

Cluster	Locally Integrated	Structurally-Balanced	Family-Friend Focused	Wider-Community Oriented	Private	Local Self-Contained
Self-Rated General Health						
Excellent, Very Good & Good	88.3% (89.74)	86.95% (88.25)	85.45% (86.51)	87.51% (88.72)	80.19% (80.78)	80.14% (81.57)
Fair & Poor	11.7% (10.26)	13.05% (11.75)	14.55% (13.49)	12.49% (11.28)	19.81% (19.22)	19.86% (18.43)
Chi-Square Statistic	$\chi^2 (5, N = 8767) = 66.64, p = <.0001$ [$\chi^2 (5, N = 6837.82) = 55.94, p = <.0001$]					
Number of other people living in the household						
0 (live alone)	28.64% (24.63)	31.49% (27.20)	28.05% (25.34)	45.48% (43.57)	28.26% (24.43)	44.99% (40.93)
1 or more	71.36% (75.37)	68.51% (72.80)	71.95% (74.66)	54.52% (56.43)	71.74% (75.57)	55.01% (59.07)
Chi-Square Statistic	$\chi^2 (5, N = 8782) = 189.19, p = <.0001$ [$\chi^2 (5, N = 6848.51) = 158.32, p = <.0001$]					
Generations living in household						
1 generation	90.72% (89.73)	91.18% (90.10)	87.6% (86.86)	91.1% (90.21)	89.83% (89.47)	89.97% (89.90)
2 or more	9.28% (10.27)	8.82% (9.90)	12.4% (13.14)	8.9% (9.79)	10.17% (10.53)	10.03% (10.10)
Chi-Square Statistic	$\chi^2 (5, N = 8767) = 14.34, p = 0.0136$ [$\chi^2 (5, N = 6837.23) = 8.06, p = 0.1532$]					
Participant a Caregiver						
No	54.31% (50.85)	57.32% (54.95)	62.19% (61.48)	56.75% (53.58)	66.07% (63.72)	69.18% (66.64)
Yes	45.69% (49.15)	42.68% (45.05)	37.81% (38.52)	43.25% (46.42)	33.93% (36.28)	30.82% (33.36)
Chi-Square Statistic	$\chi^2 (5, N = 8743) = 89.67, p = <.0001$ [$\chi^2 (5, N = 6819.95) = 74.04, p = <.0001$]					

In terms of self-rated general health, the locally integrated and structurally-balanced clusters ranked the best – 89.74% and 88.25%, respectively, ranked their health as either “excellent”, “very good”, or “good”.

In comparison, 86.51% of individuals in the family-friend focused cluster ranked their self-rated general health in the “excellent”, “very good”, or “good” category. In the wider-community cluster, 88.72% ranked their self-rated general health in the same category.

Lastly, the private and local self-contained clusters had the worst self-rated health, when compared to the other four clusters. The private cluster had 80.78% of their individuals ranked their health as either “excellent, very good, and good category” for self-rated general health. The local self-contained scored very similarly, with 81.57%.

The wider-community cluster, and the local self-contained cluster, had the two highest rates of individuals living alone (43.57%, and 40.93%, respectively). Conversely, the other clusters had rates that were much lower (in the range of 24.43%-27.20%).

In terms of generations living in the household, the family-friend focused cluster had the highest proportion of cluster members living in inter-generational households, at 13.14%. The remaining five clusters fell into a range of 9.79%-10.53% of cluster members living in inter-generational households.

Lastly, in terms of whether a participant was a caregiver to someone, the local self-contained cluster, the private cluster, and the family-friend focused cluster had the lowest rates of caregivers (33.36%, 36.28%, and 38.52%, respectively). In comparison, the structurally-balanced, wider-community oriented, and locally integrated clusters had the greatest rates of caregivers (45.05%, 46.42%, and 49.15%).

4.5 Mental Health Variables

Results in Table 6 display, by cluster, mental health outcomes. Individuals in the locally integrated network and structurally-balanced had the best mental health outcomes – in terms of self-rated mental health, 97.52% in the locally integrated group rated their mental health as either “excellent, very good, or good”, similar to 97.51% in the structurally-balanced cluster. In terms of depression and loneliness, 13.94% in locally integrated cluster scored above the depression cut-off, and 9.64% felt lonely “occasionally, or always”, compared to 14.89% and 9.47%, respectively, in the structurally-balanced group. The locally integrated group had a mood diagnosis rate of 8.28%, compared to 8.87% in the structurally-balanced group. With regards to life satisfaction, the locally integrated cluster ranked the highest, with 95.65% in the “average, high, or very high” category, compared to 93.08% in the structurally-balanced group.

In terms of self-rated mental health, the family-friend focused cluster had 96.74% in the “excellent, very good, or good” category, whereas 15.45% of individuals scored above the depression cut-off point, and 11.50% of individuals felt lonely “occasionally, or always”, and 9.70% were diagnosed with a mood disorder. For the satisfaction with life measure, 92.04% of individuals ranked in the “average, high, or very high” category. In the wider-community oriented cluster, 97.28% of individuals ranked their mental health as “excellent, very good, or good”; 16.93% ranked above the cut-off point for depression, and 9.97% of individuals felt lonely “occasionally, or always”, whereas 12.55% had a diagnosed mood disorder. In terms of satisfaction with life, 89.38% fell into the “average, high, or very high” category.

The private cluster, as well as the local self-contained cluster, ranked very closely in terms of their mental health outcomes. In the private network, 94.58% ranked their self-rated mental health as “excellent, very good, or good”, compared to 94.72% in the local self-contained

cluster. In the private cluster, 21.20% of individuals were above the depression cut-off, 13.63% felt lonely “occasionally, or all of the time”, and 14.14% had a diagnosed mood disorder. In comparison, within the local self-contained cluster, 21.83% fell above the depression cut-off, 16.75% felt lonely “occasionally, or all of the time”, and 15.39% had a diagnosed mood disorder. With regards to life satisfaction, 85.88% of the private cluster had a ranking of “average, high, or very high”, compared to 87.96% of the local self-contained cluster.

Table 6: Mental health outcomes, by cluster. Weighted values are presented in brackets.

Cluster	Locally Integrated	Structurally-Balanced	Family-Friend Focused	Wider-Community Oriented	Private	Local Self-Contained
Self-Rated Mental Health						
Excellent, Very Good & Good	97.12% (97.52)	97.14% (97.51)	96.37% (96.74)	96.88% (97.28)	93.74% (94.58)	93.74% (94.72)
Fair & Poor	2.88% (2.48)	2.86% (2.49)	3.63% (3.26)	3.13% (2.72)	6.26% (5.42)	6.26% (5.28)
Chi-Square Statistic	$\chi^2 (5, N = 8773) = 44.28, p = <.0001$ [$\chi^2 (5, N = 6843.36) = 29.63, p = <.0001$]					
Depression						
< 10	86.47% (86.06)	86.52% (85.11)	83.75% (84.55)	83.4% (83.07)	78.82% (78.80)	78.02% (78.17)
>= 10 (Depressed)	13.53% (13.94)	13.48% (14.89)	16.25% (15.45)	16.6% (16.93)	21.18% (21.20)	21.98% (21.83)
Chi-Square Statistic	$\chi^2 (5, N = 8437) = 61.51, p = <.0001$ [$\chi^2 (5, N = 6593.68) = 32.94, p = <.0001$]					
Diagnosed Mood Disorder						
No	91.36% (91.72)	90.88% (91.13)	89.82% (90.30)	88.83% (87.45)	86.93% (85.86)	84.04% (84.61)
Yes	8.64% (8.28)	9.12% (8.87)	10.18% (9.70)	11.17% (12.55)	13.07% (14.14)	15.96% (15.39)
Chi-Square Statistic	$\chi^2 (5, N = 8766) = 47.93, p = <.0001$ [$\chi^2 (5, N = 6843.64) = 43.86, p = <.0001$]					
Loneliness						
Never, Rarely	89.42% (90.36)	89.76% (90.53)	87.98% (88.50)	88.25% (90.03)	85.77% (86.37)	82.53% (83.25)
Occasionally, Always	10.58% (9.64)	10.24% (9.47)	12.02% (11.50)	11.75% (9.97)	14.23% (13.63)	17.47% (16.75)
Chi-Square Statistic	$\chi^2 (5, N = 8766) = 40.15, p = <.0001$ [$\chi^2 (5, N = 6838.06) = 27.43, p = <.0001$]					
Satisfaction with Life						
Average, High, or Very High	94.78% (95.65)	93.23% (93.08)	91.6% (92.04)	89.03% (89.38)	85.82% (85.88)	86.22% (87.96)
Slightly Below Average, Very Dissatisfied, or Dissatisfied	5.22% (4.35)	6.77% (6.92)	8.4% (7.96)	10.97% (10.62)	14.18% (14.12)	13.78% (12.04)
Chi-Square Statistic	$\chi^2 (5, N = 8613) = 116.65, p = <.0001$ [$\chi^2 (5, N = 6718.75) = 88.18, p = <.0001$]					

4.6 Social Support Variables

Results for the social support sub-scales (emotional social support, positive social support, tangible social support, and affectionate social support), as well as results for global social support, are shown in table 7. Figure 6 graphically represents these results.

With regards to social support, there were some very clear trends. The locally integrated network, and the structurally-balanced network had the greatest mean overall social support levels (97.20%, and 96.54%, respectively, fell into the “most, or all of the time” category). The family-friend focused, and wider-community clusters had frequencies of 92.97% and 91.25%, respectively, within that same category. The private and local self-contained had the poorest social support outcomes, with only 85.92% and 86.01%, respectively, rating the availability of social support as “most, or all of the time”.

