A Mixed-Methods Study on the Social Networks and Loneliness of Low-Income Diverse Older Volunteers

Dissertation

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Qiuchang Cao

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Dissertation Committee

Holly Dabelko-Schoeny, Advisor

Mo Yee, Lee

Keith Warren

Abstract

Although the health benefits of volunteering among older adults were well established in gerontological research, older migrants' abilities and interests in social participation have hardly been recognized. To address this gap, a convergent mixed-method design was used to understand the volunteering experiences, social networks, and feelings of loneliness among low-income Russian, Khmer, Somali, Nepali, and English-speaking older volunteers in the Senior Companions Program (SCP) in Columbus, Ohio (N=41). The first aim of the study was to identify the social network structures among the SCP volunteers. The second aim was to understand how the social network contributed to volunteers' experiences with loneliness. Data were collected through focus groups and surveys during the SCP monthly in-service training in October 2022. A grounded theory approach informed the qualitative analysis. Five major themes emerged from the focus groups: (1) Expanding and strengthening social networks through volunteering; (2) Experiencing and coping with loneliness; (3) Experiencing and managing the social impact of COVID; (4) Exploring and loving the program; (5) Social connections outside of the program. Participants also completed a demographic survey, a friendship nomination form, and the De Jong Gierveld Loneliness Scale. Exponential Random Graph Modeling (ERGM) was utilized to identify statistically significant structural features in the volunteers' network. Graphs and ERGM results demonstrated that participants tended to form homophily-based relationships with other volunteers of the same gender (β=3.27, $p<0.001$), from the same country (β=2.89, $p<0.001$), with the same

education level (β=0.71, $p<0.001$), and from the same site station (β=2.77, $p<0.001$). However, transitive ties (β= -1.01, $p<0.001$) and total meetings (β= -8.8, $p<0.001$) had a negative contribution to tie formation. Furthermore, the linear network autocorrelation model (LNAM) results suggested that the average level of dependency was negative within the network (ρ= -0.06, $p<0.05$). That is to say, less lonely volunteers were inclined to socialize with those experiencing higher levels of loneliness. According to the mixed-method results, all the qualitative findings confirmed or expanded the quantitative results for both aims. One exception was that the qualitative results were incongruent with the negative statistical significance of transitive ties to relationship formation in the first aim. The methodological explanations behind the above discordant results are provided in the discussion section of this dissertation. Findings imply that: (1) cross-cultural relationships among volunteers within formal volunteering programs require intentional facilitation, resources, and organizational commitment. Addressing language barriers and promoting collaboration among site stations can facilitate cross-cultural friendships. (2) The less lonely volunteers have connected with lonelier volunteers in this network possibly out of altruism. Thus, practitioners can consider intentionally encouraging altruism to prevent the spread of loneliness among older volunteers. Moreover, loneliness interventions need to account for the correlation among network members' loneliness.

Dedication

I dedicate my dissertation work to my family and friends. A special feeling of gratitude to my loving husband, Fabio A. Correa Durán whose insight, support, and unconditional trust are my ultimate inspiration at work and in life. My parents Ying Tao and Qilong Cao as well as my parents-in-law Olga M. Durán and Jairo E. Correa have been very understanding and patient with us throughout our professional journeys. I also dedicate this work and give special thanks to my wonderful friends Başar Özbilen and Xuemei Cao for being there for me throughout my candidacy and dissertation. You both are so such intelligent scholars, genuine friends, and compassionate human beings. I am really grateful for your friendship.

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Vita

Qiuchang (Katy) Cao, MSW

The Ohio State University
College of Social Work
1947 College Road N, Columbus, OH 43210
Phone: 614-300-0656
E-mail: cao.847@osu.edu
Google Scholar: Qiuchang Cao

August 2022	Ph.D. Social Work, Specialization in Gerontology, The Ohio State University
Summer 2021	Evaluation Associate, Mighty Crow
2020-2022	Graduate Teaching Associate, The Ohio State University College of Social Work
Summer 2018	Practicum intern, Ohio Living Westminster Thurber
2017-2021	Graduate Research Associate; The Ohio State University College of Social Work, Age-Friendly Innovation Center
2017	MSW (focus: mental health), University of Wisconsin Madison
2017	Licensed Social Worker, Ohio S.1701302

2016-2017 .....Group Facilitator of Badger Step Up (an alcohol risk reduction and bystander intervention program), University of Wisconsin Madison

2016-2017 .....Clinical Social Work Intern, Madison Mental Health Services

2015-2016 .....Clinical Intern, Journey Mental Health

2015.....Human Resources Intern, Bosch, China

2015.....BA Public Administration, Suzhou University, China

Publications

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Fields of Study

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Chapter 1. Introduction

Loneliness is an important indicator of older adults' well-being (National Academies of Sciences Engineering and Medicine [NASEM], 2020; Ong et al., 2016). Loneliness emerges from the perceived deficiency in the quantity or quality of social relationships (de Jong Gierveld & Van Tilburg, 2016; Weiss, 1987). Both transient loneliness and chronic loneliness have been associated with the elevated risks of physical conditions, mental illness, suicide risk, and mortality among older adults (Harris et al., 2015; Valtorta, Kanaan, Gilbody, Ronzi, et al., 2016).

The prevalence of loneliness among community-living older adults ranged from 19.3% to 43% in the existing literature, depending on the sample characteristics and measurement instruments (NASEM, 2020; Ong et al., 2016). Being female, having lower socioeconomic status (SES), never married, and identifying with marginalized groups (e.g., immigrants and refugees, racial minorities) were positively associated with loneliness among older adults (NASEM, 2020).

The emergence and continuation of loneliness can be explained by the cognitive-behavioral mechanisms (e.g., rumination, avoidance), the neurobiological mechanism (e.g., limited activity in the dorsomedial prefrontal cortex), and social environmental mechanisms (e.g., social-economic status, neighborhood environment) (J. T. Cacioppo & Cacioppo, 2018a; Käll et al., 2020; Kemperman et al., 2019; Layden et al., 2018; Spithoven et al., 2019). The above three mechanisms of loneliness can reinforce one

another. For example, compared with those not lonely, lonely individuals experienced decreased activities in the dorsomedial prefrontal cortex when viewing negative social information, which reduced empathy and increased self-protective behaviors that further contributed to social avoidance and withdrawal (S. Cacioppo et al., 2014; Layden et al., 2018; Powers et al., 2013). However, establishing and maintaining meaningful social interactions can interrupt the neurobiological and cognitive-behavior cycle that reinforces loneliness (J. T. Cacioppo & Cacioppo, 2018b; O'Rourke et al., 2018).

Volunteering has been an important way to build meaningful social connections that protect against loneliness among older adults (Serrat et al., 2020). Nevertheless, low-income older migrants have faced language, cultural, and financial barriers to participating in organized volunteering (Torres & Serrat, 2019). As a result, studies on older migrants' volunteering have mainly concentrated on their informal volunteering within the co-ethnic (sharing the same ethnicity) community, such as helping new immigrants navigate in the neighborhood (Wright-St Clair et al., 2018). Although informal volunteering within the co-ethnic community has strengthened older migrants' social networks, improved their psychological well-being, and contributed to the community cohesion (Wiles et al., 2019; Wright-St Clair et al., 2018), more studies need to investigate older migrants' participation in organized volunteering beyond their co-ethnic communities to fully comprehend their strength and capacity to engage in the multicultural society (Torres & Serrat, 2019).

Although few, some organized volunteering programs have extended their outreach to recruit low-income diverse older migrants as volunteers. The Senior Companions Program (SCP), a federal volunteering program, connects low-income older

adults with homebound older adults to prevent loneliness in both groups (Butler, 2006). SCP provides a stipend and mileage reimbursement to volunteers with the goal of ameliorating the financial barriers to formal volunteering (Butler, 2006; Cao et al., 2021; Greenfield et al., 2016). Volunteers in the SCP of Columbus Ohio consist of low-income older adults from the United States (U.S.) and older migrants (e.g., Cambodian, Somali, Bhutanese). SCP volunteers provide companionship visits and transportation support to homebound older adults. Understanding the social network of diverse older volunteers in the Columbus SCP may inform the organization of other SCPs as well as similar volunteering programs for diverse older adults in the U.S.

Despite the abundance of research on the *function* of social networks (e.g., providing social support), few studies have examined the *structures* of older adults' social networks (Ayalon & Levkovich, 2019). A social network consists of actors (e.g., individuals) and ties (i.e., relationships) among them (Kadushin, 2004). The *structures* of social networks refer to how individuals are connected (e.g. direct, indirect), the positions of actors (e.g. central, peripheral), and the network environment (e.g. dense, sparse) (W. Liu et al., 2017). Social network structures have played important roles in the spread and continuation of loneliness. For instance, loneliness has spread from groups of marginalized individuals to other network members through a contagious process (J. T. Cacioppo et al., 2009). Thus, rather than viewing loneliness in social groups solely as an individual experience, network analysis examines loneliness in the context of social relationships usually within a defined boundary (Ayalon & Levkovich, 2019).

Compared with the increasing number of studies on the social network structures among older adults in long-term care facilities, there is little information on the social

networks among community-living older adults (Ayalon & Levkovich, 2019). Moreover, the social interactions among older volunteers have hardly been a focus in the existing volunteering literature. Consequently, there is little information on the structures of social networks among diverse older volunteers. Understanding the social dynamics and structures among volunteers can provide preliminary insight into how volunteering might improve volunteers' social and psychological well-being.

This study focuses on the network structures that are particularly relevant to diverse older volunteers. For example, it has long been debated whether homophily, the tendency to connect with people who share similar identities (e.g., race and ethnicity, country of origin), is conducive to the social integration of immigrants and refugees (Fukui & Menjívar, 2015; Q. Li, 2018). Homophily can generate a sense of separation from the larger society while enhancing a sense of belonging to one's own community among diverse populations (Fukui & Menjívar, 2015; Q. Li, 2018). This network study can shed light on the role of homophily in the relationships among different groups of diverse older volunteers in SCP. Furthermore, because reciprocity and transitivity have been positively associated with friendship formation among older adults (Wiles et al., 2019a), it is worth exploring whether the SCP volunteers are more likely to be friends with those who reciprocate and whether a pair of friends tend to share a common friend.

Considering the lack of *quantitative* evidence on the network structures and the importance of the *qualitative* perspective in understanding network dynamics among diverse older volunteers, the aims of this *convergent mixed-method* study are to (1) explore the social networks of diverse older volunteers within and outside of the SCP by comparing participants' descriptions of their social interactions with the quantitative

network structures. (2) Examine how social networks correlate with the loneliness of diverse older volunteers by integrating volunteers' perspectives with the statistical significance of network autocorrelation.

Despite its limited generalizability, this study can inform future research and services for diverse older volunteers by highlighting the role of network structures in their relationship formation and their experiences with loneliness. Revealing network structures critical to the relationship formation among diverse volunteers allows practitioners to intentionally encourage or discourage certain network structures when organizing a volunteering program. For example, results from this study have suggested that volunteers tended to form relationships with other volunteers of the same gender, from the same country, sharing the same level of education, and from the same site station. Due to existing language and cultural differences, cross-cultural relationships among volunteers are unlikely to flourish without intentional facilitation and organizational support. Therefore, addressing language barriers between various cultural groups and promoting collaboration among subgroups in a multicultural volunteering program can nurture cross-cultural friendships. Additionally, results from this study have suggested that less lonely volunteers were inclined to interact with volunteers experiencing higher levels of loneliness likely out of altruism. Therefore, practitioners can consider intentionally strengthening the value of altruism among volunteers to prevent the spread of loneliness within a network. More longitudinal studies on how specific network structures influence older volunteers' loneliness can provide more targeted guidance for network interventions.

Chapter 2. Literature Review

The Loneliness of Older Adults

Definition

Loneliness is an important indicator of the well-being of older adults (Cornwell et al., 2008; Ong et al., 2016). Loneliness reflects the perceived discrepancy between the desired and actual social connections (S. Cacioppo et al., 2015; De Jong Gierveld & Van Tilburg, 2016). In other words, when people perceive the quality and/or quantity of social relationships to be less than desired, they experience emotional distress, referred to as loneliness (De Jong Gierveld & Van Tilburg, 2016; Weiss, 1987). In contrast, when being alone is desired, people are in a pleasant state of solitude (R. J. Coplan & Bowker, 2013). Therefore, although objective social isolation (lack of social connections and/or interactions) is also associated with negative mental and physical health consequences (Courtin & Knapp, 2017), objective social isolation does not equate to loneliness (De Jong Gierveld & Van Tilburg, 2016; Jeste et al., 2020). Loneliness is a multidimensional concept, which consists of emotional loneliness and social loneliness (Weiss, 1987).

Emotional Loneliness. Emotional loneliness or intimacy loneliness reflects a perceived deficiency in attachment or intimacy (De Jong Gierveld & Van Tilburg, 2016). Emotional loneliness usually occurs within one's inner social core, which individuals resort to for regular emotional support and validation (e.g. spouse) (S. Cacioppo et al., 2015; Jeste et al., 2020). Among middle-aged and older adults, being married has been

significantly negatively associated with emotional loneliness, whereas widowhood has been significantly positively associated with emotional or intimacy loneliness (S. Cacioppo et al., 2015; National Academies of Sciences Engineering and Medicine [NASEM], 2020; Qualter et al., 2015).

Social Loneliness. Social loneliness usually reflects one's perceived lack of integration in social networks (De Jong Gierveld & Van Tilburg, 2016). Social loneliness or relational loneliness can result from a perceived deficiency in social interactions with family, friends, and acquaintances (S. Cacioppo et al., 2015). Individuals usually resort to family and friends for time, energy, and resource-consuming support (S. Cacioppo et al., 2015). Therefore, more high-quality interactions with family and friends have been associated with less social loneliness (S. Cacioppo et al., 2015). Moreover, lacking meaningful social identities and participation in social groups have been also associated with increased social loneliness (S. Cacioppo et al., 2015; De Jong Gierveld & Van Tilburg, 2016). In other words, individuals have the need to connect with social groups (e.g., schools, organizations, and countries) and establish/maintain social identities through affiliation (NASEM, 2020).

Prevalence

Although loneliness can occur in any life stage, aging-related major life transitions (e.g. sensory changes, major health decline, and functional impairment) and social losses (e.g. loss of loved ones, retirement) can elevate the risk of loneliness in older adults (Qualter et al., 2015). The prevalence of loneliness in general among older adults in western countries has ranged from 19.3% to 43% in the literature (National Academies

of Sciences Engineering and Medicine, 2020; Ong et al., 2016). The variation of the prevalence rates in the literature has reflected the differences in sample characteristics and measurement instruments (Mund et al., 2019; Ong et al., 2016). Regardless of the variation, the prevalence of loneliness has been high enough to justify the importance of studying loneliness in older adults (Ciolfi & Jimenez, 2017; Ong et al., 2016).

Potential Mechanisms and Consequences of Loneliness

Cognitive and Behavioral Mechanisms. Some researchers explained the emergence and sustenance of loneliness from the cognitive-behavioral perspective. Negative appraisals of interpersonal relationships (e.g., perceiving oneself as unwelcomed) contributed to the avoidance of social interactions and emotional distress (e.g. anxiety, shame) (Käll et al., 2020; Qualter et al., 2015). Avoidant behavior and emotional distress in turn reinforced negative interpersonal appraisals, which further contributed to negative social interactions by strengthening one's sensitivity to social rejections and limiting one's capacity to empathize with others (Käll et al., 2020; Qualter et al., 2015). Negative social interactions continued to solidify negative self-appraisals (Käll et al., 2020; Qualter et al., 2015). The above cycle might have explained why some lonely individuals further avoided rather than sought out social connections when perceiving a discrepancy between the actual and desired connections (Käll et al., 2020; Layden et al., 2018; Qualter et al., 2015).

Neurological Mechanisms. Social psychiatry and neurology indicated that loneliness was associated with limited activity in the dorsomedial prefrontal cortex, which was responsible for empathy and thinking about other people's situations (Powers

et al., 2013). Compared with those not experiencing loneliness, the dorsomedial prefrontal cortex of lonely individuals was less active when viewing negative social stimuli (e.g. other people's challenges). As a result, lonely individuals demonstrated decreased interest in negative social information and higher self-protection against negative social interactions (Powers et al., 2013; Spithoven et al., 2019). In other words, lonely individuals were prone to social avoidance and withdrawal to minimize perceived social stress (J. T. Cacioppo et al., 2014; Powers et al., 2013; Spithoven et al., 2019). Although researchers also suggested that loneliness signaled the need to reconnect socially through the mentalization of positive social interactions in the dorsomedial prefrontal cortex (Powers et al., 2013), this signaling was often accompanied by increasing motivation for self-preservation, which led to lonely individuals' preferences of larger interpersonal distances in their intimate relationships (Layden et al., 2018).

Additionally, some experiments demonstrated that lonely individuals had higher activity in the ventral striatum when observing positive non-social interactions compared with social interactions (S. Cacioppo et al., 2014). Because the ventral striatum is responsible for dopamine generation, the study suggested that lonely individuals were less likely to perceive social pleasure than those not lonely (S. Cacioppo et al., 2014).

When animals and individuals perceive a discrepancy between desired and actual social connections, their activity level in the hypothalamus-pituitary-adrenal (HPA) axis is likely to increase, reducing their capacity for impulse control and preparing them for fight or flight responses (S. Cacioppo et al., 2014). The heightened HPA activity has been associated with uncertainty and danger (S. Cacioppo et al., 2014). Thus, lonely individuals and animal species have been more likely to perceive social threats,

experience anxiety and/or emotional distress, and further withdrawal socially to avoid predation (Brown et al., 2018; J. T. Cacioppo et al., 2014; S. Cacioppo et al., 2015). Loneliness can also disrupt one's sleep to foster alertness and watch out for potential danger. The depressive symptoms associated with loneliness can be interpreted as a nonverbal expression of a need for support and connection (J. T. Cacioppo et al., 2014; S. Cacioppo et al., 2014).

Loneliness was associated with increased vascular activities and under-expression of anti-inflammatory genes (Spithoven et al., 2019). Consequently, both transient loneliness and chronic loneliness were associated with negative health and mental health consequences for older adults (Brown et al., 2018). Chronic loneliness had a more significant negative impact on the health of older adults (e.g., cognitive decline) than transient loneliness (Zhong et al., 2016).

Social Mechanisms. Although loneliness has neurological foundations, it does not exist in a vacuum. Social structures and processes influence human motivations, psychology, and well-being (J.T. Cacioppo et al., 2009). Just as the groundbreaking association Durkheim (1951) has made between different types of suicide and various social contexts (Piatkowska, 2020), neurology does not provide a complete explanation for loneliness. Social network structures can alleviate or reinforce the spread of loneliness (J. T. Cacioppo et al., 2009).

Several studies demonstrated the significance of network autocorrelation in individuals' psychological well-being. Network autocorrelation represented how individuals' well-being levels (e.g., loneliness, depression) were correlated with one another in a network (Prochnow et al., 2020). A positive network autocorrelation

indicated that people with similar levels of well-being were clustered together, whereas a negative autocorrelation suggested that people socialized with those who differed in the level of well-being within a network (Prochnow et al., 2020). In a study on depressive symptoms (DS) within an online gaming community, the positive network correlation in the linear network autocorrelation model (LNAM) suggested that individuals tend to socialize with those sharing similar levels of DS (Prochnow et al., 2020). In other words, those with higher levels of DS tended to be friends with one another, whereas those with lower levels of DS clustered together (Prochnow et al., 2020). This pattern might have elevated DS among individuals with high levels of loneliness through co-rumination (Prochnow et al., 2020). Similarly, Elmer (2020) found that depressed individuals in a graduate housing community were inclined to connect with other depressed individuals, a phenomenon known as homophily in social network theories (W. Liu et al., 2017). Additionally, depressed individuals were more likely to engage in dyadic (one on one) interactions rather than group participation, contributing to dyadic isolation (Elmer, 2020). Other researchers also found that loneliness spread through the clusters of peripheral individuals in a network via a contagious process (J. T. Cacioppo et al., 2009).

Consequences

By influencing the brain structure, neurogenesis, neuro-inflammation, and sleep cycles (Smith et al., 2020), loneliness was associated with elevated risks of physical and mental illness (e.g. coronary heart disease, cognitive decline, and depression), suicide risk, and mortality for older adults (Courtin & Knapp, 2017; Holt-lunstad & Smith, 2016; Shankar et al., 2011; Valtorta, Kanaan, Gilbody, & Hanratty, 2016; Zhong et al., 2016).

Besides health implications, chronic loneliness was also associated with an annual increase of $6.7 billion in Medicare spending in the U.S. (G. O. Anderson & Thayer, 2018).

Risk and Protective Factors

Demographic Factors. Based on the neurological, cognitive-behavioral, and social mechanisms of loneliness, a series of risk and protective factors contributed to the variation in loneliness among older adults. Being female, having lower income/education, never married, identifying as a member of a marginalized group (e.g., LGBTQI+, racial/ethnic minority, and immigrants), and experiencing disabilities or functional impairment were positively associated with loneliness among older adults (NASEM, 2020). Female older adults had higher rates of loneliness likely because of their longer life expectancy and lower rates of remarriage compared with male older adults (NASEM, 2020). Low income limited one's social and economic resources to stay connected (G. O. Anderson & Thayer, 2018). As discussed earlier, marriage was a protective factor against emotional loneliness among mid-age and older adults (S. Cacioppo et al., 2015; National Academies of Sciences Engineering and Medicine [NASEM], 2020; Qualter et al., 2015). Moreover, marginalized older adults, such as older immigrants, experienced structural barriers (e.g., discrimination, lack of culturally sensitive engagement opportunities) when building social connections beyond their own communities (NASEM, 2020). Poorer health and higher levels of functional impairment also restricted older adults' mobility as well as social engagement (NASEM, 2020).

Aging-Related Major Life Transitions. Older age does not necessarily mean higher loneliness (NASEM, 2020). A national AARP study indicated that 35% of older adults between 60 and 69 years of age were lonely whereas only 24% of older adults over 70 years old were lonely according to the UCLA loneliness scale, *N*=3020 (G. O. Anderson & Thayer, 2018). In contrast with the myth that aging contributes to disengagement and loneliness, American older adults' frequency of social contact declined in their sixties, stabilized in their seventies, and increased in their eighties (Cornwell et al., 2008). The U-shape relationship between age and social contact became less prominent after accounting for major life transitions such as retirement, bereavement, and major health changes, highlighting the role of major life transitions in older adults' loneliness (Cornwell et al., 2008).

The impact of major life transitions on older adults' loneliness has been mixed and context-dependent. Although older adults tend to focus more on the quality rather than quantity of relationships (Carstensen et al., 2003), loss of social contacts after retirement and/or widowhood can still limit their capacity to select satisfying relationships and hence contribute to feelings of loneliness (Wethington & Pillemer, 2013). However, after the social changes, older adults have the agency to increase community engagement (e.g. volunteering), which can strengthen older adults' social networks and ameliorates loneliness after major life transitions (Crittenden, 2018).

Social Support, Social Relationships, and Social Networks.

Social Relationships. It has been well-established that social relationships played an important role in the health and well-being of older adults (NASEM, 2020). Social

relationships varied in quality (e.g., satisfying, stressful) and the nature of relationships (e.g., kinship, co-workers). Social relationships were often conceptualized as dyadic interactions (e.g., A is friend with B) in the existing literature, which provided limited insight into the social interactions among members within a defined social setting (Ayalon & Levkovich, 2019). Furthermore, standardized instruments measured the following two dimensions of social relationships: (1) structure versus function; (2) the level of subjectivity (Valtorta, Kanaan, Gilbody, & Hanratty, 2016). Although some standardized surveys, such as the Lubben Social Network Scales (Lubben, 1988), provided aggregated information on older adults' social networks, such as the number of friends and the frequency of interaction. These surveys were not designed to assess the structures of interactions among network members.

Social Networks. Social networks consisted of a collection of individuals and connections among them (W. Liu et al., 2017). These relationships have been studied within a defined setting or boundary for feasibility (W. Liu et al., 2017). Social relationships within a network were often shaped by the network members (referred to as nodes or vertices) and a set of relationships or social interactions (referred to as ties or edges) among them (Kadushin, 2004; W. Liu et al., 2017). Individuals within a network can have different types of social interactions. For instance, residents in a therapeutic community (TC) for substance abuse treatment can have programmatic interactions with peers to affirm or correct each other according to TC principles (Warren et al., 2020). In addition, residents in TC have also developed informal friendships by exchanging letters from home, sitting together during meals, and spending social time with peers (Cao et al., 2020).

Social Network Structures. A social network illustrates the structure and mechanism of social transactions within a defined boundary (e.g. how infectious disease transmits within a community) (W. Liu et al., 2017; Valente & Pitts, 2017). Both ethnographers and mathematicians have contributed to identifying and defining common network structures (Kadushin, 2004). Social network theory (SNT) posits that the structure of the social networks (e.g. centralization, transitivity), the network environment (e.g. homophily, influence, and selection), and the positions of individuals in the network (e.g. central, bridging, peripheral) can contribute to different outcomes (W. Liu et al., 2017; Valente & Pitts, 2017). For example, people with a high degree centrality in a disease transmission network are more likely to be infected (W. Liu et al., 2017; Valente & Pitts, 2017). Because individuals in a network can be connected indirectly through common contacts and even isolates (nodes with no ties) are influenced by how other individuals in the network are connected, social network studies can illustrate how seemingly unrelated nodes affect one another through interlinks or network environment (Borgatti et al., 2009, 2013).

According to a systematic review of social network studies of older adults by Ayalon and Levkovich (2019), the majority of whole network studies focused on middle-class white older adults in long-term care facilities (e.g., nursing homes, assisted living facilities, memory care units, or continuing care facilities) or retirement communities that have clear network boundaries. Ayalon and Levkovich only identified one study on community-living older adults participating in an educational program in Mexico (Márquez-Serrano et al., 2012). Previous findings indicated that older adults' social networks were low in density and reciprocity (Ayalon & Levkovich, 2019). The number

of incoming and outgoing ties was scarce among older adults in long-term care facilities and retirement communities (e.g., Casey et al., 2016; Schafer, 2016).

The literature on older adults in long-term care and retirement communities highlighted the importance of cognitive, health, and functional capacity in shaping social network structures. In a retirement community, older adults with better health received more ties than their counterparts in worse health conditions (Schafer, 2015, 2016). Older adults with poor health were less likely to be nominated as a close tie compared with healthier older adults (e.g., Casey et al., 2016; Schafer, 2016). The health asymmetry negatively impacted the health of older adults with poor health by separating them from those with better health (Casey et al., 2016; Schafer, 2011, 2012, 2013, 2015, 2016). Additionally, Hardiman (2017) found that among religious older women in a residential facility, better cognitive status was correlated with more social ties, which were further associated with a better quality of life. The nurses, staff, and caregivers in the residential facility had high centrality in older women's social networks (Hardiman, 2017). Similarly, other researchers found that larger network size, more out-going ties, more in-coming ties, the reciprocity of ties, high betweenness centrality, and high closeness centrality were positively correlated with the quality of life among older adults in a dementia special care unit (Abbott et al., 2015; Abbott & Pachucki, 2017).

Despite the bidirectional relationship between network structures and individual-level outcomes (e.g., loneliness, health), network structures influenced individuals' psychological and social well-being (Elmer, 2020). Triad closure, homophily, and reciprocity were negatively associated with individuals' levels of depression (Elmer, 2020). Similarly, loneliness also spread within social networks through clusters of lonely

individuals (J. T. Cacioppo et al., 2009). Thus, studies on depression, loneliness, and other mental health challenges can benefit from a relational perspective that acknowledges the dependence on social interactions (J. T. Cacioppo et al., 2009; Elmer, 2020).

Human Agency and Social Networks. Social networks have complex social meanings beyond network structures (Hollstein, 2011). Some social scientists have critiqued structural network analysis for neglecting the role of human agency that shapes social networks (Emirbayer & Goodwin, 1994). It is equally important to understand how individual motivation, decisions, and strategies have shaped networks. Human agency has provided one possible explanation for why social networks demonstrated certain structural patterns (Kadushin, 2004). For example, two major types of human needs include the need for safety and the need to reach out (Kadushin, 2004). The need for safety and affiliation usually prompts people to connect with similar people closely within their "social cocoons" (Kadushin, 2004). In other words, the need for safety and belongingness can contribute to dense and homophilous networks that represent cohesion and embeddedness (Kadushin, 2004). In contrast, people also have the motivations to reach out and establish new connections outside of their familiar social circles (Kadushin, 2004). Ties connecting disconnected groups can gain status, power, and efficacy by bridging different resources (Kadushin, 2004). Moreover, the variety of strategies for forming, maintaining, and dissolving social ties also reflect the diversity of human agency (Kadushin, 2004). For instance, older adults have used reciprocity as a standard for forming and ending relationships to balance their need for independence and social connections (Breheny & Stephens, 2009)

Organizational Contexts and Social Networks. Previous studies on the networks of older adults in institutional settings indicated that the organizational structures and contexts shaped the network structures of older adults (Casey et al., 2016; Schafer, 2015). For instance, older residents were more likely to establish friendships with those who were on the same floor (proximity) and entered the facility at approximately the same time (Casey et al., 2016; Schafer, 2015). Staff and nurses in nursing homes played a central role in older adults' social networks (Abbott & Pachucki, 2017). Furthermore, in a continuing care retirement community, those with similar cognitive, health, and functional status were more likely to be in one unit (e.g. independent living, assisted living, nursing home), reinforcing the health-based homophily among older adults (Casey et al., 2016; Schafer, 2015).

Volunteering. Volunteering can be categorized into formal and informal volunteering. Formal volunteering is also referred to as organized volunteering, in which one engages in organized activities usually structured by nonprofit organizations to benefit the community (Gil-Lacruz et al., 2019; Serrat et al., 2020). In comparison, informal volunteering refers to offering help and assistance to people outside of the household (e.g., acquaintances, neighbors, and friends) (Einolf et al., 2016; Serrat et al., 2020). The decision to volunteer reflects human agency whereas the experiences of formal volunteering are structured by organizational contexts.