In terms of the four social support sub-scales, for mean emotional social support, as well as positive social support, the trends were very similar to those seen in the mean overall social support measure. For emotional social support, the locally integrated cluster ranked highest in “most, or all of the time” at 94.67%, and 93.24% for positive social support. In the structurally-balanced cluster, 93.42% had emotional social support “most, or all of the time”, and 93.11% of individuals answered in the same category for positive social support. In the family-friend focused cluster, 89.85% had emotional social support “most, or all of the time”, and 88.56% positive social support. For the wider-community oriented cluster, 89.56%, and 86.91% had emotional and positive support, respectively, “most, or all of the time”. The private cluster had the lowest proportions of emotional support (79.65%), and positive social support (78.19%), “most, or all of the time”. Lastly, the local self-contained had slightly higher frequencies at 81.91%, and 78.58%, respectively.

For the mean tangible support, and mean affectionate social support, the locally integrated network ranked the highest in terms of social support, with 93.36% and 95.3% frequencies in the “most, or all of the time” category. The structurally-balanced cluster ranked their social support slightly less, with 91.5% in the “most, or all of the time” category for tangible social support, and 94.77% for affectionate social support. The family-friend focused had 88.44% of individuals rank their tangible social support availability as “most, or all of the time”, and 91.11% their affectionate social support. The wider-community oriented cluster, unlike the trends it presented for the other two subscales, had lower social support availability for the tangible and affectionate social support (84.26% and 84.34%, respectively) when compared to the private cluster (87.39%, and 87.21%, respectively). The local self-contained cluster ranked their availability of tangible and affectionate social support the lowest from all six clusters, at 80.63% and 82.37% within the “most, or all of the time” category of support availability.

Table 7: Social support frequencies, by cluster, for overall social support scale, as well as for the four individual sub-scales. Weighted values are presented in brackets.

Cluster	Locally Integrated	Structurally-Balanced	Family-Friend Focused	Wider-Community Oriented	Private	Local Self-Contained
Overall Social Support						
Some, a little, or none of the time	3.02% (2.80)	3.84% (3.46)	7.03% (6.42)	8.75% (7.67)	14.08% (13.80)	13.99% (12.47)
Most, or all of the time	96.98% (97.20)	96.16% (96.54)	92.97% (93.58)	91.25% (92.33)	85.92% (86.20)	86.01% (87.53)
Chi-Square Test Statistic	$\chi^2 (5, N = 8016) = 216.54, p = <.0001$ [$\chi^2 (5, N = 6291.54) = 154.88, p = <.0001$]					
Emotional Social Support						
Some, a little, or none of the time	5.33% (5.11)	6.58% (6.40)	10.15% (9.24)	10.44% (8.92)	20.35% (20.23)	18.09% (15.60)
Most, or all of the time	94.67% (94.89)	93.42% (93.60)	89.85% (90.76)	89.56% (91.08)	79.65% (79.77)	81.91% (84.40)
Chi-Square Test Statistic	$\chi^2 (5, N = 8326) = 251.31, p = <.0001$ [$\chi^2 (5, N = 6516.28) = 187.77, p = <.0001$]					
Positive Social Support						
Some, a little, or none of the time	6.76% (6.01)	6.89% (6.56)	11.44% (10.76)	13.09% (11.18)	21.81% (20.51)	21.42% (19.26)
Most, or all of the time	93.24% (93.99)	93.11% (93.44)	88.56% (89.24)	86.91% (88.82)	78.19% (79.49)	78.58% (80.74)
Chi-Square Statistic	$\chi^2 (5, N = 8593) = 280.96, p = <.0001$ [$\chi^2 (5, N = 6715) = 202.74, p = <.0001$]					
Tangible Social Support						
Some, a little, or none of the time	6.64% (5.86)	8.5% (8.35)	11.56% (10.64)	16.38% (15.74)	14.37% (12.61)	19.37% (17.76)
Most, or all of the time	93.36% (94.14)	91.5% (91.65)	88.44% (89.36)	83.62% (84.26)	85.63% (87.39)	80.63% (82.24)
Chi-Square Statistic	$\chi^2 (5, N = 8449) = 155.52, p = <.0001$ [$\chi^2 (5, N = 6611.63) = 116.89, p = <.0001$]					
Affectionate Social Support						
Some, a little, or none of the time	4.7% (4.63)	5.23% (5.11)	8.89% (8.54)	16.22% (15.66)	14.19% (12.79)	17.63% (16.51)
Most, or all of the time	95.3% (95.37)	94.77% (94.89)	91.11% (91.46)	83.78% (84.34)	85.81% (87.21)	82.37% (83.49)
Chi-Square Statistic	$\chi^2 (5, N = 8670) = 259.61, p = <.0001$ [$\chi^2 (5, N = 6766.86) = 186.46, p = <.0001$]					

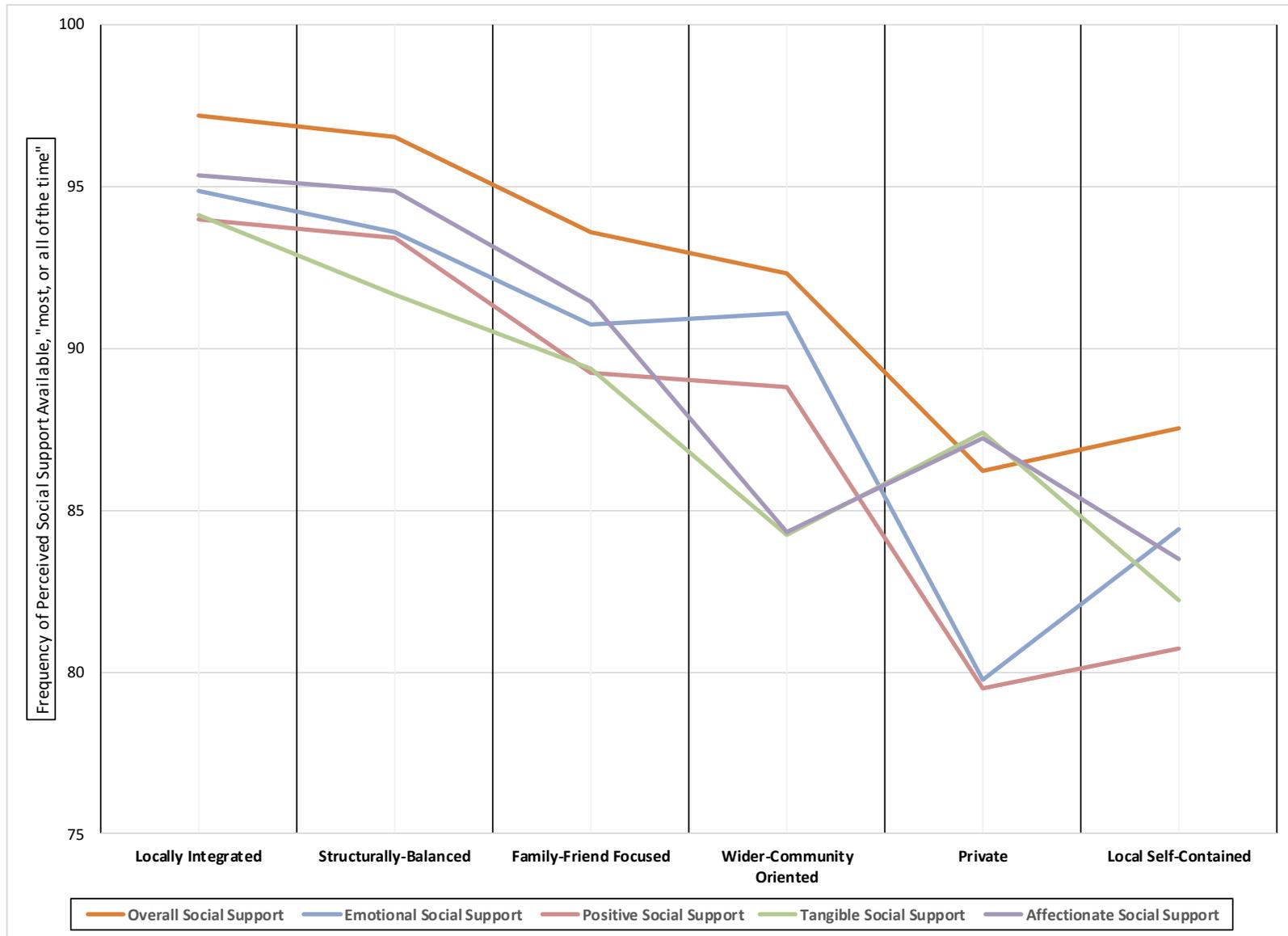


Figure 6: Frequency of perceived social support available "most, or all of the time", per each cluster

4.7 Mediation Analyses

The following section describes and presents the results of the mediation analyses.

4.7.1 Umbrella Clusters

The six clusters that emerged from the cluster analysis were grouped into three umbrella clusters, reflecting overall degree of social integration. They were labelled as follows:

1. ***Socially Integrated:*** this consisted of the locally integrated, and structurally-balanced clusters;
2. ***Moderately Socially Integrated:*** this was made up of the family-friend focused cluster, and the wider-community oriented cluster; and
3. ***Socially Isolated:*** this umbrella cluster included the private cluster, as well as the local self-contained cluster.

The six clusters were grouped together based on their similarities in terms of overall social network size, as well as based on similarities in their outcome variables, as presented in the previous section. For ease of interpretation of mediation analyses results, the three umbrella clusters, rather than the six individual clusters, were used as predictor variables.

Results for overall mean social support (kept as a continuous variable), as well as mean frequencies for the outcome variables, per each of the three umbrella clusters, are listed in Table 8. Results in this table have an $n = 6624$, since I removed all missing values for the covariates, mediator variable, as well as the five outcome variables. This n was used in the mediation analyses.

Table 8: Social support and mental health outcomes, for each of the three umbrella clusters (n=6624). Weighted values are presented in brackets.