Motivations for Volunteering. Expanding one's social network and building meaningful social interactions has been a major motivation for volunteering among people of all ages (Chen & Morrow-Howell, 2015; Gil-Lacruz et al., 2019; Yamashita et al., 2019). Although the desire to serve the community drove formal volunteering among

people across the life span (Yamashita et al., 2019), older adults' volunteering was mainly motivated by the pursuit of gratifying emotional experiences, such as opportunities for generativity (Jiang et al., 2019; Yamashita et al., 2019). In comparison, younger and middle-aged adults' volunteering was more driven by career advancement or social networking purposes (Chen & Morrow-Howell, 2015; Jiang et al., 2019; Yamashita et al., 2017). Older volunteers' motivation for generativity has been broadly defined as leaving a legacy and benefitting other people, including but not exclusive to the younger generation (Yamashita et al., 2017). Likewise, other studies suggested that older adults exhibited higher levels of altruism compared with younger adults, whose primary focus was on establishing one's families and careers (Mayr & Freund, 2020).

Altruistic motivation alone has not always resulted in participation in organized volunteering. Older adults with more social, human, and financial resources were more likely to participate in organized volunteering in the pursuit of non-material gratification (Serrat et al., 2020; Torres & Serrat, 2019). There has been robust empirical evidence connecting a higher SES with more participation in organized volunteering (Detollenaere et al., 2017; Gil-Lacruz et al., 2019; Serrat et al., 2020; Torres & Serrat, 2019). Meanwhile, other scholars argued that marginalized older adults' willingness for community participation was often thwarted by the barriers to participating in organized volunteering (e.g., transportation barriers, limited financial resources, and limited access to information) (Withall et al., 2018). Nonetheless, when opportunities were accessible, volunteering was often viewed as a chance to contribute to society or to network for potential employment opportunities, among retired and unemployed immigrants

respectively (Conkova & Lindenberg, 2020; Curvers et al., 2018; Khvorostianov & Remennick, 2016).

Aside from SES, the motivation to volunteer also differed by other sociodemographic characteristics, such as gender and race (e.g., S. H. Lee et al., 2018). Older women were more likely to volunteer than older men (Jongenelis et al., 2020). Some studies suggested that the gender difference in volunteering became less pronounced once the SES (e.g., employment, household composition) difference between men and women was accounted for (Gil-Lacruz et al., 2019). In addition, the gendered pattern of volunteering varied by type of volunteering (Gil-Lacruz et al., 2019). For example, several studies found that men were more likely to engage in organized volunteering whereas women were more likely to engage in informal volunteering (Einolf et al., 2016; Gil-Lacruz et al., 2019). Within the realm of organized volunteering, women were more likely to volunteer in organizations that advocated for social justice, whereas men were more likely to volunteer in educational and professional organizations (Gil-Lacruz et al., 2019; Jongenelis et al., 2020). This might have been because women were more likely to volunteer for altruistic purposes (e.g., social justice) whereas men were generally more motivated by the social and professional benefits of volunteering (Gil-Lacruz et al., 2019).

The motivations for volunteering also varied among various racial and ethnic groups (Morrow-Howell et al., 2014). One study on older volunteers in a national intergenerational volunteering program (Experience Corps) suggested that African American older adults were more likely to be motivated by generativity in volunteering than their white counterparts (Morrow-Howell et al., 2014). The higher levels of altruism

among African American older volunteers might have been explained by their lived experiences advocating for themselves and their community due to racism and discrimination throughout their life course (Morrow-Howell et al., 2014).

Understanding the multiple motivations for volunteering and the variations of motivations across various demographic groups informed targeted volunteer recruitment (e.g., highlighting altruism when recruiting African American older volunteers to Experience Corps) (Morrow-Howell et al., 2014). The volunteer recruitment and retention effort in the existing literature were concentrated on the roles of individual motivation and organizational structures. Organizational structures, such as sufficient staffing, consistent supervision, convenient transportation, security measures, financial incentives, and social recognition of volunteers were essential in ensuring the sustainability of volunteering programs and a satisfying experience for older volunteers (Greenfield et al., 2016; Withall et al., 2018; Yamashita et al., 2017).

Benefits of Volunteering. High-quality volunteering experiences were associated with various health and well-being benefits for older adults (Carr et al., 2018; Proulx et al., 2018). Volunteering was correlated with better cognitive health (Proulx et al., 2018), better physical health, and lower mortality rates among older adults (Morrow-Howell et al., 2003; Serrat et al., 2020). Regular volunteering was also associated with lower loneliness among older adults, particularly after major life events such as widowhood (Carr et al., 2018). For instance, widowed older adults who volunteered for two hours or more each week had similar levels of loneliness as those married (Carr et al., 2018). However, widowed older adults who volunteered less than two hours a week or did not volunteer had higher levels of loneliness than those who were married (Carr et al., 2018).

Besides the frequency of volunteering, other researchers explained the relationship between volunteering and the well-being of older adults through the activity theory and role theory (Ayalon & Levkovich, 2019). These two theories suggested that volunteering enhanced older adults' health and well-being by providing and sustaining social roles (Baker et al., 2005) as well as active lifestyles (Carstensen, 1992, 2003). For example, scholars associated the number of roles with better self-reported health among older adults (Adelmann, 1994). However, this finding has been controversial because role conflicts have been positively associated with stress and overwhelm (Gonzales et al., 2015). Consistent with the activity theory, social interactions and physical activities in volunteering have been associated with better cognitive and physical health among older volunteers for Experience Corps, which is a high-intensity intergenerational (older adults and school-age children) volunteering program (Matz-Costa et al., 2016).

Moreover, engaging in regular volunteering also enhanced older adults' embeddedness in their social networks, thereby contributing to better physical/mental health outcomes (Baker et al., 2005). The friendship network size moderated the relationship between the frequency of volunteering and the change in life satisfaction of older adults (Jiang et al., 2019). Older volunteers who lost more friends over the four years experienced greater improvement in their quality of life through volunteering (Jiang et al., 2019). Perceived reciprocity (Siegrist & Wahrendorf, 2009) and the quality of community participation (Matz-Costa et al., 2016) also moderated the effect of volunteering on older adults' psychological well-being. These findings provided some initial evidence on the association between volunteering, social networks, and volunteers' psychological well-being. Nonetheless, more studies need to examine the structures of

social interactions beyond network size to identify critical network processes informative for future interventions.

Loneliness Interventions

Existing interventions for social isolation and loneliness usually targeted populations with increased risk for social isolation and loneliness, such as older adults and people with mental illnesses (Yousefi Nooraie et al., 2021). Despite the differences in population characteristics, loneliness interventions were generally delivered at the following levels: individual, interpersonal, group, or community (Yousefi Nooraie et al., 2021). Several systematic reviews assessed the components and effectiveness of social network interventions in addressing the loneliness of vulnerable populations.

To synthesize the knowledge of interventions for loneliness among people with mental illness, a systematic review suggested that loneliness interventions among adults with psychotic disorders included peer support, volunteering, supported social engagement, and dog-assisted psychotherapy (K. Anderson et al., 2015). Anderson and colleagues concluded that psychosocial skills training was most effective when a professional is present and when socialization involved friends and family members (K. Anderson et al., 2015). Another review found that supported community engagement was more effective in increasing the social network size of people with mental illness compared with other interventions, such as individual social skills training, group skills training, supported community engagement, supported employment, and peer support interventions (Webber & Fendt-Newlin, 2017). Interventions improving the general well-being of people with mental illness also had an indirect effect on loneliness (Webber &

Fendt-Newlin, 2017). Another review identified the following types of loneliness interventions for people with mental illness: changing social cognition (how people interpret and process social interactions), social skills training, psychoeducation, supported socialization, and wider community campaigns (Mann et al., 2017).

Whereas Webber's team highlighted the effectiveness of community engagement (Webber & Fendt-Newlin, 2017), Mann and colleagues emphasized the importance of addressing social cognitions in loneliness interventions (Mann et al., 2017). Additionally, a recent review of interventions for subjective and objective isolation among people with mental illness identified a combination of the aforementioned interventions (R. Ma et al., 2020). Although the evidence on the effectiveness of loneliness interventions among people with mental illness was still relatively weak, the authors argued that interventions targeting social cognition might be more effective than other loneliness interventions (R. Ma et al., 2020).

Furthermore, short-term pharmacological interventions may hold promise for people stuck in the vicious cycle of chronic loneliness and those not responding to psychosocial interventions (e.g., CBT, social skills training, support groups) (S. Cacioppo et al., 2015). Examples of pharmacological interventions include serotonin reuptake inhibitors and oxytocin that promote pro-social behavior and reduce hypervigilance to social stress/threat (S. Cacioppo et al., 2015).

Similar to the above loneliness interventions for people with mental illness, the format of loneliness interventions for older adults can also be categorized into individual-oriented (e.g. social skills training, correcting maladaptive social cognition through psychoeducation and cognitive behavior therapy), relationship-oriented (e.g. enhanced

social support through home visits or mentorship, creating opportunities for social interaction), and community-oriented (e.g. community campaigns) (Ong et al., 2016). Systematic reviews and meta-analyses have suggested that well-designed interventions addressing the social cognition of older adults might be a promising type of intervention (Ong et al., 2016).

Besides the above individual-oriented interventions, relationship-oriented interventions can also address the loneliness of older adults. Findings on the effectiveness of group-level interventions (such as friendship programs and support groups) for loneliness were mixed. One popular form of group intervention is friendship programs. According to a randomized control trial, friendship or supported socialization programs increased the social contacts of older adults and improved their general well-being but had a non-significant effect on their loneliness scores (Pitkala et al., 2011). Whereas Kahlbaugh and colleagues (2011) found that older adults who engaged in group-based console games were less lonely than those who did not (Kahlbaugh et al., 2011).

Although community-level interventions (e.g., campaigns, transportation support, and community art programs) to address the loneliness of older adults have been growing, there has been limited evidence of the effectiveness of community-level interventions on the loneliness of older adults (Fakoya et al., 2020). Scholars have proposed further exploration of the effectiveness of various types of network interventions, such as social skills building, network mapping, changing ties, changing the prominence of certain actors, and structuring network clusters to address loneliness during the COVID-19 among various groups of marginalized populations, including older adults (Yousefi Nooraie et al., 2021).

COVID-19 and Loneliness of Older Adults

During the COVID-19 global pandemic, the social isolation and loneliness of older adults received increased attention with the implementation of social distancing measures (Sood, 2020; Vahia et al., 2020). Older adults who were living alone, widowed, and those with functional impairment were particularly vulnerable to social isolation during the pandemic (Sood, 2020). One longitudinal study measured loneliness and mental health of community-living Dutch older adults in October 2019, November 2019, and May 2020 (Van Tilburg et al., 2020). May 2020 was approximately two months after the implementation of social distancing measures in the Netherlands. Findings indicated that social distancing was not significantly associated with loneliness (Van Tilburg et al., 2020). However, personal losses during the pandemic (e.g. illness of oneself, illness or deaths of family members, loss of social activities, and lack of needed professional support), worries about the pandemic, and reduced trust in social institutions were significantly associated with increased loneliness (particularly emotional loneliness), anxiety, and depression among older adults (Van Tilburg et al., 2020). In contrast, a scoping review of studies published during the pandemic suggested that social restrictions during COVID-19 negatively affected older adults' sense of connectedness and overall well-being (Sayin Kasar & Karaman, 2021).

Loneliness among Diverse Older Adults

Prevalence of Loneliness among Diverse Older Adults. Based on the Statistics Canada's General Social Survey (GSS) which collected data from participants through random digit dialing across Canada (*N*=3692) in 2008, researchers analyzed the

loneliness of older adults over 65 years old (De Jong Gierveld et al., 2015). Findings indicated that the mean score of the 6-point De Jong Gierveld Loneliness (DJGL) scale among non-European older immigrants (1.96) was significantly higher than native older adults (1.26) (De Jong Gierveld et al., 2015). Older immigrants from French and English-speaking countries were not significantly lonelier than native older adults in Canada, whereas older immigrants from countries with different language and cultural backgrounds were significantly lonelier than native older adults (De Jong Gierveld et al., 2015).

Another study based on the GSS data collected in 2007 found that first-generation older immigrants in Canada (Chinese, South Asian, British, French, and other European origins) had higher rates of loneliness than second-generation immigrants who were born in Canada with at least one parent born outside of Canada (Z. Wu & Penning, 2015). Similarly, 24% to 50% of older immigrants from China, Africa, the Caribbean, Pakistan, and Bangladesh were lonely in the United Kingdom (U.K.) (Victor et al., 2012). One exception was the Asian Indian older immigrants in the U.K., whose rates of loneliness were similar to that of non-immigrant older adults (8-10%) in the U.K. Studies in the U.S. also suggested that older immigrants, such as older Chinese immigrants (Simon et al., 2014), older Korean immigrants (H. J. Park et al., 2019), and older Latinx immigrants (J. Lee et al., 2020) in the U.S. had higher rates of loneliness than non-immigrant older adults.

The Outcomes of Loneliness among Diverse Older Adults. Similar to studies on general older adults, loneliness has been associated with a series of physical and mental health consequences for different groups of older adults (e.g., NASEM, 2020). A

10-year population-based study in the U.S. found that a higher level of social integration was significantly negatively associated with the mortality of White and African Americans. Latinx older adults benefited equally from a moderate and high level of social integration (Barger & Uchino, 2017).

Furthermore, perceived isolation (e.g., loneliness) and social disconnectedness (i.e., lack of social contacts) had different health and mental health consequences among various racial groups (Miyawaki, 2015). Both perceived isolation and social disconnectedness were significantly negatively associated with the physical and mental health of white older adults (Miyawaki, 2015). Perceived isolation was negatively associated with mental health while social disconnectedness was negatively associated with physical health among black older adults (Miyawaki, 2015). Social disconnectedness was significantly negatively associated with the mental health of Hispanic older adults (Miyawaki, 2015).

Risk and Protective Factors of Loneliness among Diverse Older Adults.

Demographic Factors. Socio-demographic factors affecting the loneliness of older immigrants were largely similar to those affecting the general older adults. Older age, being female, being unmarried, living with fewer people, having poorer self-reported health, and higher levels of functional impairment were positively associated with the loneliness of older immigrants (X. Q. Dong & Chen, 2017; Simon et al., 2014). Better SES and higher levels of education were protective factors against loneliness and depression among older immigrants (Ip et al., 2007; NASEM, 2020). According to a study on Canadian older immigrants, employed and retired immigrant older adults had

lower levels of loneliness than those in other employment conditions (Z. Wu & Penning, 2015). The number of adult children was also negatively associated with the loneliness of Asian older immigrants. Those who were childless had higher rates of loneliness (Simon et al., 2014). Married older immigrants were less lonely than those who were widowed or never married (Wu & Penning, 2015; Simon, Chang, Zhang, et al., 2014).

Furthermore, migration-related factors can also contribute to the variation in loneliness among older migrants. Migration at an older age and shorter years of residence in the receiving country were associated with higher levels of loneliness and depression among older migrants (Guo, Stensland, et al., 2018; Z. Wu & Penning, 2015). Among older immigrants, minority older immigrants had higher rates of loneliness than European immigrants in North America (Z. Wu & Penning, 2015). Loneliness also varied among older minority immigrants from different countries (De Jong Gierveld et al., 2015). The language and cultural differences between the sending and receiving countries were positively associated with the loneliness of older minority immigrants in North America (De Jong Gierveld et al., 2015).