Umbrella Cluster	Socially Integrated	Moderately Socially Integrated	Socially Isolated
n* (Weighted n)	3354 (1,556,495)	1901 (961,167)	1369 (727,005)
Summed Social Support	65.04 ± 11.43, Range 7-76	61.94 ± 13.70, Range 5-76	58.92 ± 16.77, Range 0-76
ANOVA	F (2, 6621) = 108.71, p = <.0001		
Self-Rated Mental Health			
Excellent, Very Good & Good	97.38% (97.76)	96.90% (97.09)	93.94% (94.91)
Fair & Poor	2.62% (2.24)	3.10% (2.91)	6.06% (5.09)
Chi-Square Statistic	$\chi^2 (2, N = 6624) = 35.38, p = <.0001$ [$\chi^2 (2, N = 5230.32) = 20.92, p = <.0001$]		
Depression			
< 10	87.15% (86.14)	84.80% (84.85)	79.47% (79.41)
≥ 10 (Depressed)	12.85% (13.86)	15.20% (15.15)	20.53% (20.59)
Chi-Square Statistic	$\chi^2 (2, N = 6624) = 44.67, p = <.0001$ [$\chi^2 (2, N = 5230.32) = 22.65, p = <.0001$]		
Diagnosed Mood Disorder			
No	91.09% (91.51)	89.37% (88.77)	85.83% (85.37)
Yes	8.91% (8.49)	10.63% (11.23)	14.17% (14.63)
Chi-Square Statistic	$\chi^2 (2, N = 6624) = 28.65, p = <.0001$ [$\chi^2 (2, N = 5230.32) = 30.75, p = <.0001$]		
Loneliness			
Never, Rarely	90.34% (90.83)	89.11% (89.74)	84.81% (85.19)
Occasionally, Always	9.66% (9.17)	10.89% (10.26)	15.19% (14.81)
Chi-Square Statistic	$\chi^2 (2, N = 6624) = 30.22, p = <.0001$ [$\chi^2 (2, N = 5230.32) = 20.45, p = <.0001$]		
Satisfaction with Life			
Average, High, or Very High	94.31% (95.48)	91.43% (91.96)	86.78% (87.98)
Slightly Below Average, Very Dissatisfied, or Dissatisfied	5.69% (5.52)	8.57% (8.04)	13.22% (12.02)
Chi-Square Statistic	$\chi^2 (2, N = 6624) = 75.07, p = <.0001$ [$\chi^2 (2, N = 5230.32) = 48.92, p = <.0001$]		

*=does not include missing values from covariates, mediator variable, as well as outcome variables

The socially integrated cluster had the greatest levels of social support (65.04 ± 11.43). The moderately socially integrated cluster (61.94 ± 13.70) was in the middle between the other two groups. Lastly, the socially isolated cluster had the least amount of social support (58.92 ± 16.77). The same gradient was observed for each of the five mental health outcome variables. In the socially integrated cluster, 97.76% of participants ranked their self-rated mental health as “excellent, very good, or good”, versus 97.09% in the moderately socially integrated cluster, and just 94.91% in the socially isolated cluster. For depression, the proportion of individuals who were scored as depressed was 13.86% for the socially integrated cluster, 15.15% for the

moderately isolated umbrella cluster, and 20.59% for the isolated umbrella cluster. In terms of diagnosed mood disorder, the prevalence rates followed a similar pattern – from a low of 8.49%, rising to 11.23%, and 14.63%, from most socially integrated, to moderately socially isolated, to most socially isolated. In terms of feeling lonely, in the socially integrated cluster 9.17% of individuals felt lonely “occasionally, or always”, followed by 10.26% in the moderate cluster, and 14.81% in the isolated cluster. Lastly, in terms of satisfaction with life, the individuals in the socially integrated cluster were the most satisfied with their lives (95.48%), followed by those in the moderately socially isolated cluster (91.96%), and the individuals in the socially isolated umbrella cluster the least so (87.98%).

4.7.2 Mediation Analyses Results

The following section describes the results of the five mediation analyses that were conducted, testing whether social support mediated the relationship between levels of social network integration, and five different mental health outcomes. For each of the five mediation analyses, covariates were added into the model in a hierarchical fashion. First, the baseline model of social integration, social support, and mental health was conducted. Then, a second model with the sociodemographic variables added in was run. These were: age, sex, marital status education, and income. Finally a third model was run with the health covariates included (the chronic morbidity index, and the OARS scale). R^2 values indicated that the third model was the most optimal. Values for each of the three models are presented in Appendix A.

4.7.2.1 Self-Rated Mental Health (SRMH)

Table 9 displays the path coefficients, standard errors, and significance levels, for the adjusted mediation model that tested whether social support mediated the relationship between

level of social network integration, and self-rated mental health. Figure 7 displays these results graphically.

Table 9: Path coefficients for the adjusted mediation analysis model, examining the association between level of social integration, and self-rated mental health, through the mediator social support.

Predictors	Outcomes	
	Social Support	SRMH
Umbrella Clusters:		
Socially Isolated ^a	-5.027 (0.408) ****	-0.6004 (0.164) ***
Moderately Integrated ^a	-2.253 (0.364) ****	-0.0476 (0.175)
Social Support		0.0272 (0.0044) ****
Covariates:		
Age ^b	0.156 (0.324)	0.352 (0.143) *
Sex ^c	2.473 (0.336) ****	0.244 (0.149)
Marital Status ^d	8.625 (0.375) ****	-0.334 (0.170) *
Education ^e	0.396 (0.363)	0.187 (0.151)
Income ^f	1.075 (0.282) ****	0.193 (0.119)
Chronic Diseases	-0.193 (0.061) **	-0.139 (0.0226) ****
Function Status ^g	-1.816 (0.462) ****	-0.679 (0.164) ****

Statistically significant at: **** $p \leq 0.0001$ *** $p \leq 0.001$ ** $p \leq 0.01$ * $p \leq 0.05$

^a= reference= socially integrated cluster

^b= 0=65-74 year olds; 1= 75-85 year olds

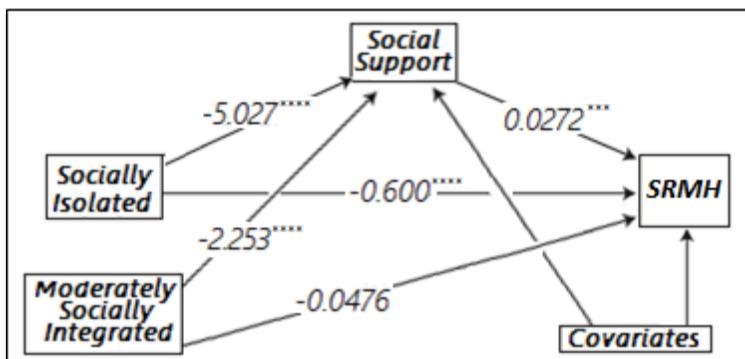
^c= 0= Male; 1= Female

^d= 0= single/widowed/divorced; 1= married

^e= 0= high school education; 1= post-secondary

^f= 1= less than \$20,000/year; 2= \$20,000-\$50,000/year; 3= \$50,000 or >/year

^g= 0= no functional impairment; 1= some functional impairment



Note: Statistically significant at: **** $p \leq 0.0001$ *** $p \leq 0.001$ ** $p \leq 0.01$ * $p \leq 0.05$

Figure 7: Mediation of the relationship between level of social integration, and self-rated mental health, through the mediator social support.

As shown in table 9, and figure 7, as level of social isolation increased (relative to the most social integrated cluster), social support decreased. Conversely, as social support increased, self-rated mental health increased.

Table 10 displays the indirect, and direct effects, for the relationship between differing levels of social network integration, and self-rated mental health, with social support as the mediating variable.

Table 10: Parameter estimates and 95% confidence intervals for indirect, and direct effects, in the adjusted mediation model, examining the association between social integration, and self-rated mental health, through the mediator social support.

	Umbrella Cluster= Socially Isolated ^a		Umbrella Cluster= Moderately Socially Integrated ^a	
	Parameter Estimate ¹	95% Confidence Interval	Parameter Estimate ¹	95% Confidence Interval
Indirect Effect	-0.137	(-0.190, -0.091)	-0.0612	(-0.0911, -0.0374)
Direct Effect	-0.600	(-0.922, -0.279)	-0.0476	(-0.390, 0.295)

^a= reference= socially integrated cluster

¹= Parameter estimates are unstandardized beta coefficients

As shown in table 10, relative to the reference group (socially integrated cluster), membership in the socially isolated cluster indirectly influenced self-rated mental health through the mediator, social support. The bias-corrected bootstrap confidence interval for the indirect effect for the socially isolated cluster was significant ($\beta = -0.137$, CI: -0.190 to -0.0910), whereas for the moderately socially integrated cluster, an indirect effect was also entirely below zero ($\beta = -0.0612$, CI: -0.0911 to -0.0374), indicating that for both levels of social integration, the relationship was indirectly mediated by social support.

For the socially isolated cluster, there was also a direct effect present, between the socially isolated cluster, and self-rated mental health, independent of the mediator social support ($\beta = -0.600$, CI: -0.922 to -0.279). However, for the moderately socially integrated cluster, there

was no evidence of a direct relationship between the cluster, and self-rated mental health, independent of the mediator (moderately socially integrated: $\beta = -0.0476$, CI: -0.390 to 0.295), meaning that the relationship existed entirely through social support.

4.7.2.2 Depression

Table 11 displays the path coefficients, standard errors, and significance levels, for the adjusted mediation model that tested whether social support mediated the relationship between level of social network integration, and depression. Figure 8 displays these results graphically.