Major Life Events and Migration. In addition to aging-related major life events (e.g., retirement, widowhood), older minority migrants also experience migration-related major life transitions (e.g., acculturation, social losses) (Conkova & Lindenberg, 2020; Z. Wu & Penning, 2015). The intersection of aging-related major life transitions (e.g. functional/health decline, loss of loved ones) and migration can elevate the risk of loneliness among older minority immigrants (Z. Wu & Penning, 2015). Both immigration and aging-related major life transitions have been associated with social losses and shrinking social network sizes (Z. Wu & Penning, 2015). Depending on the age of

immigration and length of residence in the receiving country, migration can disrupt the continuity of social networks in the sending country while limiting the depth and breadth of relationships in the receiving country (Z. Wu & Penning, 2015). Reasons for migration (e.g., family reunification, seeking employment, refugees) have also been associated with the variations in social losses among older migrants (De Jong Gierveld et al., 2015). For instance, older refugees were more likely to leave close family behind and were less likely to return to the sending country than voluntary immigrants (De Jong Gierveld et al., 2015).

Family Conflicts and Cohesion. Regardless of the reasons for immigration, migrating to a new environment with different social norms and cultural expectations can change older migrants' position in their social networks (Curtin et al., 2017). Some older migrants have experienced a loss of status in the family (Guo et al., 2016). Some older migrants have transitioned from mentors of younger generations to dependents of adult children due to financial dependency, language barriers, and cultural barriers encountered in the host society (Curtin et al., 2017; Guo et al., 2016). Late-life migration, low SES, and high levels of functional impairment have been positively associated with older migrants' financial dependency and co-residence with adult children (Ciobanu et al., 2017; Guo et al., 2015; Guo, Stensland, et al., 2020; Simon et al., 2014). Furthermore, some minority older migrants have been very involved with helping adult children with house chores and playing the role of grandparents in the family, leaving them with limited time and means to connect with people outside of the household (Wright-St Clair & Nayar, 2019; Martin-Matthews et al., 2013; Dong et al., 2012b). Despite the within-group variations, high levels of intergenerational interdependency within migrant families

have underscored the importance of family cohesion in older migrants' social connectedness and psychological well-being (Guo, Stensland, et al., 2019).

Discrimination. Discrimination and language/cultural differences made it challenging for minority older immigrants to establish social relationships beyond co-ethnic networks (NASEM, 2020). Interpersonal and structural discrimination have limited the scope and diversity of older migrants' social networks through distrust and institutional racism (Torres, 2020). As racialized minorities, various types of othering processes (e.g. racism, xenophobia, micro-aggression) at the interpersonal and institutional level hindered older minority migrants from establishing trusting relationships beyond their kinship network (Ciobanu et al., 2017; Viruell-Fuentes et al., 2012).

Depending on their migration experiences, older immigrants have had different employment histories in the U.S. and face different levels of policy barriers in accessing social/health services and participating in organized community activities (Torres & Serrat, 2019). Perceived discrimination was positively associated with the loneliness and psychological distress of older immigrants (Viruell-Fuentes et al., 2012; NASEM, 2020). Perceived discrimination has contributed to loneliness by inhibiting belongingness and impairing one's self-efficacy to engage socially (S̄witaj et al., 2015).

Acculturation. First-generation older immigrants have faced the challenge of negotiating between the cultures of sending and receiving countries when developing a sense of connectedness (Rhee, 2019; Romero & Piña-Watson, 2017). Acculturation is a multi-dimensional transition or adjustment in attitude, behavior, and cultural identity when exposed to different cultures (Berry, 2005). Common acculturation indicators have

included language preferences, the ethnic compositions of social networks, choice of media, and attitudes toward interracial relationships (Dong, Bergren, et al., 2015).

Different acculturation strategies may result in different levels of acculturation, social integration, and psychological well-being of older immigrants (Rhee, 2019; Ward & Geeraert, 2016). Acculturation strategies have included assimilation (stronger identification with settlement culture), integration (strong identification with both cultures), separation (stronger identification with home culture), and marginalization (weak identification with both cultures) (Ward & Geeraert, 2016).

Several studies have investigated late-life older immigrants' experience of "aging out of place" in an unfamiliar society (Curtin et al., 2017; Sadarangani & Jun, 2015). For instance, older East Asian immigrants have often faced challenges regarding redefining the concept of "home" after the migration (Curtin et al., 2017; Zhan et al., 2017) and adjusting expectations for filial piety as they acculturated into a more individualist society (X. Dong, Zhang, et al., 2015; Guo, Byram, et al., 2020).

Social Networks. Despite the growing body of evidence connecting social network structures with the psychological well-being (e.g. loneliness, depression) of the general population (e.g. Elmer, 2020), information on the social network structures and loneliness of diverse older adults is scarce and fragmented**.** Although older migrants have expressed a desire to maintain their independence by building relationships with people and organizations outside of the kinship network (Wiles et al., 2019a), their willingness to form and maintain relationships outside of the family can be impeded by social and environmental factors (e.g., transportation barriers, limited neighborhood cohesion, and lack of culturally sensitive social engagement opportunities) (Morgan et al., 2019, 2020;

H. J. Park et al., 2019). Feeling undeserving can also obstruct diverse older adults from seeking befriending services (Wiles et al., 2019a). In other words, older migrants' inclination to connect with people with similar racial and cultural backgrounds might have been intensified by racism, xenophobia, gender, language barriers, and poverty (Morgan et al., 2020; Wiles et al., 2019a; Zhou, 2017).

The existing quantitative social network studies among older immigrants have been mainly network typology studies. Scholars found that older Asian Americans in restricted networks (living with adult children, fewer connections with spouses and friends) had a greater chance of experiencing depression than those in other types of social networks (couple-based, friend-based, and diverse) (N. S. Park et al., 2015, 2019). Personal network studies (i.e. studies on social relationships of individuals rather than social interactions within a group) on older Chinese immigrants in the U.S. found that they tend to have smaller personal networks than their counterparts from other racial and ethnic backgrounds (Dong & Chang, 2017). Meanwhile, kinship played an important role in older Chinese immigrants' social networks (Dong & Chang, 2017). However, Li and colleagues (2019) found that the size and quality of social networks had a more significant impact on Chinese older immigrants' depression than network composition. Having three to five strong network ties, medium contact frequency, and high emotional closeness were negatively associated with depression among older immigrants (M. Li et al., 2019). Despite revealing the network compositions of older immigrants, typological studies provided limited information on underlying social mechanisms behind network formation or dissolution.

Volunteering among Diverse Older Adults. Regardless of the benefits associated with volunteering, diverse older adults including older immigrants had lower rates of participating in organized formal volunteering activities than their non-immigrant counterparts (Curvers et al., 2018; Mui et al., 2013; Torres & Serrat, 2019). Language, cultural, and financial barriers hindered older immigrants from engaging in organized volunteering opportunities (Serrat et al., 2020; Torres & Serrat, 2019). As a result, some older immigrants reported feeling invisible in the community and have expressed the desire to reconnect through culturally familiar community activities (Wright-St Clair et al., 2018; Wright St-Clair & Nayar, 2020).

Despite their limited participation in organized volunteering opportunities, diverse older adults with migrant backgrounds often assisted members of their co-ethnic community informally (Einolf et al., 2016; Wright-St Clair et al., 2018). Informal volunteering in one's co-ethnic community allowed older migrants to reuse their knowledge/skills to improve their social connectedness and the cohesion of their co-ethnic communities (Wright-St Clair et al., 2018; Wright St-Clair & Nayar, 2020).

Although few, some scholars have started investigating formal volunteering among diverse older adults. One study on Chinese older volunteers in New York found that older Chinese volunteers who participated in supporting Chinese family caregivers in the communities reported feeling empowered by training and the service opportunity (Mui et al., 2013). The skills and knowledge from training and volunteering helped older Chinese volunteers communicate with their own family members more effectively. Over 60% of older Chinese volunteers reported better physical and emotional health after volunteering (Mui et al., 2013). Although Mui and colleagues found that the trusting

relationship among volunteers was positively associated with their well-being and mental health (Mui et al., 2013), the social interactions among diverse older volunteers within the volunteering organization remained largely unexplored.

The structures of social interactions play a role in the psychological well-being of diverse older adults. Wiles and colleagues (2019) found that friendship programs for diverse older adults with migrant backgrounds were the most beneficial when participants developed trusting mutual friendships beyond the professional-client relationship. Developing mutual friendships based on reliability and reciprocity alleviated diverse older adults' loneliness (Wiles et al., 2019a).

Diverse older adults (e.g., low-income, minority, immigrant older adults) have often faced institutional and structural barriers to organized/formal volunteering (Ford et al., 2013; National Academies of Sciences Engineering and Medicine, 2020). The organizational structures can escalate or minimize the barriers to entry (Greenfield et al., 2016). A federal volunteering program, the Senior Companion Program (SCP), addressed the barriers to formal volunteering by providing low-income older volunteers with monthly training, a stipend, and mileage reimbursement for their companionship visits (Crittenden, 2018). According to previous studies on SCP, over 40% of companions reported improvement in their social connections and 25% of companions reported increased social engagement after retirement through SCP (Butler, 2006).

COVID-19 and Loneliness of Older Immigrants. Minority immigrants and refugees have been disproportionately impacted by the COVID-19 pandemic. First, low-income immigrants and refugees had higher rates of living in overcrowded neighborhoods and households with limited capacity to socially distance, compared with

their higher-income counterparts (Greenaway et al., 2021). Second, some groups of immigrants and refugees with no health insurance have relied on emergency rooms for regular care (Greenaway et al., 2021; Kluge et al., 2020). Due to concerns about being infected with COVID-19 in emergency rooms, low-income immigrants and refugees with no health insurance had little access to health care during the pandemic (Greenaway et al., 2021; Kluge et al., 2020). The stigma that immigrants and refugees transmit COVID-19 across international borders has also deterred some immigrants and refugees from utilizing health services (Greenaway et al., 2021; Kluge et al., 2020). Third, language barriers and the technological divide (e.g. lack of internet connections) have also hindered immigrants and refugees, particularly those with limited English fluency, from accessing timely COVID-19 prevention and intervention information (Kluge et al., 2020). The technological divide has also limited low-income older immigrants' capacity to remain socially connected with their network members outside of the household and outside of the host country (Kluge et al., 2020). Furthermore, the discontinuation of in-person services and programs for immigrants and refugees has also limited the social support available to them outside of their homes (Kluge et al., 2020).

In spite of the health disparity between immigrant and non-immigrant populations, some studies have shed light on older immigrants' resilience in face of racism, xenophobia, and travel restrictions during the global pandemic (Greenaway et al., 2021; Kluge et al., 2020). Some studies have featured the resilience and wisdom Chinese older immigrants have demonstrated in face of elevated racism, xenophobia, and ageism during COVID-19 (Wang et al., 2021). More studies are needed to uncover the

challenges and resilience among various groups of older immigrants during the pandemic.

Furthermore, some scholars tested interventions that address the loneliness of older migrants during the pandemic. Some emerging evidence has shown the promise of relationship-oriented interventions among older migrants (Lai et al., 2020). For example, a randomized control parallel trial in Canada identified a statistically significant reduction in the loneliness of Chinese older immigrants who received eight weeks of peer support (emotion and problem-solving support in-person and/or over the phone), compared with their counterparts in the control group who received regular brief phone greetings from the program coordinator (Lai et al., 2020). Another study suggested addressing financial difficulties and organizing outdoor socially-distanced activities with immigrant older adults might ameliorate loneliness among immigrants during the pandemic (Pan et al., 2021).

Theory and Conceptual Framework

Social Network Theory

Social network theory (SNT) highlights the importance of structural patterns in social interactions (Borgatti et al., 2009, 2013). SNT posits that the structure of the social networks (e.g. centralization, transitivity), the network environment (e.g. homophily, influence, and selection), and positions of individuals in a network (e.g. central, bridging, peripheral) contribute to different outcomes (Valente & Pitts, 2017). Rather than assuming complete independence of individual behavior, SNT acknowledges that

relationships among people are influenced by how others interact within a network (Borgatti et al., 2009, 2013).

Guided by the relational view of SNT, social network analysis (SNA) demonstrates how members of a network are connected through network structures (descriptive SNA) and how network structures influence outcomes, such as resource distribution, disease transmission, health behavior, access to resources, social capital, social support (Borgatti et al., 2009, 2013). Important social network structures identified in SNT are quantified by mathematical formulas in quantitative SNA (Borgatti et al., 2009, 2013). Through visualization, qualitative, and quantitative analysis, SNA reveals social structures and mechanisms within a social setting (Borgatti et al., 2009, 2013).

In addition to exogenous effects (e.g. individual age, gender, SES) that are independent of network interactions, inferential SNA also captures effects endogenous to a network (e.g. reciprocity, transitivity, clustering) (Borgatti et al., 2009, 2013). SNT/SNA complements individual-focused theory and methodology by conceptualizing and measuring the dependencies among members of a network (Borgatti et al., 2009, 2013). SNT provides a structural view of understanding social interactions (Kadushin, 2004). SNA not only applies SNT but is also an important method in systems science, which focuses on studying the often non-linear relationships among different components of a system (e.g. individuals, interpersonal relationships, organizational structures) through qualitative inquiry (e.g. critical systems heuristics) and quantitative methods (e.g. social network analysis, agent-based modeling) (Carey et al., 2015). The focus in system science is on the whole system rather than individuals. The conceptualization and

methodologies from systems science have been widely applied in areas such as public health and implementation science (Carey et al., 2015; Northridge & Metcalf, 2016).

General Terminologies in SNT/SNA. SNT/SNA utilizes specific terminologies when referring to a network. Participants who nominated friends are referred to as egos, whereas the nominated friends are alters (Borgatti et al., 2013). Egos are also referred to as nodes in quantitative SNA (Borgatti et al., 2013). In graph theory, egos are referred to as vertices (Borgatti et al., 2013). This study utilizes nodes/egos/vertices interchangeably to refer to participants who nominated friends. Egos can also be nominated as alters by other egos (Borgatti et al., 2013). Moreover, the relationship or connection between ego and alter is referred to as a tie (Borgatti et al., 2013). A tie is referred to as an edge in graph theory (Borgatti et al., 2013). Ties/edges are both utilized in this project to refer to relationships between egos and alters (Borgatti et al., 2013; Cranmer et al., 2020). Another concept related to an edge is a dyad. We say A and B are a dyad in the following four scenarios: (1) when A and B has does not have a tie; (2) when A is connected to B; (3) when B is connected to A; (4) When A and B are mutually connected (Borgatti et al., 2009; Kadushin, 2012). That is to say, dyads refer to all possible ties in the network whereas edges refer to existing ties (Borgatti et al., 2009; Kadushin, 2012). The following paragraphs define the network structures central in SNT/SNA and explain their relevance to the current study.

Network Size. Network size is the most commonly studied network structure in loneliness literature (e.g., Ma et al., 2020; Webber & Fendt-Newlin, 2017) and gerontology literature (Ayalon & Levkovich, 2019). Studies have found a negative relationship between older adults' loneliness and the size of their social networks, as well

as the frequency of contact with network members (Cornwell et al., 2008; Schafer et al., 2018). However, the size of the network and the frequency of contact have provided limited information on how individuals in a network are connected.

Centrality. Centrality reflects the prominence or structural importance of a certain node (Kadushin, 2012). Some common types of centrality include degree centrality, betweenness centrality, and closeness centrality (Borgatti et al., 2013). Degree centrality measures the number of social ties an individual has (Borgatti et al., 2013). Individuals with a high degree centrality are highly connected with other network members and may thus have advantages in accessing the social capital in a network (Borgatti et al., 2013). A node with a high degree centrality is also likely to be influential on the outcomes (e.g., health, well-being) of other people in the network (Borgatti et al., 2013). Another way an individual can be influential or central in a network is by controlling the path from one segment of the network to another (Borgatti et al., 2013; Brandes et al., 2016). Individuals with high betweenness centrality play indispensable roles in brokering network components (a group of nodes that are connected to each other) that would otherwise be disconnected (Borgatti et al., 2013; Brandes et al., 2016). Similarly, an individual with the highest closeness centrality has the shortest paths with all network members and thus is critical in spreading information efficiently (Borgatti et al., 2013; Brandes et al., 2016).

Schafer and colleagues found that healthier older adults in a retirement community tended to have a higher out-degree centrality (out-going ties) when socializing but a lower in-degree centrality (in-coming ties) when discussing important matters (Schafer, 2011). Older adults with a high degree centrality (have many social

ties) in an assisted living facility were more likely to connect with other residents and assist with the transition of new residents (Abbott et al., 2012). Additionally, older adults with a higher betweenness centrality in a dementia special care unit had a better quality of life, suggesting that betweenness centrality was associated with a better quality of life (Abbott & Pachucki, 2017).

Density. The density of social networks is defined as the number of direct ties out of all possible ties in a network (Kadushin, 2012). For instance, high density is often observed in kinship networks with a large number of connections among network members (Kadushin, 2012). In contrast, low-density networks tend to have disconnected structural holes (Kadushin, 2012). Smaller networks tend to have a higher density than larger networks given a fixed number of edges (Borgatti et al., 2009, 2013). Egos bridging the structural holes in low-density networks acquire power and importance in the network by controlling the flow of resources, information, and communication between two groups (Kadushin, 2012).

Network density has also been correlated with the well-being of older adults. For instance, older adults in dense social networks were less likely to experience abuse even when perpetrators were embedded in older adults' social networks (Schafer & Koltai, 2015). This finding also indicated that the network environment operated independently from dyadic relationships (e.g. perpetrator and survivor), which again suggested the importance of studying the full networks of older adults (Schafer & Koltai, 2015).

Reciprocity. Reciprocity is present when a relationship is mutual. For example, individual A identifies individual B as a friend, and when B also regards A as a friend, A and B's friendship is reciprocal. In contrast, when A nominates B as a friend, but B does

not identify A as a friend, A and B's friendship is not reciprocal. Early in the life course, humans learn to reciprocate as an important means to develop and maintenance of friendships (Kadushin, 2012). However, people can also "reciprocate" hurtful actions for revenge (Borgatti et al., 2013).

Reciprocity of support is important for enhancing the sense of belonging and preventing loneliness among older adults (Morgan et al., 2019; Wiles et al., 2019a). The benefits of offering help may outweigh the benefits of receiving help (Morgan et al., 2019; Wiles et al., 2019a). In addition to meeting older adults' needs for services, creating opportunities for their active participation and contribution is equally important for aging well (Neville et al., 2018; Torres & Serrat, 2019). Breheny and Stephens (2009) examined how older people balanced social connections and independence when interacting with friends and families through reciprocity. Findings from semi-structured interviews indicated that older adults were more likely to accept social support when they can reciprocate or have contributed in the past (Boneham & Sixsmith, 2006; Breheny & Stephens, 2009). Older adults used reciprocity as the standard to form or dissolve relationships with people (Breheny & Stephens, 2009).

Transitivity and Clustering. Transitivity and clustering have been often used interchangeably in network studies (Borgatti et al., 2009; Kadushin, 2012). The transitivity of networks refers to the number of closed triangles in a network. For example, person A and person B have a common friend C, when person A and person B are also friends, person A, B, and C form a closed triangle. Transitivity is prevalent in human networks and distinguishes human networks from physical, biological, or neural networks (Kadushin, 2012). That is to say, if A has a tie with B, B has a tie with C, then

A is likely to have a tie with C and forms a close triangle (Borgatti et al., 2013). Transitivity reflects the social mechanism that a friend of a friend is likely to be a friend (Kadushin, 2012). The clustering coefficient of a network is the percentage of closed triads in a network (Borgatti et al., 2013). A high clustering coefficient and high density have been associated with higher levels of perceived support (S. Lee et al., 2016).

Transitivity or closed triads can lead to the formation of clusters, defined as groups or cliques within a larger network that has a higher density of ties within than outside of the clique (Borgatti et al., 2013). Individuals in clustered social networks have reported higher levels of perceived support (S. Lee et al., 2016) and have also been more influenced by the health/social behaviors of their network members (Flatt et al., 2012; Lin et al., 2019). Some studies suggested that residents in therapeutic communities who have highly clustered networks experienced lower rates of reincarceration (Campbell et al., 2019). The formation of clusters can foster a sense of connectedness but can also contribute to clusters that jeopardize the common goal within a network (Campbell et al., 2019). Clustering often accompanies other network phenomena/structures such as homophily (Kadushin, 2012).

Older adults in long-term care facilities had the propensity to cluster based on health, cognitive, and functional status. Abbott and colleagues (2012) collected social network data with the assistance of photos and network rosters in an assisted living facility. The researchers found that older adults with cognitive impairment had fewer social ties than those without the impairment. Older adults with cognitive impairment often relied on their spouses with no cognitive impairment to connect with others (Abbott

& Pachucki, 2017). Furthermore, older adults with cognitive impairment lacked ties with residents who had high cognitive functioning(Abbott & Pachucki, 2017).

Homophily. Social network theories (SNT) suggest that similarities support connections, a social network feature referred to as homophily (Valente & Pitts, 2017). Homophily can be categorized by status homophily (e.g., age, gender, race/ethnicity, social-economic status) and value homophily (e.g., beliefs, religion) (Paolillo & Lorenz, 2018). Some agent-based modeling studies have suggested that valued-based homophily reduced ethnic segregation (Henry, 2021; Paolillo & Lorenz, 2018). However, strong ethnic homophily has fostered high levels of ethnic as well as value segregation (Paolillo & Lorenz, 2018).

Homophily can also be categorized into structurally induced homophily and choice-based homophily (Ertug et al., 2022; Melamed et al., 2020). Whereas structurally induced homophily is usually shaped by the organizational, community, and/or societal structures; choice homophily refers to choosing to connect with similar individuals out of personal preferences (Ertug et al., 2022). In practice, it is challenging to distinguish between induced versus choice-based homophily (Ertug et al., 2022). For example, some people might have chosen to be affiliated with certain organizations because they prefer to stay with similar individuals. It is also possible that people initially affiliated with an organization for a certain service (e.g., housing), and then happened to meet others sharing similar identities due to structural factors (e.g., geographic locations) (Ertug et al., 2022; Firmansyah & Pratama, 2020). Therefore, parsing out whether choice or structure was the primary mechanism behind homophily was often complicated. In other words, homophily can be a result of individual choice, interpersonal dynamics, and/or

induced by environmental/structural constraints (Ertug et al., 2022; Firmansyah & Pratama, 2020).

Homophily is often considered a barrier to the social integration of marginalized groups and can negatively impact their employment and economic opportunities (Henry, 2021; Paolillo & Lorenz, 2018). Studies have suggested that homophilous ties tend to be strengthened over time, thereby contributing to sustained clustering within the group and segregation between the groups (Henry, 2021; Melamed et al., 2020; Paolillo & Lorenz, 2018).

Similarly, studies guided by the bonding and bridging social capital theory as well as the structural holes versus network closure theory (a branch of SNT) have found that homophily had negative economic, social, and resource ramifications on marginalized communities (Burt, 2017; Claridge, 2018; Gao et al., 2013; Gonzales & Nowell, 2017; Lancee, 2020; Torres-Vitolas, 2018). In the above two theories, bonding ties usually referred to relationships among people from the same culture whereas bridging ties usually referred to relationships among people from distinct cultural groups (Claridge, 2018). In a network with complete closure, all individuals were connected with one another usually based on certain shared identities (i.e., homophily) (Lancee, 2020). For example, high levels of network closures were observed within a kinship network and a co-ethnic community (Lancee, 2020). In comparison, structural holes where network components were disconnected often offer opportunities for bridging ties to connect unique resources across the otherwise disconnected components of a wider network (Lancee, 2020). That is to say, high levels of homophily with the absence of cross-cultural intervention can contribute to the isolation of a diverse community from the

larger society, which further constrains their social, economic, and political resources (Claridge, 2018; Lancee, 2020).

Nonetheless, other researchers argued that homophily fostered a sense of safety and belongingness within the group, which has been a basic psychological motivation for establishing social networks (Kadushin, 2012). The literature has suggested that working-age immigrants were more likely to establish and maintain social relationships with people sharing similar ethnicity and first language than non-immigrants (Q. Li, 2018). Strong ties with one's own ethnic community and family members not only fostered confidence in one's culture but also reinforced a sense of belongingness in the host country (Q. Li, 2018). In contrast, intercultural communication was not directly correlated with immigrants' sense of belonging (Q. Li, 2018). Some qualitative studies asserted that connecting with other co-ethnic older adults helped older immigrants overcome language and cultural barriers in fostering a sense of connectedness (Wright-St Clair et al., 2018). However, other researchers continued to be concerned about the cocooning effect of interacting only within co-ethnic communities and separating from the larger multicultural society (Fukui & Menjívar, 2015; Torres & Serrat, 2019). More studies are needed to understand the role of homophily in the network of diverse older adults.

Life Course Perspective

Life Course Perspective (LCP) (Elder et al., 2003) has been frequently applied to the integration and social connectedness of immigrants and their families (Wingens, Windzio, Valk, & Aybek, 2011). There are five major principles in LCP: (1) aging as a

lifelong process; (2) human agency (e.g., immigration decisions); (3) historical time and place; (4) timing of transitions (e.g., age at immigration); (5) interdependency and linked lives (e.g., social networks, family interdependence) (Elder, Johnson, & Crosnoe, 2003).

Cross-sectional LCP studies have focused on the impact of major life transitions (e.g., immigration, retirement, loss, and bereavement) on individuals' health, well-being, and opportunities in the contexts of historical time and place (Treas & Gubernskaya, 2016; Wingens et al., 2011). Throughout the aging process, major life transitions and one's human agency were associated with the changes in older migrants' linked lives (social networks) (Treas & Gubernskaya, 2016; Wingens et al., 2011). The impact of the transitions can vary by the timing and the duration of the transition (Z. Wu & Penning, 2015). Moreover, individuals going through the transitions can utilize their human agency to shape their experiences (Almeida & Wong, 2009; Elder et al., 2003; Wong & Almeida, 2013). LCP is helpful for this study because the "linked lives" coincide with the investigation of participants' social networks within and outside of the SCP.

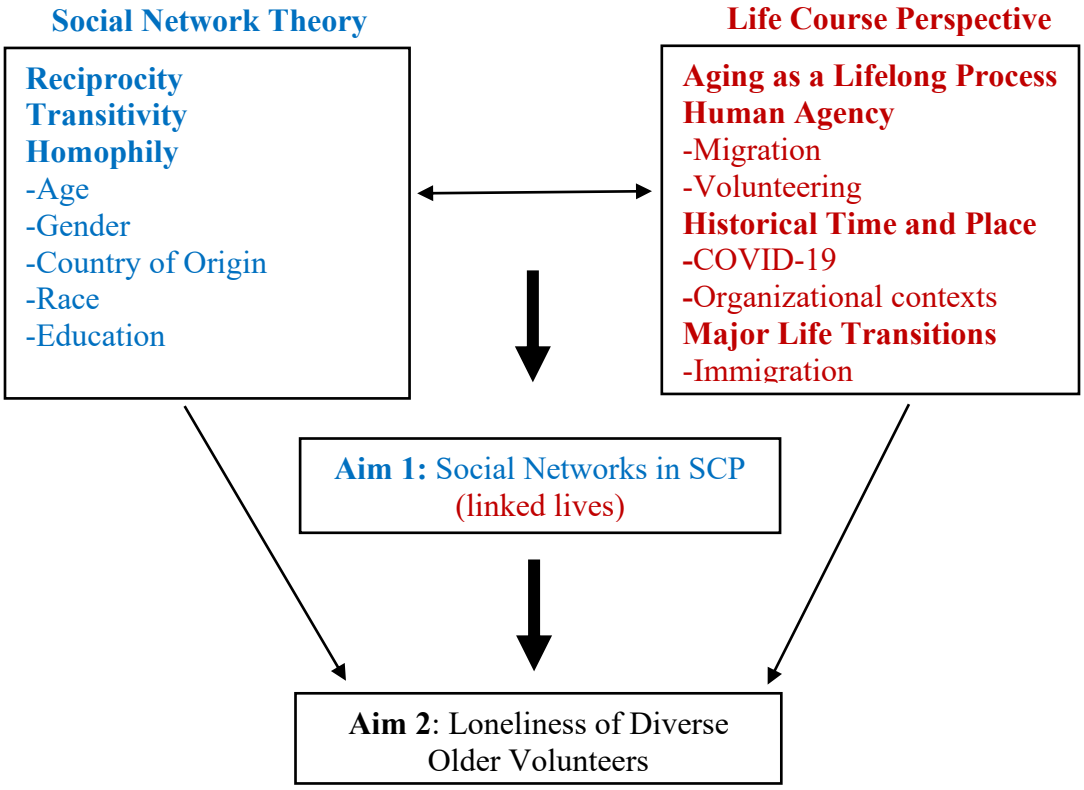
LCP complements the SNT by highlighting the impact of aging-related major life transitions, immigration (major life events), the timing of transition (age at immigration), and human agency (e.g., volunteering) (Treas & Gubernskaya, 2016). Because of its flexibility, LCP has often been integrated with other theories and frameworks in social sciences (Treas & Gubernskaya, 2016; Wingens et al., 2011). The conceptual framework of this study (Figure 1) integrates the LCP with SNT.

Linked lives. As mentioned above, social connections play a central role in the health and well-being of older immigrants (Dong et al., 2012b; Guo et al., 2015; Guo, Stensland, Li, et al., 2020). The linked lives in LCP guide researchers in exploring whether/how family and friendship networks impact networking within SCP and whether/how friendships within SCP extend beyond the program.

The emphasis on linked lives in LCP naturally integrates with the focus on social network dynamics in SNT. Moreover, LCP complements the SNT by highlighting the impact of aging-related major life transitions, immigration (major life events), the timing of transition (age at immigration), and human agency (immigration, volunteering) in this network study (Treas & Gubernskaya, 2016).

The conceptual framework that integrates SNT and LCP of this study is displayed in Figure 1. The concepts unique to LCP and SNT are presented in separate text boxes in Figure 1. Because the *linked life* principle in LCP overlaps with SNT, both theories have jointly informed the data collection (e.g., friendship nomination form) and analysis of Aim 1 regarding the social network structures of SCP. Their joint influence on Aim 1 is represented by the bold arrow in Figure 1. For Aim 2, the lead researcher has integrated the non-overlapping concepts unique to LCP and SNT to guide the inquiry and analysis. SNT supports the investigation of how network processes contribute to loneliness, whereas LCP prompts the examination of how socio-demographic characteristics and major life transitions impact loneliness. The two separate arrows from SNT and LCP in Figure 1 represent their unique contribution to Aim 2. The bold arrow from Aim 1 to Aim 2 suggests that the network processes explored in Aim 1 set the stage for Aim 2.

Figure 1. Conceptual Framework



Gaps in the Literature

Several major gaps exist in our understanding of social networks and the loneliness of diverse older volunteers. First, in the loneliness literature, incorporating the social network perspective can advance our understanding of the emergence and spread of loneliness in various social settings (J. T. Cacioppo et al., 2009). Among the studies that have assessed the relationship between social networks and psychological well-being (e.g., J. T. Cacioppo et al., 2009; Elmer, 2020; Prochnow et al., 2020), few specifically focused on older adults.