Table 11: Path coefficients for the adjusted mediation model, examining the association between level of social integration, and depression, through the mediator social support

Predictors	Outcomes	
	Social Support	Depression
Umbrella Clusters		
Socially Isolated ^a	-5.027 (0.408) ****	0.230 (0.0926) *
Moderately Integrated ^a	-2.253 (0.364) ****	0.0239 (0.0877)
Social Support		-0.0410 (0.0026) ****
Covariates		
Age ^b	0.156 (0.324)	-0.251 (0.0766) **
Sex ^c	2.473 (0.336) ****	0.261 (0.0794) ***
Marital Status ^d	8.625 (0.375) ****	0.140 (0.0881)
Education ^e	0.396 (0.363)	-0.159 (0.082)
Income ^f	1.075 (0.282) ****	-0.230 (0.0636) ***
Chronic Diseases	-0.193 (0.061) **	0.133 (0.0131) ****
Function Status ^g	-1.816 (0.432) ****	0.544 (0.0925) ****

Statistically significant at: **** $p \leq 0.0001$ *** $p \leq 0.001$ ** $p \leq 0.01$ * $p \leq 0.05$

^a= reference= socially integrated cluster

^b= 0= 65-74 year olds; 1= 75-85 year olds

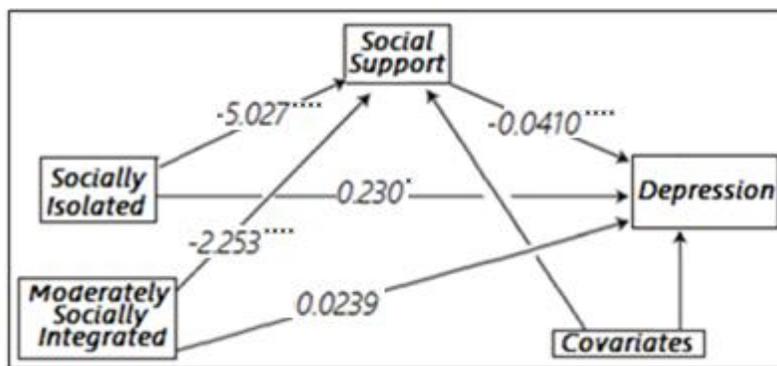
^c= 0= Male; 1= Female

^d= 0= single/widowed/divorced; 1= married

^e= 0= high school education; 1= post-secondary

^f= 1= less than \$20,000/year; 2= \$20,000-\$50,000/year; 3= \$50,000 or >/year

^g= 0= no functional impairment; 1= some impairment



Note: Statistically significant at: ****p ≤ 0.0001 ***p ≤ 0.001 **p ≤ 0.01 *p ≤ 0.05

Figure 8: Mediation of the relationship between level of social integration, and depression, through the mediator social support.

As shown in table 11, and figure 8, as level of social isolation increased (relative to the most social integrated cluster), social support decreased. Conversely, as social support increased, depression level decreased.

Table 12 displays the indirect, and direct effects, for the relationship between differing levels of social network integration, and depression, with social support as the mediating variable.

Table 12: Parameter estimates and 95% confidence intervals for indirect, and direct effects, in the adjusted mediation model, examining the association between level of social integration, and depression, through the mediator social support.

	Umbrella Cluster= Socially Isolated ^a		Umbrella Cluster= Moderately Socially Integrated ^a	
	Parameter Estimate ¹	95% Confidence Interval	Parameter Estimate ¹	95% Confidence Interval
Indirect Effect	0.206	(0.164, 0.252)	0.0923	(0.0631, 0.124)
Direct Effect	0.230	(0.0482, 0.411)	0.0239	(-0.148, 0.196)

^a= reference= socially integrated cluster

¹= Parameter estimates are unstandardized beta coefficients

As shown in table 12, relative to the reference group (socially integrated cluster), membership in the socially isolated cluster indirectly influenced depression through the mediator, social support. The bias-corrected bootstrap confidence interval for the indirect effect

for the socially isolated cluster was significant ($\beta = 0.206$, CI: 0.164-0.252), as was the indirect effect for the moderately socially integrated cluster ($\beta = 0.0923$, 0.0631 to 0.124), indicating that for both levels of social integration, the relationship was indirectly mediated by social support.

For the socially isolated cluster, there was also direct effect present, between the socially isolated cluster, and depression, independent of the mediator social support ($\beta = .230$, CI: 0.0482 to 0.411). However, for the moderately socially integrated cluster, there was no evidence of a direct relationship with depression (moderately socially integrated: $\beta = .0239$, CI: -0.148 to 0.196), meaning that the relationship exists entirely through social support.

4.7.2.3 Diagnosed Mood Disorder

Table 13 displays the path coefficients, standard errors, and significance levels, for the adjusted mediation model that tested whether social support mediated the relationship between level of social network integration, and diagnosed mood disorder. Figure 9 displays these results graphically.

Table 13: Path coefficients in the adjusted mediation model, examining the association between level of social integration, and diagnosed mood disorder, through the mediator social support

Predictors	Outcomes	
	Social Support	Mood Disorder
Umbrella Clusters		
Socially Isolated ^a	-5.027 (0.408) ****	0.372 (0.104) ***
Moderately Integrated ^a	-2.253 (0.364) ****	0.0642 (0.0997)
Social Support		-0.0167 (0.0029) ****
Covariates		
Age	0.156 (0.324)	-0.739 (0.0907) ****
Sex	2.473 (0.336) ****	0.336 (0.0903) ***
Marital Status	8.625 (0.375) ****	-0.130 (0.0997)
Education	0.396 (0.363)	0.250 (0.0990) *
Income	1.075 (0.282) ****	-0.133 (0.0721)
Chronic Diseases	-0.193 (0.061) **	0.130 (0.0146) ****
Function Status	-1.816 (0.432) ****	0.566 (0.104) ****

Statistically significant at: **** $p \leq 0.0001$ *** $p \leq 0.001$ ** $p \leq 0.01$ * $p \leq 0.05$

^a= reference= socially integrated cluster

^b= 0= 65-74 year olds; 1= 75-85 year olds

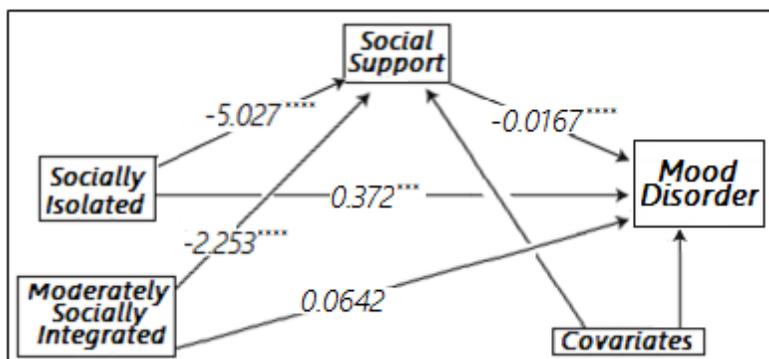
^c= 0= Male; 1= Female

^d= 0= single/widowed/divorced; 1= married

^e= 0= high school education; 1= post-secondary

^f= 1= less than \$20,000/year; 2= \$20,000-\$50,000/year; 3= \$50,000 or >/year

^g= 0= no functional impairment; 1= some impairment



Note: Statistically significant at: ****p ≤ 0.0001 ***p ≤ 0.001 **p ≤ 0.01 *p ≤ 0.05

Figure 9: Mediation of the relationship between level of social integration, and diagnosed mood disorder, through the mediator social support.

As shown in table 13, and figure 9, as level of social isolation increased (relative to the most social integrated cluster), social support decreased. Conversely, as social support increased, mood disorder level decreased.

Table 14 displays the indirect, and direct effects, for the relationship between differing levels of social network integration, and mood disorder, with social support as the mediating variable.

Table 14: Parameter estimates and 95% confidence intervals for indirect, and direct effects, in the adjusted mediation model, examining the association between level of social integration, and diagnosed mood disorder, through the mediator social support

	Umbrella Cluster= Socially Isolated ^a		Umbrella Cluster= Moderately Socially Integrated ^a	
	Parameter Estimate ¹	95% Confidence Interval	Parameter Estimate ¹	95% Confidence Interval
Indirect Effect	0.0839	(0.0547, 0.119)	0.0376	(0.0227, 0.0574)
Direct Effect	0.372	(0.167, 0.576)	0.0642	(-0.131, 0.260)

^a= reference= socially integrated cluster

¹= Parameter estimates are unstandardized beta coefficients

As shown in table 14, relative to the reference group (socially integrated cluster), membership in the socially isolated cluster indirectly influenced diagnosed mood disorder, through the mediator, social support. The bias-corrected bootstrap confidence interval for both the indirect effect for the socially isolated cluster and the moderately socially integrated clusters were significant ($\beta = 0.0839$, CI: 0.0547 to 0.119; vs. $\beta = 0.0376$, CI: 0.0227 to 0.0574), indicating that for both levels of social integration, the relationship was indirectly mediated by social support

For the socially isolated cluster, there was also a direct effect present, between the socially isolated cluster, and diagnosed mood disorder, independent of the mediator social support ($\beta = 0.372$, CI: 0.167 to 0.576). However, for the moderately socially integrated cluster, there was no evidence of a direct relationship with depression (moderately socially integrated: $\beta = 0.0642$, CI: -0.131 to 0.260), meaning that the relationship exists entirely through social support.

4.7.2.4 Loneliness

Table 15 displays the path coefficients, standard errors, and significance levels, for the adjusted mediation model that tested whether social support mediated the relationship between level of social network integration, and loneliness. Figure 10 displays these results graphically.