Second, in the migration literature, studies have mainly focused on the social integration of working-age immigrants, immigrant children, and children of immigrants

through the "strength of weak ties" in the labor force or the educational system (e.g. Q. Li, 2018). The networks of older immigrants have been overlooked. Among studies on the social relationships of older immigrants, a heavy emphasis has been placed on older immigrants' kinship and close friendships (e.g. Guo et al., 2015, 2019; Guo, Byram, & Dong, 2020; Guo & Stensland, 2018). As a result, there is limited information regarding older migrants' social networks outside of their families. Additionally, existing social network studies on older immigrants have been mainly qualitative, focusing on their perceptions, barriers, and facilitators to social engagement (Torres & Serrat, 2019). Among the few network studies that have examined network structures quantitatively, findings have been limited to network size, typology, and composition (e.g. N. S. Park et al., 2015, 2018).

Third, in the gerontological literature, among the growing number of studies on the network structures of older adults, few have investigated networks of community-living older adults (Ayalon & Levkovich, 2019). Because social structures are influenced by cultural norms and organizational contexts (Kadushin, 2012, 2004), the existing network studies on middle-class white older adults in long-term care facilities provides limited insight into how low-income diverse older volunteers interact.

Fourth, although participation in volunteering programs was negatively associated with the loneliness of older adults (Crittenden, 2018), the social interactions among older volunteers were not systematically investigated. Despite the evidence supporting the social benefits of SCPs (Butler, 2006), it is unclear how volunteers' social networks correlated with their loneliness. Volunteering and friendship programs have offered critical opportunities to low-income diverse older volunteers who would otherwise have

limited access to social networks outside of their families (Wiles et al., 2019a). Therefore, it is important to investigate the social networks within and outside of the volunteering program.

Moreover, the number of minority older immigrants and refugees have been growing both nationally and locally in central Ohio (American Community Survey [ACS], 2015, 2018; OSUCSW & Columbus City Council, 2018). Central Ohio has the largest population of Bhutanese refugees and the second largest population of Somali migrants in the U.S. (OSUCSW & Columbus City Council, 2018). With the increasing diversity of settlement locations of older immigrants and refugees (Marrow, 2020), more studies need to investigate the social integration of older immigrants in non-traditional immigration destinations (an immigration destination with an increasing number of immigrants but little history/infrastructure to host large numbers of immigrants) (Marrow, 2020), including central Ohio.

To address the gaps above, this *convergent mixed-method study* sheds light on the network structure among a group of diverse older adults and examines how the social network of diverse older volunteers correlates with their loneliness. Through the mixed-method integration, this study reveals the social dynamics and structures among diverse older volunteers. This study also examines the role of the social network in volunteers' loneliness (Borgatti et al., 2009, 2013). The specific aims, the corresponding research questions, and the quantitative hypothesis of this study are presented below:

Aim 1: Explore social networks of diverse older volunteers within and outside of the volunteering program by merging participants' accounts of their social interactions with quantitative network structures.

(1) QUAL: Accounting for human agency and organizational contexts, what are older volunteers' experiences interacting with other volunteers of SCP, clients from SCP, and family members/friends?

(2) QUAN: What are the quantitative social network characteristics among diverse older volunteers of SCP? To be specific, do volunteers tend to be friends with those sharing similar characteristics (i.e., age, gender, race, country of origin, education, site station)? Do volunteers tend to be friends with those who reciprocate? Does a pair of friends tend to agree on a third person as a common friend in the SCP network?

Aim 1 Quantitative Hypothesis: all homophily variables, reciprocity, and transitivity are positively associated with tie formation within SCP.

(3) Mixed-Method: How do participants' experiences support, challenge, and/or expand the quantitative network characteristics?

Aim 2: Examine the role of the SCP network in volunteers' loneliness by integrating participants' perspectives with the statistical significance of the network autocorrelation when estimating loneliness.

Aim 2 addresses the following three research questions:

(1) QUAL: How do diverse older volunteers perceive the role of social networks in the experiences of loneliness?

(2) QUAN: Is the network autocorrelation statistically significantly associated with loneliness among diverse older volunteers when accounting for other predictors of loneliness?

Aim 2 Quantitative Hypothesis: holding all else constant, the network autocorrelation is positive within the SCP network. Specifically, it is hypothesized that

individuals are prone to connect with those sharing similar levels of loneliness. This hypothesis is supported by the existing studies that identified a positive autocorrelation among network members' depression and loneliness (J. T. Cacioppo et al., 2009; Elmer, 2020; Prochnow et al., 2020).

(3) Mixed-Method: How do participants' perceived importance of the social network in loneliness converge with and diverge from its statistical significance?

Significance

Findings from this study can inform future research and services for diverse older volunteers. Aim 1 reveals critical network structures contributing to the relationship formation among diverse volunteers, enabling practitioners to intentionally foster or avoid certain network structures (e.g., identity-based homophily, transitivity) within their organizations. In other words, findings offer specific guidance for human and aging services (e.g., volunteering programs, companionship programs) in structuring and organizing social interactions among program participants.

By underscoring the importance of network correlation in volunteers' experiences with loneliness, findings from aim 2 set the stage for future research on how specific network structures contribute to loneliness. Findings also have implications for loneliness prevention and intervention by encouraging the adoption of network interventions, such as targeting individuals in certain network positions (e.g. central, peripheral, isolated); or adding, modifying, deleting, and rewiring social ties (W. Liu et al., 2017; Valente & Pitts, 2017). Additionally, as one of the first mixed-method studies on the social interactions among volunteers and their impact on volunteers' loneliness, findings underscore the

often-overlooked role of interactions among volunteers in sustaining organized volunteering.

Furthermore, by examining networks within and outside of SCP, this current study sheds light on the relationship between the SCP network and volunteers' external support system (e.g., friends and families). Understanding the relationship between various networks of diverse older volunteers can provide a holistic understanding of diverse older volunteers' social connectedness.

Besides, considering the lack of mixed-method network studies, the integration of qualitative and quantitative methodology in this current study can inform future applications of mixed-method social network studies among diverse populations. This study provides valuable insight into the data collection, sampling, analysis, and data integration for mixed-method network studies. As one of the few network studies on multiple groups of culturally and linguistically diverse older adults, this study also offers important methodological considerations for future multilingual and multicultural research.

Chapter 3. Methods

Research Design

This study has adopted a pragmatist epistemological worldview. Unlike qualitative or quantitative studies that are usually guided by a single philosophical worldview, convergent mixed-method studies adopt a pragmatist worldview that is pluralistic in nature (Creswell & Clark, 2018). The pragmatist worldview is problem-centered and focuses on what works when addressing real-world problems (Creswell & Clark, 2018). Pragmatism does not see positivism and constructivism as conflicting paradigms (Creswell & Clark, 2018). Instead, a pragmatic mixed-method study collects information from both subjective experiences through a bottom-up approach and a top-down process to reveal the complex reality (Creswell & Clark, 2018). Thus, a pragmatic epistemological worldview welcomes the integration of approaches informed by both constructivism and positivism in one study to form a wholistic understanding of the reality.

Informed by a pragmatic epistemological worldview, this convergent mixed-method study (also referred to as a concurrent mixed-method study) collected both qualitative and quantitative data at approximately the same time with the purpose of triangulation, convergence, and comparison between the two types of data (Creswell & Clark, 2018). In this convergent mixed-method study, the sampling, data collection, and analysis of qualitative and quantitative data were independent. The collection of

quantitative data did not depend on the findings from qualitative data and vice versa (Creswell & Clark, 2018). The convergent mixed-method design was appropriate for this study because one type of data alone did not provide a complete understanding of the research questions (Creswell & Clark, 2018).

This convergent mixed-method design triangulated the qualitative and quantitative information of social networks in this study. Social Network Analysis (SNA) was derived from Social Network Theory (SNT) and was designed to demonstrate the structures of social relationships (Borgatti et al., 2013). Viewing its history, SNA had roots in both qualitative and quantitative inquiries. In the social sciences, social network graphs initially emerged as a simple visualization tool in sociology and anthropology. Before the introduction and development of graph theory and mathematical methods in network science (S. Wasserman & Faust, 1994), anthropologists and sociologists already investigated social interactions and social networks qualitatively (Hollstein, 2011). Qualitative network approaches aimed to explain why and how networks form from participants' perspectives (Hollstein, 2011). With the later development of mathematical and graphical methods, SNA evolved into a field dominated by quantitative methods, representing social structures through mathematical formulas and graphs (Yousefi Nooraie et al., 2018). Quantitative SNA accounted for the dependencies among participants statistically, which was not possible in conventional quantitative methods that require independent and identical distribution (IID) of observations (Cranmer et al., 2020). The development of the inferential social network analytical methods enabled researchers to identify statistically significant network structures and processes, which contributed to the formation or dissolution of relationships (Cranmer et al., 2020).

Being rooted in both qualitative and quantitative research, SNA is inherently compatible with the mixed-method approach. The mixed-method approach allowed qualitative and quantitative methods to complement each other in SNA (Yousefi Nooraie et al., 2018). Qualitative SNA provided the contexts, processes, and rationales for forming social relationships; whereas quantitative SNA produced network graphs, descriptive network characteristics, statistically significant network properties that affected the relationship formation, and statistically significant network processes associated with individual-level outcomes (e.g., health, health behavior, social connectedness) (Steglich et al., 2012; Van Asselt-Goverts et al., 2018; Webster et al., 2019; Windsor et al., 2016).

In this study, qualitative SNA alone provided no statistical evidence on the association between network structures and loneliness, whereas quantitative SNA provided limited information on the context, motivation, and processes of interactions. Integrating qualitative and quantitative data offered a more comprehensive picture of older volunteers' social networks. Triangulating quantitative and qualitative network data enabled researchers to not only identify the quantitative social structures among diverse older volunteers but also how and why these structures were formed from participants' perspectives. Additionally, comparing the qualitative and quantitative findings on how the social network correlated with loneliness provided both statistical and contextual (e.g., cultural, organizational, and interpersonal) explanations of how the SCP network was associated with volunteers' loneliness.

Participants

The Senior Companions Program (SCP) is a federal volunteering program that connects low-income older adults with homebound older adults to foster social connectedness and prevent loneliness in both groups (Butler, 2006). The Columbus Ohio SCP recruited older volunteers and clients into the program via recruitment talks in the community, often assisted by other non-profit organizations (e.g., Community Refugee and Immigrant Services [CRIS], Asian American Community Services [AACS]) referred to as site stations. Once recruited, older volunteers and their clients were matched based on their personal preferences. Older volunteers and their clients could choose to be matched with those who share similar ethnic, language, and cultural backgrounds.

The low-income older volunteers in SCP consisted of culturally and linguistically diverse older volunteers with migrant backgrounds. Each group of older migrants had a unique migration trajectory to the U.S. This and the following paragraphs provide some general cultural contexts regarding the different groups of older migrants in the SCP. The Nepali-speaking volunteers are Bhutanese who are ethnically Nepali. When Bhutan launched the ethnic cleansing campaign ("one country, one people") in the mid-1980s, the ethnically Nepali Bhutanese fled from Bhutan to Nepal, where they lived in the refugee camps for many years before resettling in other countries (e.g., U.S., Australia) (Centers for Disease Control and Prevention [CDC], 2021a). Hinduism is the most common religion among the ethnically Nepali Bhutanese refugees in the U.S. (CDC, 2021a).

The civil war, natural disasters, and famine have contributed to large-scale emigration from Somalia in recent decades. Somali migrants included both refugees and voluntary immigrants (Tamir & Anderson, 2022). Somali migrants in the U.S. have been

largely concentrated in cities such as Minneapolis, Columbus, and Seattle in the U.S. (Centers for Disease Control and Prevention [CDC], 2021b). Islam is the state religion of Somalia (CDC, 2021b).

The majority of Cambodians migrated to the U.S. between 1975 and 1994. The national language of Cambodia is Khmer. The majority of Cambodians were refugees escaping the brutality of the Khmer Rouge regime as well as the subsequent social and political turmoil (Chan, 2015; Pew Research Center, 2021). Despite experiencing challenges with mental health (e.g., post-traumatic stress disorders) and integration into the U.S. educational system as well as the labor force, Cambodian refugees established vibrant communities honoring their traditional culture and religion (i.e., Buddhism) after resettling in the U.S. (Chan, 2015).

Another group of diverse volunteers in SCP spoke Russian. According to the SCP staff members, most Russian-speaking volunteers in the SCP program were post-World War II Jewish immigrants, including survivors of the holocaust. The educational and employment success among Jewish Russian immigrants was documented in the literature (Chiswick & Larsen, 2015). Despite language and employment challenges at their initial arrival, most working-age Russian-speaking Jewish immigrants in the U.S. gained income comparable to their U.S.-born counterparts in a relatively short amount of time (Chiswick & Larsen, 2015). To summarize, each group of older migrants was exposed to different economic, political, and social conditions before and after migration.

Sampling

This study conducted convenience sampling for both qualitative and quantitative participants from the SCP in Columbus. All current volunteers of SCP in Columbus were

eligible for the study. Because the goal of this study was direct comparison and integration of qualitative and quantitative data, both types of data were drawn from the same sample at approximately the same time (Creswell & Clark, 2018). Participants first completed the quantitative survey and then participated in the focus groups. Completing the survey first allowed the participants sufficient time to complete the friendship nomination form and prepared them for questions in the focus group. The design was still considered convergent because the collection of qualitative data was not dependent on the results from the quantitative analysis (Creswell & Clark, 2018).

Recruitment

The community engagement and recruitment process of this study was facilitated by the existing collaborative relationship between the Age-Friendly Innovation Center (AFIC) and SCP. AFIC has aimed to foster equal opportunities for engagement and participation (e.g., volunteering, employment) for people of all ages, particularly for older adults (Choi et al., 2020; Menec, 2017). AFIC engaged with SCP volunteers related to Age-Friendly Community domains and transportation services in previous research efforts in 2016 and 2019 (Dabelko-Schoeny et al., 2021; Mid-Ohio Regional Planning Commission, 2017). Prior connections with SCP facilitated the relationship-building between the research team and the SCP staff members.

With assistance from the SCP volunteer coordinators in Columbus, the lead researcher recruited both the interview and survey participants through the dissemination of flyers (Appendix A). The SCP volunteer coordinator shared the flyer inviting older volunteers to participate in the scheduled in-service training. Older volunteers who attended the training were then invited to participate in the study. SCP volunteers were

invited to participate in focus groups and complete paper surveys in the language they prefer. The total time commitment was approximately two hours from the volunteers in the in-service training.

Data Collection Procedures

Training The Research Team

Members of the AFIC assisted with the data collection. All team members have a minimum bachelor's degree in a social science discipline. All team members completed the Collaborative Institutional Training Initiative (CITI), Responsible Conduct of Research (RCR), and the Conflict of Interest (COI) (Ohio State University Office of Research Compliance, 2020). All participants received training and/or had experience conducting focus groups. A 90-minute ZOOM training and a 90-minute in-person training were provided to the team members regarding the purpose, methods, and procedures of this study. The ZOOM training was conducted approximately one month before the data collection.