Table 15: Path coefficients in the adjusted mediation model, examining the association between level of social integration, and loneliness, through the mediator social support

Predictors	Outcomes	
	Social Support	Loneliness
Umbrella Clusters		
Socially Isolated ^a	-5.027 (0.408) ****	0.129 (0.105)
Moderately Integrated ^a	-2.253 (0.364) ****	-0.114 (0.0993)
Social Support		-0.0366 (0.003) ****
Covariates		
Age ^b	0.156 (0.324)	0.0270 (0.0850)
Sex ^c	2.473 (0.336) ****	0.0990 (0.0906)
Marital Status ^d	8.625 (0.375) ****	-0.933 (0.0970) ****
Education ^e	0.396 (0.363)	-0.134 (0.0929)
Income ^f	1.075 (0.282) ****	0.0312 (0.0698)
Chronic Diseases	-0.193 (0.061) **	0.0401 (0.015) **
Function Status ^g	-1.816 (0.432) ****	0.270 (0.108) *

Statistically significant at: ****p ≤ 0.0001 ***p ≤ 0.001 **p ≤ 0.01 *p ≤ 0.05

^a= reference= socially integrated cluster

^b= 0= 65-74 year olds; 1= 75-85 year olds

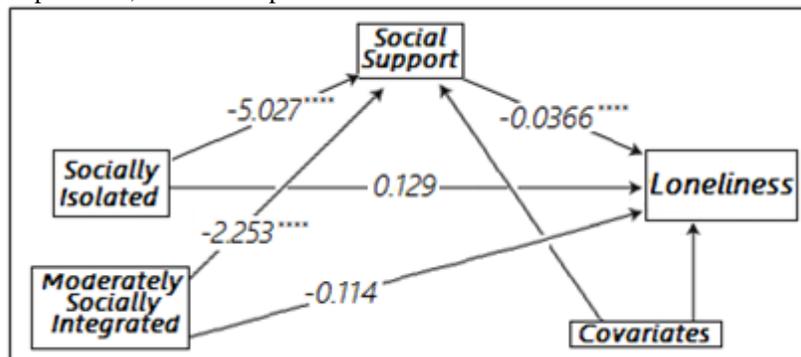
^c= 0= Male; 1= Female

^d= 0= single/widowed/divorced; 1= married

^e= 0= high school education; 1= post-secondary

^f= 1= less than \$20,000/year; 2=\$20,000-\$50,000/year; 3= \$50,000 or >/year

^g= 0= no functional impairment; 1= some impairment



Note: Statistically significant at: ****p ≤ 0.0001 ***p ≤ 0.001 **p ≤ 0.01 *p ≤ 0.05

Figure 10: Mediation of the relationship between level of social integration, and loneliness, through the mediator social support

As shown in table 15, and figure 10, as level of social isolation increased (relative to the most social integrated cluster), social support decreased. Conversely, as social support increased, loneliness decreased.

Table 16 displays the indirect, and direct effects, for the relationship between differing levels of social network integration, and loneliness, with social support as the mediating variable.

Table 16: Parameter estimates and 95% confidence intervals for indirect, and direct effects, in the adjusted mediation model, examining the association between level of social integration, and loneliness, through the mediator social support

	Umbrella Cluster= Socially Isolated ^a		Umbrella Cluster= Moderately Socially Integrated ^a	
	Parameter Estimate ¹	95% Confidence Interval	Parameter Estimate ¹	95% Confidence Interval
Indirect Effect	0.184	(0.145, 0.229)	0.0824	(0.0568, 0.112)
Direct Effect	0.129	(-0.0765, 0.334)	-0.114	(-0.309, 0.0804)

^a= reference=socially integrated cluster

¹= Parameter estimates are unstandardized beta coefficients

As shown in table 16, relative to the reference group (socially integrated cluster), membership in the socially isolated cluster indirectly influenced loneliness, through the mediator, social support. The bias-corrected bootstrap confidence interval for the indirect effect for the socially isolated cluster was significant ($\beta = 0.184$, CI: 0.145 to 0.229), as was that for the moderately socially integrated cluster ($\beta = 0.0824$, CI: 0.0568 to 0.112), indicating that for both levels of social integration, the relationship was indirectly mediated by social support.

For the socially isolated cluster, there was no direct effect present for diagnosed mood disorder support ($\beta = 0.129$, CI: -0.0765 to 0.334). The direct effect between the moderately socially integrated cluster and diagnosed mood disorder was also not significant ($\beta = -0.114$, CI: -0.309 to 0.0804). In other words, the relationship between both of the umbrella clusters with loneliness was mediated entirely through social support.

4.7.2.5 Satisfaction with Life (SWL)

Table 17 displays the path coefficients, standard errors, and significance levels, for the adjusted mediation model that tested whether social support mediated the relationship between level of social network integration, and satisfaction with life. Figure 11 displays these results graphically.

Table 17: Path coefficients in the adjusted mediation model, examining the association between level of social integration, and satisfaction with life, through the mediator social support

Predictors	Outcomes	
	Social Support	SWL
Umbrella Clusters		
Socially Isolated ^a	-5.027 (0.408) ****	-0.490 (0.120) ****
Moderately Integrated ^a	-2.253 (0.364) ****	-0.194 (0.117)
Social Support		0.0495 (0.0032) ****
Covariates		
Age ^b	0.156 (0.324)	0.530 (0.102) ****
Sex ^c	2.473 (0.336) ****	-0.160 (0.104)
Marital Status ^d	8.625 (0.375) ****	-0.0097 (0.114)
Education ^e	0.396 (0.363)	0.148 (0.107)
Income ^f	1.075 (0.282) ****	0.232 (0.0818) **
Chronic Diseases	-0.193 (0.061) **	-0.115 (0.0166) ****
Function Status ^g	-1.816 (0.432) ****	-0.503 (0.120) ****

Statistically significant at: ****p ≤ 0.0001 ***p ≤ 0.001 **p ≤ 0.01 *p ≤ 0.05

^a= reference= socially integrated cluster

^b= 0= 65-74 year olds; 1= 75-85 year olds

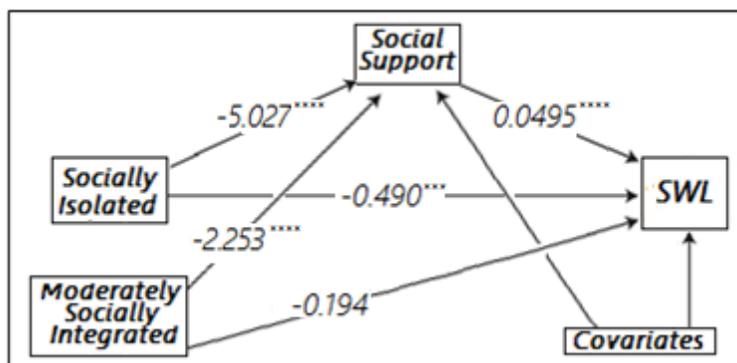
^c= 0= Male; 1= Female

^d= 0= single/widowed/divorced; 1= married

^e= 0= high school education; 1= post-secondary

^f= 1= less than \$20,000/year; 2= \$20,000-\$50,000/year; 3= \$50,000 or >/year

^g= 0= no functional impairment; 1= some impairment



Note: Statistically significant at: ****p ≤ 0.0001 ***p ≤ 0.001 **p ≤ 0.01 *p ≤ 0.05

Figure 11: Mediation of the relationship between level of social integration, and satisfaction with life, through the mediator social support.

As shown in table 17, and figure 11, as level of social isolation increased (relative to the most social integrated cluster), social support decreased. Conversely, as social support increased, satisfaction with life increased.

Table 18 displays the indirect, and direct effects, for the relationship between differing levels of social network integration, and satisfaction with life, with social support as the mediating variable.

Table 18: Parameter estimates and 95% confidence intervals for indirect, and direct effects, in the adjusted mediation model examining the association between level of social integration, and satisfaction with life, through the mediator social support

	Umbrella Cluster= Socially Isolated ^a		Umbrella Cluster= Moderately Socially Integrated ^a	
	Parameter Estimate ¹	95% Confidence Interval	Parameter Estimate ¹	95% Confidence Interval
Indirect Effect	-0.249	(-0.303, -0.198)	-0.111	(-0.149, -0.0758)
Direct Effect	-0.490	(-0.724, -0.255)	-0.194	(-0.424, 0.0366)

^a= reference= socially integrated cluster

¹= Parameter estimates are unstandardized beta coefficients

As shown in table 18, relative to the reference group (socially integrated cluster), membership in the socially isolated cluster indirectly influenced satisfaction with life, through the mediator, social support. The bias-corrected bootstrap confidence interval for the indirect effect for the socially isolated cluster was significant ($\beta = -0.249$, CI: -0.303 to -0.198). For the moderately socially integrated cluster, the indirect effect was also entirely below zero ($\beta = -0.111$, CI: -0.149 to -0.0758), indicating that for both levels of social integration, the relationship was indirectly mediated by social support.

For the socially isolated cluster, there were no direct effects present, neither between the socially isolated cluster and satisfaction with life, ($\beta = -0.490$, CI: -0.724 to -0.255), nor the moderately socially integrated cluster and life satisfaction ($\beta = -0.194$, CI: -0.424 to 0.0366). In other words, the relationship between both of the umbrella clusters with loneliness was mediated entirely through social support.

Chapter 5: Discussion

5.1 General Discussion

Using baseline data from the tracking cohort of participants in the Canadian Longitudinal Study on Aging (CLSA), this thesis had three objectives:

- 1) to examine if individuals could be grouped into common clusters that reflected their level of integration within their social networks, reflecting a range of socially integrated to more socially isolated clusters;
- 2) to examine if and how the clusters differed in terms of sociodemographic, physical health, and mental health outcomes; and
- 3) to examine whether the type and frequency of social support differed between different clusters, and if social support mediated the relationship between level of social network integration, and mental health outcomes.

I will discuss the results for each of these objectives in turn.

Can individuals be grouped into different social network clusters?

As presented in the previous section, I was able to cluster individuals based on nine social network comparison variables that were based on both the Wenger typology, as well as on previous research. Using a national-level sample of Canadian older adults 65 to 85 years old, the cluster analysis allowed me to categorize different types of individuals based on their common characteristics, thereby ‘building’ common social networks. Each of these social network clusters represented a collection of individual social ties, linking the central individual with the people that surrounded them. I found six network clusters; the following is a brief description of

each of the network clusters found in this study, in terms of the structural social network comparison variables.

Locally Integrated. Individuals in the locally integrated network cluster had wide and inclusive networks, with high frequency of contact with all of their network members. They were also very involved in social activities. This cluster was the most socially integrated.

Structurally-Balanced. Individuals in this network had wide networks, similar to the locally integrated cluster. Their ties consisted of children, friends and neighbours, and they maintained frequent contact with all these individuals. However, on average, their number of siblings was very low, and the corresponding frequency of contact with this set of ties was also low. Like the previous cluster, they were also highly involved in social activities.

Family-Friend Focused. The individuals in this network cluster had overall fewer ties than the previous two clusters. This cluster consisted mostly of social network ties with children, siblings, and friends. Individuals in this cluster had good frequency of contact with family and friends. They had very low neighbour contact, and moderately-low social participation.

Wider-Community Oriented. Individuals in this social network cluster had comparatively very few children and siblings, but they did have a wide network of friends, and neighbours, that they had frequent contact with. Compared to the previous cluster, a greater proportion of their network ties were with friends. They also had moderately-high social participation.

Private. These individuals had a smaller network, mostly made up of children, siblings, and neighbours. They had the lowest social participation rate, and the least contact with their social network members, focusing on contact with their children.

Local Self-Contained. Individuals in this network had the smallest network size, and a low social participation rate. However, contact with the people that they did have in their network was fairly frequent, particularly with friends and neighbours. In other words, they didn't have many social ties, but nevertheless, they were very close with the ones they did have. In comparison to the previous cluster, they had more contact with their network members.

According to Wenger's typology (Golden, Conroy, & Lawlor, 2009; Wenger, 1989; Wenger, 1991), individuals can fit into five clusters –two socially integrated clusters, and three socially isolated clusters. The clusters found in this thesis were very similar to Wenger's, for the most part. An important difference was noted in my family-friend focused cluster. This cluster was more socially integrated than that found in Wenger's typology. Individuals in this cluster had a high proportion of friends in their network, and were also more active in social activities, than those in the Wenger's family-focused cluster. However, my cluster was similar to the Wenger cluster in terms of having very low contact with neighbours, as well as having a higher proportion of individuals who resided in intergenerational households. The differences between my family-friends focused cluster, and Wenger's family-focused cluster might be due to a different cultural context. That is, Wenger's study took place in Wales, and therefore, some differences in cluster characteristics might be attributed to study location.

It is important to note that the structurally-balanced cluster was not part of the Wenger typology, nor has it been found in previous social network typology studies. This cluster was characterized by having a low mean number of siblings, but was otherwise very well socially integrated. This cluster had the greatest proportion of adults in the oldest age group, and further analyses for this cluster showed that when the 'number of siblings' variable was stratified by age group, the proportion of individuals in the oldest age groups (i.e. 75-85 years old) decreased as

the mean number of siblings increased. This could suggest that the individuals in the older age group were only children, or more likely, that their siblings had passed away (see further discussion in section 5.2: Strengths and Limitations).

Social network typology studies using cluster analysis, or the related latent class analysis technique, have been applied in many different countries. Studies in Israel (Litwin, 2001, 2003), as well as in China (Li & Zhang, 2015), and South Korea (Park, Smith, & Dunkle, 2014) each found common network clusters – a diverse cluster, a family-focused cluster, a friend-focused cluster, as well as a restricted cluster. Conversely, a recent Australian study (Windsor, Rioseco, Fiori, Curtis, & Booth, 2016), found a family-focused cluster, a friend-focused cluster, as well as a restricted cluster, and two diverse clusters (a strongly diverse cluster, and a moderately diverse cluster). The results of my study compared relatively well to these findings, for the most part. In my results, the private network cluster was slightly more related to their family-clusters, by being a more restricted cluster. Furthermore, my family-friend cluster was more integrated than either their individual family-focused, or friend-focused clusters. However, my family-friend cluster was comparatively similar to the results of a Polish study (Kozerska, 2015) that found three clusters – a family-friend focused cluster, a diverse cluster, as well as a restricted cluster.

Many studies, however, found additional clusters that were generally country-specific. For example, in the United States, it is typical in the literature to find more than one restricted cluster. Fiori et al. (2006) found a diverse, a family-focused, as well as a friend-focused cluster, and two restricted networks – one non-family cluster, as well as one non-friends cluster. These latter two clusters compare to my local self-contained cluster, and private cluster, respectively. My private cluster was mostly focused on children, similar to research by Litwin & Shiovitz-Ezra (2011a), who also used United States data. The researchers found a diverse cluster, and

friend-focused cluster, as well as a congregant-focused network, and a restricted cluster.

Additionally, their family-focused cluster was found to be very child-focused, and authors labelled it as a second 'restricted' cluster. One other study conducted in the United States (Fiori et al., 2008) also found four of the common clusters – diverse, friend-focused, family-focused, and restricted. However, they found two friend-focused clusters: a supported one, as well as an unsupported one, and two restricted clusters: structurally restricted, and one that was functionally restricted.

It is also worth noting that there was a social network typology study (Stone & Rosenthal, 1996) that was conducted using Statistics Canada data, from the 1990 General Social Survey. The researchers found six clusters in their study: 'friendship-poor, socially isolated' (comparable to my local self-contained cluster), 'small, child-focused' (similar to my private cluster), 'extended family and friends-focused' (similar to my wider-community cluster), as well as 'small balanced', 'large balanced', and 'very large balanced'. These latter three clusters were the most socially integrated, and gradually increased in size, as reflected in their cluster names. However, they were generally larger in size than the socially integrated clusters I had found in my study, and aside from their overall size, did not have any further distinguishing features. It is important to note, that this study used different criteria for their cluster analysis than what was used both in this thesis, as well as in other social network typology research, limiting the comparisons that can be made between it, and my study. For their cluster analysis, the authors included the following variables: a social network-size index, as well as an index reflecting the relative (proportional) shares of participant's children, siblings, friends, parents, and spouse; the presence of a spouse or partner; living arrangement; as well as an index of the frequency of seeing and telephoning each of their children, siblings, friends, and parents.

Do clusters differ in terms of sociodemographics, as well as physical and mental health outcomes?

In addition to the social network comparison variables, each network cluster had certain sociodemographic properties that further defined it, with clusters also differing in terms of physical health and mental health outcomes. The following is a discussion of the results pertaining to the second objective.

Sociodemographic and Exploratory Variables***Age***

According to the SST, and SAVI theories, social networks in older adulthood tend to shrink, whether through normative events, or through active pruning of networks, in order to focus on those individuals who are the most important to the social convoy's inner circle. Overall, the results of this thesis suggest that with advancing age, social networks tend to shrink from the periphery toward the core, with a growing emphasis on family members, and decreasing focus on social participation and wider-community connections, therefore, supporting these theories. The individuals in the locally integrated cluster, as well as the wider-community oriented cluster, were on average younger than those in the family-friend focused cluster, who were in the middle of the age continuum. The two most restricted networks – the private, and the local self-contained – had the smallest networks, and were the oldest. Ajrouch et al. (2005) suggested that inner circle membership has a certain universal consistency – made up of close family (i.e. spouse, and children), and that although external factors may influence the availability and access to social resources, as well as to extended relationships, they do not influence the “depth of social relations” in this circle. For example, with increasing age, mobility might restrict access to social participation activities, but the core network of family (i.e. children) would theoretically remain a steady source of support.

However, I found one cluster – the structurally-balanced cluster – that did not follow this general age trend. They had the greatest proportion of individuals in the 75-85 years old group, yet they were a very socially integrated cluster. This would counteract the arguments made that network size decreases with age. Individuals in this cluster, however, tended to be married, which might influence their network size. Conversely, in his study of older adults, researcher Schnittker (2007) found that with age, the number of peripheral friendship ties did not change, but the number of close confidants did, meaning that the older adults' frequency of support and relationship quality increased. However, he attributed this change not to the fact that network composition was altered, but rather that participants had become more 'psychologically proactive' in their relationships, supporting the SST.

Sex & Marital Status

Four of the clusters – locally integrated, structurally-balanced, family-friend focused, and wider-community oriented were split very close to the sample averages in terms of male to female ratio. However, the private network cluster was male-dominated, whereas the local self-contained was a female-dominated cluster. With regards to marital status, the majority of individuals in the locally integrated cluster, structurally-balanced, and private cluster were married, and the family-focused was around the sample average. The wider-community oriented cluster and the local self-contained cluster were two networks that were largely made up of single individuals.

Despite the wider-community network having the highest proportion of individuals who were single/divorced/separated, they had a wide range of connections and involvement with the broader community, which might counteract the absence of the marital relationship. One

prospective study of adults found that those individuals who were never married were much more likely to have frequent contact and both provide and receive help from and for parents, siblings, neighbors, and friends, than married individuals were (Sarkisian & Gerstel, 2015). Similar to these findings, in my study, the wider-community cluster had one of the highest rates of caregiving among all the clusters, with rates second only to the locally integrated cluster.

The local self-contained cluster, on the other hand, had both a high proportion of single/divorced/separated individuals, but they were also characterized by having a high proportion of widowed individuals. Similarly, researchers Doubova et al. (2010) did find a specific widowed cluster within their analyses. These were generally women in poor health, who did not belong to many community groups, but had some friends and family as frequent contacts, as was also found in this study.

The private cluster, even though they had a large proportion of married individuals, they were still a restricted social network. Researchers Wenger, Burholt, & Scott (2001) found that individuals in this network were household-focused, and married. In a study by Fiori & Jager (2011), their restricted network was also mostly comprised of male, married individuals.

Income and Education

Researchers Ajrouch et al. (2005) found that individuals in higher income and educational brackets had more dispersed networks, and wider circles of friends. This was also, for the most part, replicated in this study. When compared to the more restricted clusters, the structurally-balanced and locally integrated clusters had the highest income and education levels. Both of these clusters had very strong ties with individuals outside of their families. The wider-community oriented cluster also had one of the highest education levels, but a household income

that was comparable to that of the family-friend focused cluster, despite the latter cluster having more household members than the former (see section 5.2: Strengths and Limitations, for a discussion on income and household status). The lowest education rates were found in both the socially isolated clusters – that is, the private, and the local self-contained, as well as the family-friend focused cluster. Similarly, the lowest income was found in the private cluster, as well as in the local self-contained.

Physical Health Results

The two clusters that were the most restricted – the private cluster, and the local self-contained, had the greatest number of chronic diseases, as well as the highest proportion of individuals with at least a mild functional impairment. They also ranked their general health as the poorest. Conversely – with the exception of the structurally-balanced cluster – the most socially integrated clusters (i.e. the locally integrated, family-friend focused, and the wider-community oriented) had the least number of chronic diseases, and the least number of individuals who had at least a mild functional impairment. These findings agreed with other research in this area (e.g. Doubova et al., 2010; Fiori et al., 2008). However, the structurally-balanced cluster – a socially integrated cluster – had more chronic diseases, as well as higher rates of functional impairment than these three clusters. These results may be attributed to a high proportion of older adults in this cluster. The structurally-balanced cluster did, however, rank better in terms of physical health outcomes than the restricted networks – that is, the private and local self-contained clusters.