Through the training, the lead researcher trained in social network analysis presented the survey and research guide to the team. First, the lead researcher conveyed the purpose of the friendship nomination form and explained relevant ethical considerations. Second, the lead researcher discussed the purpose and structure of the interview guide with the team. Third, the lead researcher provided written instructions on focus group facilitation and survey data collection to address important logistic considerations (e.g., time management, recording, working with interpreters) in the data collection process. In addition to the one-hour ZOOM training, the lead researcher

provided logistic updates via several team meetings and answered questions about the study between meetings. Another in-person training was held one day before the data collection to review the instruments, procedures, and the logistics of data collection.

Consent

Verbal consent for the focus group and survey was collected from participants before the data collection. As facilitators read through the script, a translated written copy of the consent script was provided to participants to facilitate understanding. The interpreters assisted with the verbal consent process for companions whose preferred language was not English. Appendix B contains the verbal consent scripts for staff members. Appendix C presents the verbal consent script utilized with volunteers. Both qualitative and quantitative data were collected from the same sample during the October in-service training in 2021.

Qualitative Data Collection

Expert Interview. Expert interviews were conducted with SCP staff members to understand how organizational structures shaped the social networks among senior companions. The lead researcher interviewed three staff members of SCP about organizational structures, contexts, volunteer and staff interactions, formal and informal socialization opportunities for volunteers, and the impact of the pandemic on the program. The expert interview guide is presented in Appendix D. The staff members received a $20 gift card for their participation. Expert interviews were conducted in late September and early October in 2021 before the focus groups with SCP volunteers.

Focus groups with Diverse Volunteers. Focus groups were conducted with older volunteers of SCP in October 2021. Compared with one-on-one interviews, the unique advantage of focus groups has been to generate a diversity of ideas by encouraging the exchange of perspectives among participants (Rabiee, 2005; Sargent et al., 2017). Focus groups have been adept at stimulating information-rich conversations particularly when trust and relationships have been developed among participants (Rabiee, 2005; Sargent et al., 2017). With the established long-term rapport among the SCP volunteers and skillful facilitation, focus groups can invigorate volunteers to discuss their shared as well as distinct experiences with volunteering, social relationships inside and outside of SCP, direct encounters with, or observations of loneliness in their network.

Focus groups were recorded upon participants' permission. The research team took detailed field notes documenting participants' non-verbal language, verbal responses, the study setting, and sitting arrangement during the focus group. In the focus groups, the facilitators asked open-ended questions to (1) understand the social interactions among diverse older volunteers within and outside of the volunteering program and (2) identify older volunteers' perception of the role of the social network in loneliness. The interview guide (Appendix E) consisted of an ice-breaking question followed by four to five sub-questions for each topic in the interview guide (Creswell, 2014). Researchers included probes in the interview guide when needed. The purpose of including probes was to elicit additional, detailed, and focused information if needed (Creswell, 2014). For participants who provided comprehensive and detailed information in response to an interview question, probing questions were not used (Creswell, 2014). Interviews were conducted by the lead researcher with assistance from interpreters based

on the language preference of participants. To facilitate the merge of qualitative and quantitative data (Creswell & Clark, 2018), the lead researcher asked parallel questions on concepts central to the quantitative inquiry (i.e., social interactions, social networks, and loneliness) in the qualitative focus groups (Creswell & Clark, 2018). The focus groups took approximately 60 minutes.

Quantitative Data Collection

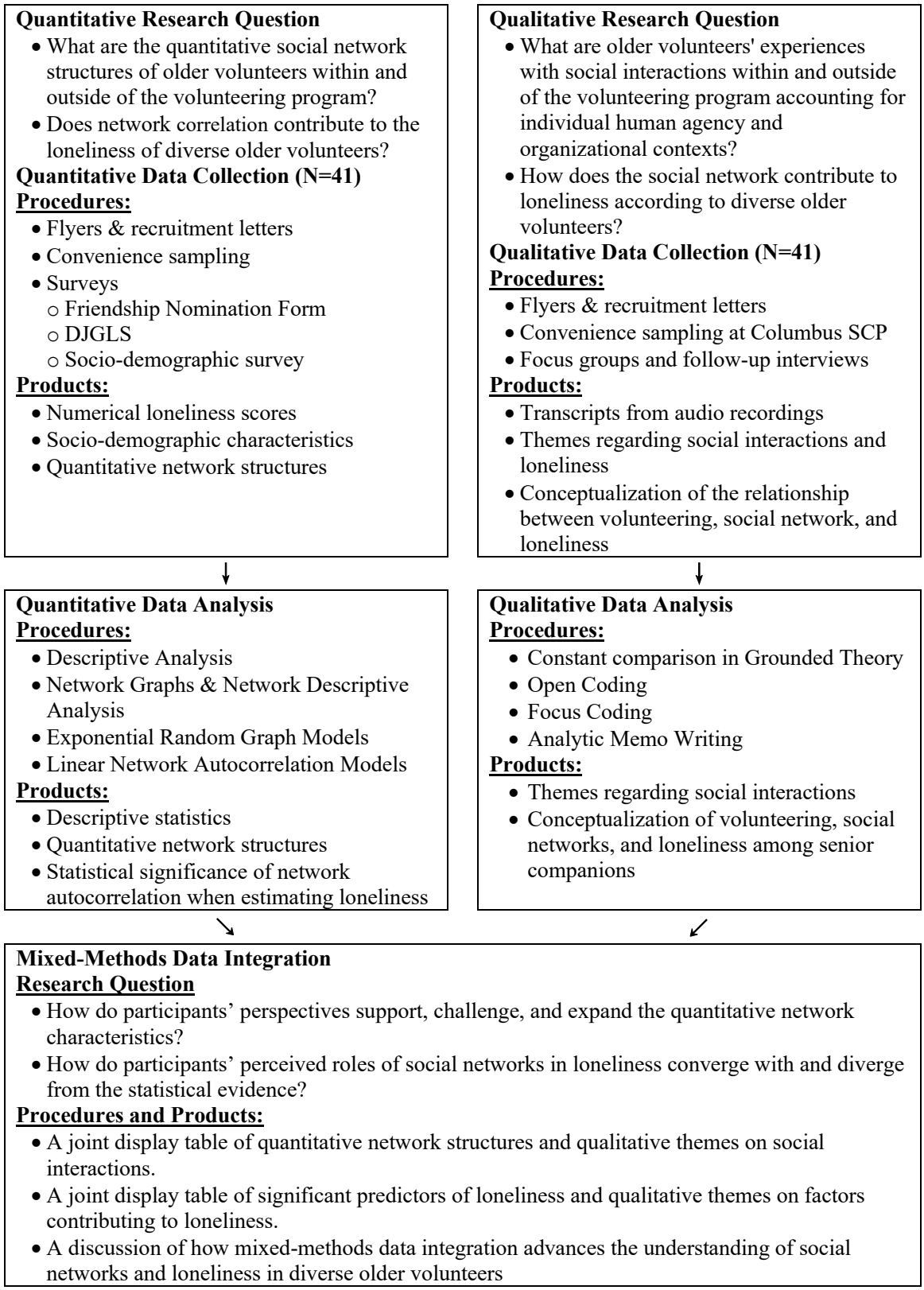
Quantitative data were collected through surveys at the in-service training. Participants were asked to complete the following paper surveys: a socio-demographic survey (Appendix F), a friendship nomination form (Appendix G), and the De Jong Gierveld Loneliness Scale (DJGLS) in Appendix H. After providing their demographic information, participants completed the friendship nomination form. Each participant (ego) was asked to identify the names of five friends (alters) they met through the Senior Companion Program (SCP), their relationship with each alter, and each alter's characteristics (e.g., age, gender). Using a name roster of senior companions provided by SCP, the facilitators directed participants to refer to the name roster and provide the names of their friends in English whenever possible. The last survey participants completed was DJGLS, which is a six-item standardized instrument assessing individuals' loneliness.

The participants completed the paper surveys in the language they preferred. The facilitators explained the purpose of each survey and answered questions from participants with the interpreters' assistance when needed. The paper surveys took approximately 30 minutes for participants to complete. The lead researcher provided a

$10 gift card to each older volunteer who participated in the survey and/or the focus groups during the in-service training. Older volunteers were also entered into a lottery system to win a $100 gift card and one volunteer received the $100 gift card.

After reviewing and cleaning the collected data, three follow-up interviews were conducted in November 2022, using the same data collection instruments to improve the completeness of social network data. Because the majority of the incomplete network surveys were from English-speaking participants, the follow-up interviews were conducted with English-speaking participants with incomplete friendship nomination forms. Those who responded to the outreach text were recruited for the follow-up interviews. The follow-up interviews were recorded upon participants' permission. Notes were taken to ensure accurate documentation of the information. If participants nominated less than five friends in the initial data collection, they were asked if they would like to nominate additional friends during the follow-up interview. The lead researcher also utilized the interview guide on volunteering, social network, and loneliness in follow-up interviews to enrich existing qualitative findings. The follow-up interviews were around 30 minutes each. An additional $10 gift card was mailed to the older volunteers after the follow-up interview. A summary of the qualitative and quantitative procedures of this current study is presented in Figure 2.

Figure 2. Study Procedures



Measures

Socio-demographic Characteristics

The age of participants was calculated by subtracting the year of birth provided by participants from 2021. Gender was collected through the question "What is the gender you identify with?" consisting of three response options: male, female, and other. Participants were asked to select one country/region of origin from the following categories: United States, China, Bhutan, Cambodia, Nepal, Russia, Somalia, and other. The lead researcher consulted the SCP staff members when constructing the response options for the country of origin to ensure their relevance to the SCP volunteers. Additionally, participants were instructed to select all that apply for their race and ethnicity. Response options for race/ethnicity included: White, Black or African American, American Indian or Alaska Native, Asian or Pacific Islander, Hispanic or Latino/Latina/Latinx, and other.

Participants also selected their highest level of education from the following response options: no high school degree, high school degree or equivalent, some college, no degree, Associate degree, Bachelor's degree, and graduate or professional degree. Furthermore, participants selected all categories that applied to their current employment status among the following: employed full-time, employed part-time, self-employed, retired and not looking for work, unemployed but looking for work, and other. Marital status was measured through a multiple-choice question "what is your current marital status" with the following categories: married, divorced or separated, never married, widowed,

and cohabitation (living with a partner without being married). Participants selected all that apply for their household living arrangement from the following categories: I live alone, I live with a spouse/partner, I live with my children, I live with my grandchildren, I live with other relatives, I live with non-relatives, and other.

In addition, participants were asked to provide their age of migration and length of residence in the U.S. if they were not born in the U.S. Participants also rated their perceived health and neighborhood livability via Likert Scale questions: "How is your health in general?" and "Thinking about your neighborhood as a whole, how would you rate the neighborhood you live in?" Each of the two Likert Scale questions had response options ranging from very bad to very good. In addition, participants' frequency of volunteering in the past month and the number of family and friends seen or heard from at least once a month were collected through separate text-entry questions. Whenever an "Other" category was provided as a response option, there was space for specifying the answer. Detailed information about the question type and wording of the socio-demographic survey can be found in Appendix F mentioned above.

Network Structures

Participants were asked to nominate up to five people they met through SCP whom they regarded as friends via the friendship nomination form (Appendix G). Each row in the nomination form represented an alter. When an ego nominated an alter, a tie was defined from ego to alter. The strength of the tie was then evaluated through Question 9 in the nomination form: "How many times have you interacted with (e.g., in-person, phone) this person in the past month?" The frequency of interactions as reported

by volunteers was then introduced as the network weight for the valued Exponential Random Graph Models (ERGM) in this study, which is explained in detail in the analysis section.

As discussed in Chapter 2, commonly modeled network structures included degree centrality (in-degree centrality, out-degree centrality), popularity, reciprocity, transitivity/clustering, and the density of a network. Some commonly modeled endogenous network structures were presented in Table 1. These network structures were examined in the ERGM of this study. The diagram in the table presents a graphical definition of the specific network structures. The text definition of the network structure reflects its conceptual meaning and also its operationalization in ERGM. The following paragraphs further discuss how questions asked in the friendship nomination form translate into each network structure.

Degree centrality represented the importance or prominence of a node by counting how many friends each node had (Borgatti et al., 2009). In this directed network, in-degree centrality was the number of in-coming ties an ego has, which was determined by how many people nominated the ego as a friend in their nomination forms (Borgatti et al., 2013). Out-degree centrality was the number of out-going ties from the ego, which was determined by the number of alters the ego nominated via the nomination form. Degree centrality was often referred to as the total degree centrality, which was the sum of in and out degrees (Borgatti et al., 2013).

Closeness centrality was usually measured by the shortest distance from one node to the rest, referred to as the geodesic distance (Borgatti et al., 2013; Brandes et al., 2016). The distance between nodes is the number of edges between them. The closeness

centrality for this network with disconnected components was calculated as the inverse of geodesic distance (the shortest path between vertices) (Duke Network Analysis Center, n.d.).

The betweenness centrality for node A was defined as a sum across dyads. Each term in the sum was the fraction of the shortest paths that went through node A out of all shortest paths that connected the nodes of the dyad (Borgatti et al., 2013; Brandes et al., 2016). The above degree centrality measures were utilized in the descriptive network analysis (e.g., Figure 5) of this study.

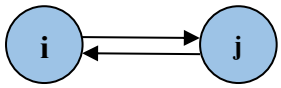
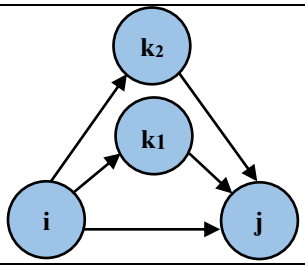
In addition, when participant A and participant B both nominated each other as friends using the nomination form, a reciprocal tie existed between them. The reciprocity of a network was the count of reciprocal pairs in the network. Reciprocity can only be calculated when the network is directed, which was the case in this study because friendship nomination had a direction (i.e., to and from). All existing reciprocal ties were counted regardless of their weight.

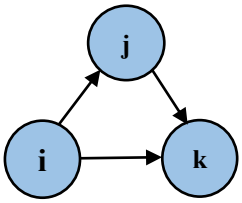
Transitivity referred to the tendency to form triads (triangles) among members of the network. There were two major ways to measure the transitivity of a network: (1) counting the number of triads within the network; (2) counting the number of ties within transitive triads. A transitive triad consisted of three nodes (i, j, k) where a two-path i→j→k existed. Although multiple ERGM terms exist to model transitivity, the term *transitive ties* shown in Table 1 was selected over *ttriple* in ERGM. The term *transitive ties* were less prone to degeneracy in ERGM as each transitive tie was only counted once, regardless of the number of shared partners. All existing transitive ties were counted

regardless of their weight. The percentage of transitive ties in SCP was reported in the descriptive network analysis.

Factors exogenous to the network dynamics (e.g., homophily) were not presented in Table 1. Questions 2 to 6 in the friendship nomination form allowed egos to share the demographic characteristics (age, gender, race, country of origin, highest level of education) of alters based on egos' knowledge. After obtaining the characteristics of egos and alters, the homophily of a continuous variable (i.e., age) was calculated as the absolute difference between two nodes whereas the homophily of categorical variables was calculated by counting the number of cases where two connected nodes share the same attribute (e.g., gender) (Cranmer et al., 2020). Questions 7 and 8 in the nomination form asked egos to explain the nature of the relationship with alters (volunteer of SCP, client of SCP, staff members of SCP, and other) and whether the relationship extended beyond SCP (whether introduced alter to a family member). Information obtained from questions 7 and question 8 was reported in the descriptive findings in Chapter 4.