Mental Health Results

With decreasing social network size, and therefore, decreasing diversity, self-rated mental health decreased, depression rates increased, as did diagnosed mood disorder rates,

whereas satisfaction with life decreased. With the exception of the family-friend focused cluster, which had slightly higher rates of loneliness than the wider-community oriented cluster did, loneliness also increased with decreasing network size.

Findings indicated that the more socially restricted (and less diverse) the network cluster, the worse the mental health outcomes were. Those in the most socially integrated group fared the best, followed by those in the moderately socially integrated group, whereas those in the socially isolated group fared the worst in terms of their mental health outcomes. These results are in agreement with other social network studies looking at mental health outcomes (e.g. Fiori et al., 2006; Litwin & Shiovitz-Ezra, 2011a).

The structurally-balanced cluster provides an interesting perspective, however. They had a greater number of chronic diseases and functional impairments, when compared to the locally integrated cluster, as well as when compared to the family-friend focused and wider-community oriented clusters. However, they ranked well in terms of their mental health outcomes – that is, self-rated mental health, depression, loneliness, diagnosed mood disorder, as well as in terms of their satisfaction with life. This cluster speaks towards the importance of having a diverse set of ties in older adulthood.

Do clusters with different social network ties have different types and frequencies of social support?

As presented in the theoretical framework, Weiss' theory of the Functional Specificity of Relationships postulates that from different social network ties, individuals receive different types of support. By studying the four different sub-scales of social support, I was able to see how social support type and frequency of social support type differed for different social network clusters that had different types of ties. For example, clusters that had strong family ties in the

absence of strong community ties, versus clusters that had strong community ties, but not family ties.

The locally integrated and structurally-balanced clusters ranked high on each of the four sub-scales of support, meaning that they had good emotional, positive, tangible, and affectionate social support available when needed. Although with slightly lower social support rates, the family-friend focused cluster ranked similar to the socially integrated clusters.

Prior research indicates that affection and tangible social support are two types of support that are generally provided by close family, particularly by spouses (Antonucci & Wong, 2010). For these two measures, the wider-community oriented cluster, as well as the local self-contained cluster had the lowest rates of these two types of support. They were the two clusters that had the highest rates of unmarried people (either widows, or divorced/separated/or never married), as well as they both had the least number of children and siblings within their networks. However, although the wider-community oriented cluster had very few ties with family (with children or siblings), individuals in this cluster had very strong community ties (i.e. with friends, neighbours, and through social activities). Consequently, for emotional and positive social support, the wider-community oriented cluster was in line with the other moderately socially integrated cluster (the family-friend focused cluster). Research has suggested that these two types of support are provided to an individual through ties outside of the closest family circles – for example, through community ties, and through social participation (Antonucci & Wong, 2010).

Comparatively, the private cluster had the opposite findings that the wider-community oriented cluster did. They were relatively high on affectionate and tangible support, but low on emotional and positive social support. The majority of individuals in this cluster were married,

and had close ties with children and siblings. However, ties with others – such as with friends, neighbours, or ties through social activities – were very limited.

The findings discussed above indicate that type of social ties influences availability of certain social support, within a social network. However, across clusters, the overall perceived social support rate decreased as the clusters became more socially isolated. Together, this suggests that both overall degree of diversity (quality of ties), as well as the size of the social network (quantity), impact the overall availability of social support.

What is the relationship between social isolation, social support, and mental health?

The cluster analysis technique that was used in this thesis measured structural characteristics of networks. That is, the number of people, and frequency of contact with them, as well as the frequency of social participation. Conversely, the results of the mediation analyses examined the role of the functional component of the social network, and whether social support was a mediator between social integration and the mental health outcomes.

The results of the mediation analyses were consistent with my hypothesis, that social support was a mediator between social isolation, and mental health outcomes. In other words, it is because of social support that there is a relationship between level of social integration, and mental health. Since social support was a measure of perceived quality of relationships, this also suggests that increasing quality of relationships would mediate and improve mental health outcomes for those in more socially isolated clusters.

For all five mediation analyses, the socially isolated cluster had indirect effects that were stronger than those effects found for the moderately socially integrated. This suggests that there is a dose response present between levels of social integration, meaning that as an individual

becomes more socially isolated, the role that social support has in mediating the relationship between isolation level and mental health increases. This is due, in part, to the fact that the relationship between the socially isolated cluster and social support was stronger than that between the moderately socially integrated cluster and social support, thereby influencing the strength of each indirect effect.

For the moderately socially integration cluster, for all five mental health outcomes, there were no direct effects present, meaning that the relationship between social integration level, and mental health, was entirely mediated by social support. However, for four of the analyses with the socially isolated network cluster (outcomes self-rated mental health, depression, diagnosed mood disorder, as well as satisfaction with life), direct effects were significant. This suggests that there were other factors involved in the relationship between the quantity of relationships (that is, for socially isolated individuals), and their mental health outcomes.

Although there were multiple covariates controlled for, there are a number of other factors that might be influencing these direct relationships. For example, biological factors, such as genetic susceptibility (Capara et al., 2009; Lesch, 2004; Stubbe, Posthuma, Boomsma, & De Geus, 2005), environmental conditions, or psychosocial factors could be influencing this direct relationships (Cohen & Janicki-Deverts, 2009), or even personality (Hong & Giannakopoulos, 1994). Or perhaps it is something about the clusters themselves – for example, with less people within their networks, individuals may not be as successful at buffering out poor or negative relationships, which in turn would impact mental health outcomes. Conversely, those who have stronger and more diverse social network ties may be under a strong social influence, and, for example, more prone to living a healthier lifestyle, which in turn might result in more positive mental health (Kawachi & Berkman, 2001; Rook, 1984; Schuster, Kessler, & Aseltine, 1990). It

could also be that the other outcomes are moderating these direct relationships (for example, depression might be moderating the satisfaction with life outcome).

For the mediation analysis with loneliness as the outcome variable, there was only an indirect relationship for analyses for both levels of social integration. The absence of a significant direct effect (that is, the absence of a statistically significant relationship between level of social integration and loneliness), indicates that it is through social support that a relationship exists between both the moderately socially integrated group and loneliness, as well as for the socially isolated group, and loneliness.

5.2 Strengths and Limitations

The research studying social isolation and social networks is a dynamic and multifaceted area, a fact that is strongly evident in the multiple ways that these two concepts are defined and measured. Furthermore, social networks and social isolation are two related topics, and, therefore, the way that an individual's social network is measured impacts the interpretation of social isolation. Within the literature, there is an overarching lack of a universal definition of social isolation, as well as a lack of a consistent measurement in determining level of isolation, whether through counting social contacts, participation, or through the measurement of social networks (Sabir et al., 2009; Victor et al., 2000). Hence, the generalizability across the literature is limited.

In general, similar social network typologies using cluster analysis, or latent class analysis – which are the two most common types of analyses used in this research field – focus on similar types of cluster comparison variables as were used in this study, resulting in clusters that are generally very consistent (i.e. locally integrated, wider-community oriented, etc.), with

some differences (i.e. number of clusters, cluster labels, small differences in cluster type). One strength of this study was that it did include a multitude of different social ties, and ultimately found clusters that fit in well with the theoretical framework. That being said, however, for these two techniques, the results are only as good as those variables that are added into the analysis. Therefore, while social ties such as family and friends are consistently added into the cluster analysis procedure, it is common for studies to focus on different types of family ties, for instance. Furthermore, although studies will include a variety of relationship ties, many will add them into their cluster analyses as composite network size variable, rather than as individual variables. This limits the detail that the clustering procedure can bring out. Consequently, this perhaps explains why I ended up with the unique structurally-balanced cluster, since I included a sibling variable that set this cluster apart from the other clusters, and in particular, separated it from the locally integrated cluster. While these two clusters were similar in terms of level of social integration (except for the sibling variable), they were different in age structure, potentially because of the inclusion of the sibling variable.

A limitation of much of the research conducted within this field, is that social participation is limited to one or two very general measures (or often, very specific measures—for example, defining ‘social participation’ mainly through religious activities). A strength of this study was that an index of eight participation variables was included, in order to provide a rich representation of varied interests and activities. Additionally, with the exception of a few studies (e.g. Li & Zhang, 2015; Litwin & Shiovitz-Ezra, 2011a) social network typology studies often fail to look at how clusters differ from one another beyond their cluster comparison variables. For example, while marital status is commonly studied (usually as a structural variable, however), other cluster sociodemographic factors – unless they are outcome measures – are

rarely examined. Therefore, a strength of this study was that it did look at a wide variety of sociodemographic factors, exploring whether clusters had distinguishing features, beyond their structural components.

Like all studies that use secondary data analysis, the researcher cannot alter the questionnaire that was presented to participants. Unfortunately, there were questions that could have been asked or structured differently, potentially resulting in an enriched data analysis for this study. For example, many of the questions involving social relationship were asked in a very broad manner. One particular example is that of “how many relatives do you have?” The way this question was worded left it open for interpretation by participants (for example, one might include distant cousins, whereas another might only include closer relationships). It perhaps would have been more valuable to limit the responses in a way that was more structured, and focused on particular types of relationships that one would expect would be more relevant for a convoy of social relations.

Furthermore, within the Wenger typology, distance between the central individuals, and their social network members provides a further measurement of quality of social support, and is an important aspect of determining support convoys (Wenger, 1989). For example, it has been noted that emotional support may actually increase with distance – contact that is exchanged and maintained with individuals who live a distance away from one another may take more effort to maintain, and therefore the relationship may be interpreted as more meaningful (Voorpostel & Van Der Lippe, 2007). Furthermore, for individuals who live close to one another, the support relationship may be one based more on instrumental need, rather than emotional need.

Additionally, in today’s connected world, being engaged or integrated, does not necessarily require being in the same physical location as someone else. Support can be provided through

telephone or electronic communication. Frequency of contact, which was used as a cluster comparison variable, specifically asked when the last time participants had met in person, outside of the household. There were no questions about contact via telephone, videoconferencing or social media, all of which can be as important as face to face contact, and actually, older adults who have functional limitations may rely on these other types of communication avenues, in order to stay socially connected and active.

Research has shown that the formation of social networks can be highly influenced by ethnic background (e.g. Fiori et al., 2008; Litwin & Stoeckel, 2013). Therefore, a limitation of this study was that I did not stratify analyses by ethnic background, a factor which may have influenced the results of this study. Furthermore, other factors have shown to influence network formation, including immigrant status (Litwin & Shiovitz-Ezra, 2006; Park et al., 2013), as well as religious affiliation (Litwin & Shiovitz-Ezra, 2011b). A limitation of my own study is that I did not look at either of these two measures. Furthermore, network clusters have shown to differ between countries, which limits the generalizability of these results to other nations.

Additionally, there were a few limitations with the data set itself. First and foremost, the tracking cohort's baseline data is a cross-sectional snapshot of survey participants. This limits the researcher's ability to study the sequence of events, which does not allow for causality to be inferred. Therefore, it could actually be that it is not social isolation that is causing reduced mental health outcomes in the sample, but rather that those who have poor mental health outcomes are deliberately isolating themselves.

Another limitation of the data set was with the way that income was measured, which was as yearly *household* income. When comparing clusters to one another, it was clear that some

clusters had very high proportions of individuals who lived alone, and therefore, it would be expected that their household income would be less, particularly when compared to a cluster that had more than one person living in the household. Many studies using Statistics Canada data re-categorize household income quintiles, based on the number of household members (e.g. Shields & Shooshtari, 2001; Shooshtari, Menec, & Tate, 2007). For this particular study, due to the nature of how the responses to the household income question were structured (i.e. the response categories were very broad), it was not possible to restructure this variable.

With regards to sampling methods, the exclusion criteria used by CLSA limits the national representation of the target population. The target population does not include all Canadians (i.e. those living in long term care settings, on First Nations reserves, in the three territories, or cognitively impaired individuals at time of initial contact were all excluded), and therefore, it is not fully representative of all Canadian older adults. Additionally, all responses were self-reported, with recall bias being a possibility.

This study does, of course, have its strengths: surveys are a common descriptive research method used in social science and health research, since they allow the researcher to gather a large amount of rich data in a relatively short time frame. Questions are asked in a standardized manner, so that responses can be easily analyzed and compared. In this survey, no proxies were allowed, meaning that all questions were answered by the respondents themselves.

Lastly, I had a very large sample size, which increased the power of the data analyses, as well as the representativeness of the findings. An increased power through sample size allows the researcher to detect small, and subtle effects. However, because of a very large sample size, standard errors will generally become smaller, and therefore even minuscule or negligible

differences can lead to statistically significant results, regardless of whether a true effect is present. Therefore, having a p-value set at 0.05 (and relying on p-values alone) might lead to declaring results as statistically significant, when in fact they may be of little practical significance; an alternative approach may have been to set the p-value threshold at a lower level (i.e. at 0.001, for example).

5.3 Future Research & Policy Implications

The results presented in this thesis provided a fascinating look into the social milieu of older adults. Social isolation in older adulthood, as discussed, is an issue that is prevalent in the lives of older adults in Canada, and is detrimentally associated with poor mental health outcomes. Having good health and well-being, as well as staying socially integrated, are two important aspects often mentioned when considering what healthy aging means (Stephens, Breheny, & Mansvelt, 2015), and furthermore, according to Rowe & Kahn (1997), successful aging is defined as having a “low probability of disease and disease-related disability, high cognitive and physical functional capacity, and (an) active engagement with life” (p. 433).

Future Research

With regards to future research, it would be interesting to study place of dwelling – that is, urban versus rural, suburbs versus high-density living. This would provide insight into whether these clusters are associated with specific geographic profiles. As well, frequency of contact beyond what was included in this study – particularly integrating social media or other electronic communications– would further provided a more nuanced picture of how those who are the most socially isolated employ (or do not) this technology within their daily lives. This is

of particular importance, as virtual social networks are becoming an increasingly important aspect of people's daily lives.

As mentioned before, social isolation is a complex, multilayered issue, and it is important to explore the different aspects of an individual's life together, to identify different risks, and consequences. Mental health is one part of this, but it is also of value to examine other potential consequences that might arise from social isolation, including, for example, whether socially isolated individuals make different decisions regarding lifestyle behaviours that may be positive, or more detrimental, to their health and well-being (such as health-benefitting behaviours, like healthy eating, or participating in physical activities, or, on the flip side, detrimental-health behaviours, such as smoking).

The data used in this study was from the baseline questionnaire for the tracking cohort of participants in the CLSA; the first release of data for participants who will be followed for the next twenty years. Therefore, the longitudinal nature of the CLSA will allow researchers to follow these individuals, to see how the clusters found in this study change over time, and whether the younger networks, for example, shrink, or how patterns of social support change over time. For example, it would be useful to study networks that were small to begin with at younger ages, to see how these people fair, and to examine how social support levels change over time, an aspect of particular importance when considering the impact that major transitions, such as retirement, or the loss of a spouse, have in life.

Policy Implications

The world is aging, and demographics are shifting; fertility rates are shrinking, people are living longer lives, and a large cohort of Baby Boomers is reaching retirement age. This

inevitably will have a ripple effect throughout the different spheres of the lives of older adults, particularly with regards to social support. One example is demonstrated through the concept of a ‘beanpole’ family – that is, there are more generations alive simultaneously, however, each has fewer members than the one before it. This is a phenomenon common in The Baby Bomber generation, which is wider, but narrower than previous generations (meaning they have many more siblings than they do children). This will have implications for future social support roles.

This research, providing a look into the lives of Canadian older adults, characterized six different clusters that differed in terms of structure, function, as well as by a range of sociodemographic characteristics. These findings have the potential to be applied in a practical or clinical setting, to assess social isolation risk, and thereby target individuals at risk of poor health, and mental health outcomes, as well as those who are at risk of having inadequate social support to successfully live in the community.

The Practitioner Assessment of Network Type (PANT) (Wenger & Tucker, 2002) is a checklist of sorts that was developed to help practitioners assess how vulnerable an individual is in terms of network social support. The tool was developed in part by Clare Wenger, and is based upon the Wenger typology. The aim of PANT is to help social work practitioners to evaluate social networks in older adults, based on the networks found in the Wenger typology (Wenger, 1989). PANT has been validated for use in middle and low income countries (Thiyagarajan, Jotheeswaran, & Webber, 2014), and has been used in various research studies. For example, it has been used to assess the link between social network type, and nutrition risk among frail older adults with low socioeconomic status in South Korea (Kim, 2016), as well as to measure mortality associated with restricted networks (Santini et al., 2015). The results of this

study, given its use of Canadian data, can help contribute to the development of a similar tool, in a Canadian context.

The results of this study suggest that as level of social integration increases, the diversity of social ties does as well. This increases the quality of social support provided, in turn resulting in better mental health outcomes. Therefore, through unique policy initiatives across government and community levels, as well as by engaging in unique research ideas, the focus should shift to fostering the development of healthier social environments for older adults. The results of this thesis show that, based on structural characteristics, people can be grouped into unique clusters that provide a robust opportunity to assess vulnerabilities, in an upstream way.

Conclusion

The research conducted in this study provided an important look into the social milieu of community-dwelling older adults in Canada, as well as a look into the impact that the degree of integration within a social network had on mental health and well-being. First, by categorizing individuals into different clusters based on structural variables, results demonstrated that some individuals were more socially integrated into their social networks than others. Consequently, the most socially integrated networks were defined by having a diverse set of social network ties, and had the most diverse types of social support. As social networks increasingly became more socially isolated – meaning that their networks increasingly shrunk in size – and they became increasingly less diverse, their overall social support decreased. However, results also indicated that who an individual has in their network (meaning, the type of social network tie) impacts the specific type of social support being provided to the individual.

Furthermore, as level of social integration decreased, the prevalence of poor mental health outcomes increased. Therefore, those individuals who were most socially isolated had the poorest self-rated mental health, and were faced with increased depression risk, diagnosed mood disorder, as well as higher rates of loneliness. They were also the least satisfied with their lives. Lastly, it was found that perceived social support (a measure of quality of relationships) is a potential mediator in the relationship between levels of social integration, and mental health outcomes, a relationship that was strongest as social integration level decreased.

The relationships and social ties we share with others provide us with the social sustenance and support needed to do well in everyday life. The collections of these social ties are complex structures, involving multiple dimensions that are overlapping, at the individual, community and societal levels. The structure of the network and its functional components interact to influence an individual's social, psychological, and physical well-being. By continuing to study social networks, and the effects that the absence of social relationships has on multiple aspects of our daily lives, we can continue to discover more about these interactions, and, moreover, take steps to further understand the influence of the social network in older adulthood.

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Appendix A

R² values for the mediation analyses

Pathway: Umbrella Clusters → Social Support					
Model:					
Baseline					0.0318
Baseline + Sociodemographic Covariates					0.1304
Baseline + Sociodemographic Covariates + Health Covariates					0.1350
Pathway: Social Support → Outcome					
Model Outcome	GMH*	Depression*	Mood*	Loneliness*	SWL*
Model:					
Baseline	0.0454	0.0970	0.0262	0.1033	0.1360
Baseline + Sociodemographic Covariates	0.0528	0.1172	0.0584	0.1438	0.1531
Baseline + Sociodemographic Covariates + Health Covariates	0.0950	0.1628	0.1023	0.1491	0.1822
Pathway: Umbrella Clusters → Outcome					
Model Outcome	GMH*	Depression*	Mood*	Loneliness*	SWL*
Model:					
Baseline	0.0181	0.0112	0.0084	0.0085	0.0247
Baseline + Sociodemographic Covariates	0.0271	0.0456	0.0456	0.0916	0.0617
Baseline + Sociodemographic Covariates + Health Covariates	0.0747	0.1000	0.0931	0.0997	0.0991

* = R² Nagelkerke