Table 1. *Examples of Network Structures*

Endogenous Effect	Diagram	Definition
Reciprocity		The count of mutual pairs in a network. A pair of nodes i and j is said to be mutual if both ties i→j and j→i exist.
Transitivity		A transitive triple is defined as a set of 3 nodes i, k_1, j, together with ties i→k_1, k_1→j, i→j. ERGM term *ttriple* counts 2 triangles in this diagram, which is prone to degeneracy.

Transitive ties		A tie i→k is called transitive if at least one two-path i→j→k exists; or, equivalently, if an alter j exists such that both i and j agree in nominating k. ERGM term *transitiveties* counts only 1 tie in this diagram and the one above it; it is less prone to degeneracy.

Loneliness

Loneliness was assessed through the six-item version of the De Jong Gierveld Loneliness survey (DJGLS, Appendix H) quantitatively (De Jong Gierveld & Kamphuis, 1985). The first three questions in the scale assessed emotional loneliness through negatively worded items (e.g., "I experience a general sense of emptiness") whereas the last three questions in the scale assessed social loneliness via positively worded items (e.g., "there are plenty of people I can rely on when I have problems"). Each question had three response options (yes, more or less, and no). In the negatively worded questions (Question 1-3), the neutral ("More of Less") and positive answers ("Yes) were scored as 1, suggesting the presence of emotional loneliness. For positively worded questions (Question 4 to 6), the neutral answer ("More or Less") and the negative answer ("No") were scored as a 1, indicating the presence of social loneliness. Those who scored 2 or more on the DJGLS were considered to be lonely (De Jong Gierveld & Van Tilburg, 2008).

DJGLS has demonstrated good reliability and validity in measuring the loneliness of older adults (Penning et al., 2014). The age invariance of DJGLS made it more appropriate for measuring the loneliness of midlife and older adults than other

standardized loneliness measures (e.g., UCLA loneliness scale) (Penning et al., 2014). The 6-item DJGLS was developed using data from the Dutch Living Arrangements and Social Networks of Older Adults Survey (NESTOR-LSN) (N=4494). The Cronbach's alpha for the 6-item DJGLS ranged between .70 and .76 for adults (De Jong Gierveld & Van Tilburg, 2008). To examine the validity and factorial structure of the six-item DJGLS, the researchers selected participants from the Netherlands Kinship Panel Study (NKPS) (N=8154) and participants ranged from 18-79 years old. The 6-item DJGLS illustrated bi-dimensionality (De Jong Gierveld & Van Tilburg, 2008) and adequate congruent validity using the Regional Health Services survey conducted on 4659 adults (21-99 years old) in the Netherlands (De Jong Gierveld & Van Tilburg, 2008).

In addition to its' high validity and reliability among adults in Netherland, DJGLS has been tested to be reliable and valid in assessing the loneliness in a variety of other countries with varying economic and cultural backgrounds (e.g., France, Germany, Russia, and Japan) (De Jong Gierveld & van Tilburg, 2010). Using DJGLS, researchers have also found that Canadian immigrants from similar languages and cultures were not significantly lonelier than non-immigrants (De Jong Gierveld et al., 2015). However, older immigrants with greater language and cultural differences from the host country were significantly lonelier than non-immigrant older adults (De Jong Gierveld et al., 2015). Other factors contributing to the loneliness of older immigrants (e.g., sociodemographic characteristics, immigration-related factors, self-rated health, perceived neighborhood environment) (De Jong Gierveld et al., 2015; S. Johnson et al., 2019; Neville et al., 2018; Zarookian, 2017) were assessed in the socio-demographic survey of this study (Appendix F).

Analysis

Qualitative Data Analysis

Transcription and Translation. The lead researcher transcribed the recorded focus groups with the assistance of Landmark Associates, a multi-lingual confidential transcription service (Landmark Associates, 2009). English transcripts were transcribed in English verbatim. Because focus groups with Bhutanese (Nepali-speaking), Russian, Somali, and Cambodian (Khmer-speaking) older adults were facilitated by interpreters, two languages were spoken in the above focus groups. Therefore, the English and non-English portions of these interviews were transcribed in a two-step manner. The English portion of the interview (i.e., questions asked by interviewers, interpreted answers, and answers directly given in English by participants) were first transcribed verbatim. Then, the non-English portion of the Russian and Khmer interviews was transcribed verbatim and translated back to English by professional transcriptionists with expertise in the corresponding language. Although the non-English portion of the Nepali and Somali transcripts was not transcribed verbatim due to funding constraints, the Somali- and Nepali-speaking research team members reviewed, edited, and added to the transcripts after the lead researcher transcribed the English portion of these two transcripts to ensure their accuracy and completeness.

Qualitative Data Analysis. The qualitative analysis of this study was informed by the constructivist Grounded theory (GT) approach (Charmaz, 2006, 2014). GT has been particularly useful for theorizing under-studied processes/relationships (Teherani, Miartimianakis, Stenfors-Hayes, Wadhwa, & Varpio, 2015). GT helped the lead researcher identify patterns of social interaction (aim 1) and the conceptualization of the

relationship between social networks and loneliness (aim 2). Philosophical differences existed among different versions of GT (e.g., Glaser and Strauss, Corbin, Charmaz) (Singh & Estefan, 2018). The GT proposed by Glaser (1978) implied a positivist philosophy, which assumed a single reality grounded in data and stresses the objectivity of researchers. Similarly, Strauss and Corbin suggested a post-positivist approach to GT, which acknowledged the multiple realities data may imply while strictly restricting researchers' subjectivity through systematic coding procedures (Singh & Estefan, 2018).

In contrast with the previous objective GTs that distanced researchers from the participants and data collected, the constructivist GT that informed the analysis of this study encouraged researchers to co-construct the theory with participants (Charmaz, 2006, 2014). The reflexivity of researchers has been critical in distinguishing researchers' contributions and participants' perspectives (Charmaz, 2006, 2014). Instead of focusing on the generalizability of a theory as in the previous versions of GT, the constructivist GT was deeply rooted in the local and cultural contexts (Singh & Estefan, 2018). Because this current study investigated the relationship between network structures and the loneliness of diverse older volunteers with the Columbus SCP, the constructive GT has been the most appropriate approach for developing a conceptual framework sensitive to the local community (Singh & Estefan, 2018).

Additionally, rather than making an unrealistic assumption regarding researchers' complete objectivity, constructivist GT viewed the subjectivity of researchers as a tool and encouraged researchers to discuss how their identities shape the research questions, data collection (e.g., interview dynamics), analysis, and interpretation (Singh & Estefan,

2018). Embracing one's identity has been particularly important when researchers shared similar experiences with potential study participants (Singh & Estefan, 2018).

The analysis of the qualitative portion of the study was informed by the constant comparison approach in constructive GT. The lead researcher engaged in reflexive writing when theming participants' perspectives and how social interactions influence participants' loneliness (Charmaz, 2006, 2014). Analytic memos on codes, categories, subthemes, and themes facilitated the conceptualization (Charmaz, 2006, 2014).

The analyses started with initial line-by-line coding, which enabled researchers to break down the process/action of interest by steps and understand participants' perception of the process, the context, and the consequences (Charmaz, 2006, 2014). Through the initial coding, researchers developed and defined initial codes/categories that reflected friendship formation processes in the program and experiences with loneliness (Charmaz, 2006, 2014). Some example questions that guided the initial coding of this study included: what were some functions of social interactions among older volunteers (e.g., goal, emotional support, contribution to the community)? What were some common social processes (e.g., confrontation, affirmation) in older volunteers' social interactions? How did various types of social interactions resemble and differ from one another? Why did older volunteers engage in various types of social interactions? What strategies did older volunteers use in forming, maintaining, and dissolving social relationships? How did participants think and feel about different types of social interactions? How did different relationships (clients, volunteers, family/friends) influence each other? How did participants define loneliness? What did participants think and feel about loneliness? The

lead researcher then compared and combined similar codes into larger categories (Charmaz, 2006, 2014).

Once the initial categories were developed, researchers conducted focused coding to select the most relevant categories that summarize large amounts of data. Comparing data to data facilitated the development of focused codes. Meanwhile, researchers also compared data to codes to improve the fit of the focused codes (Charmaz, 2006, 2014). For this study, the lead researcher selected and/or combined initial codes regarding social interactions, social network, loneliness, and their relationships in the focused coding.

The detailed step-by-step axial coding procedures proposed by Strauss and Corbin have been critiqued for limiting researchers' flexibility and innovation when theorizing (Charmaz, 2006; Singh & Estefan, 2018). Charmaz proposed some more flexible axial coding procedures, which encouraged researchers to consider the contexts of each category (e.g., when, how, and why a process happens) when developing subcategories. In this study, the life span and situational contexts (e.g., COVID-19) of loneliness were carefully considered when constructing codes. This approach provided a pathway for theoretical reasoning and enhanced the comprehensiveness of the conceptualization (Charmaz, 2006; Singh & Estefan, 2018).

In the final stage of theoretical coding, the lead researcher identified a conceptual framework that best explained the research questions (Charmaz, 2006, 2014). The lead researcher theorized the patterns of socialization within the program and how these interactions contributed to the feelings of loneliness among senior companions. Although constructive GT informed the analysis and interpretation of the qualitative data, this study

is not a GT study because iterative data collection and analysis were not conducted (Charmaz, 2006, 2014).

Analytic Memos. Detailed analytic memos were written to facilitate the development of codes, categories, and themes (Charmaz, 2006, 2014). Codes, categories, and themes were reviewed iteratively based on the constant comparisons of data and initial codes (Charmaz, 2006, 2014) to ensure the accurate conceptualization of volunteering, social networks, and loneliness among volunteers in SCP. After initial coding, the analytic memos of major codes were reviewed and compared. Then, similar codes were combined to reduce the redundancy and facilitate the conceptualization between volunteering, social network, and loneliness.

Reflexive Writing. Several aspects of my identity shaped the question formation, interview question development, data collection dynamics, and the interpretation and analysis of qualitative data. Being brought up in a multi-generational environment with close emotional connections with my grandparents and older adults in the neighborhood, I have been naturally intrigued by the meaning-making in late life. Furthermore, as an international student from China, my own experiences navigating life in the United States and my professional experiences serving transnational families during my internships in mental health clinics have heightened my interest in topics of integration and belongingness among older immigrant populations.

During the data collection, I facilitated one focus group with English-speaking older volunteers. Through observation of the verbal and non-verbal language of the group, we started to bond over the experiences of isolation during the pandemic. My age and look (e.g., height, earrings) were noticed and commented on by participants. Looking

relatively young and being a student might have influenced the dynamics between me and the participants. For example, at the start of the focus group, one participant stated that the purpose of the particular in-service training was to train me instead of them. I agreed by reiterating that we were there to learn from them and use their experiences to inform future interventions. Similarly, despite my intention to benefit the program and the participants, community partners also perceived their roles to be training and supporting me in my academic endeavor as a student throughout the expert interview.

The group of participants I interviewed all identify as Christians according to their own descriptions. Although I identify as spiritual but not religious, faith-based coping strategies stood out to me as a theme due to their prominence in the transcript. Moreover, I am particularly impressed by the statement from my focus group participants regarding the importance of being kind to everybody regardless of race, ethnicity, or culture as a way to ameliorate loneliness. The above statement coincided perfectly with my personal belief in the interconnectedness of all human beings. Similar statements on being kind to everybody and helping everybody were also identified in other English-speaking and non-English-speaking focus groups. Because my personal network has included people with similar and dissimilar cultural backgrounds, I have been intrigued by processes and factors contributing to the homophily and heterophily among participants.

Although it was not possible to facilitate all focus groups by myself given the limited number of in-person meetings offered by SCP at the time of the data collection, I got the opportunity to greet all participants and set up for all focus groups (e.g., organization of forms, prioritization of questions, timing, note-taking, recording). Debriefing was conducted with facilitators immediately following the data collection to

capture their first-hand experiences with the data. I immersed myself in the data by repeatedly listening to the recording, transcribing the English portion of focus groups, reviewing the field notes taken by myself and the facilitators, and reviewing edited transcripts. I reached out to facilitators and interpreters who were familiar with the culture of the specific group to enhance the accuracy of my interpretation.

Inter-Rater Reliability. A second coder, a second year of the Master of Social Work student, coded more than 20% of the data as a reliability coder as recommended by some methodologists (e.g., M. Syed & Nelson, 2015). The reliability coder gained familiarity with the project by participating in the data collection. Building on the reliability coder's knowledge of the project, the lead researcher further trained the reliability coder through practice transcripts and codebook discussions. Before coding, the reliability coder reviewed several transcripts and the codebook compiled by the main coder. The reliability coder and the main coder met to discuss the coding structure and the reliability coder proposed revisions to the codebook. The final codebook is presented in Appendix I. Follow-up written communication was conducted until both coders agreed on the codebook. After agreeing on the coding structure, the reliability coder coded the designated transcripts (Syed & Nelson, 2015). Out of the eight focus groups, the reliability coder coded one English-speaking focus group and two non-English-speaking focus groups (Khmer and Somali) to address the variation and complexity in the non-English-speaking focus groups. Both the English and non-English-speaking focus groups were selected randomly using a random number generator (Syed & Nelson, 2015). Once the reliability completed the coding, the main coder and the reliability coder discussed and reconciled the discrepancies in coding via interactive team meetings. After the

reconciliation, the average percentage agreement between the two coders was 96.56% across all codes. No further reconciliation was conducted after reaching the acceptable percentage agreement. The coding of the main coder was adopted as the final coding (Syed & Nelson, 2015).

Quantitative Analysis

Data Entry. The lead researcher entered the information on the paper survey into three separate excel sheets. The information collected via the socio-demographic survey was entered into the "Node Attribute" sheet, which contained socio-demographic information of each node (person) in the network. Each row represented one participant, and each participant was assigned a unique ID number. For questions with multiple answers, such as household composition, and reasons for migration, each response option was entered as a single answer question. For example, the response option "I live with a spouse/partner" under household composition was represented by a column in excel with true or false answers. Similar procedures were performed for other response options under household composition, such as "I live alone", and "I live with my children".

Furthermore, data collected via the friendship nomination form were entered into the second excel sheet called "Edge List", which stored information on edges (relationships). Each row represented an edge or a tie between two participants. The first two columns of the edge list presented ego ID and alter ID respectively, illustrating which participant nominated whom. The remaining three columns in the edge list included information on where the ego first met the alter, whether the ego introduced the alter to someone outside of SCP, and how many times the ego interacted with the alter in

the past month. These three columns offered additional information on the nature and strength of the relationships (i.e., edges). Egos also provided their alters' sociodemographic characteristics via the friendship nomination form. Alters' sociodemographic information was moved to the "Node Attribute" spreadsheet after cleaning. Variable coding was documented in excel. Data validation was applied in Excel to improve the correctness of data entry. The entered data were also reviewed repeatedly for accuracy.

Data Cleaning. To ensure the confidentiality of participants' information, the lead researcher anonymized the data by replacing all names with IDs. Moreover, to improve the reliability of the data, further data cleaning was performed after data entry. In the demographic survey, some participants selected multiple answers for the highest level of education, which was written as a single answer question. Thus, the lead researcher kept only the highest level of education among all selected answers. For instance, one participant selected both "High school degree or equivalent" and "Some college, no degree", in this case, "Some college, no degree" was documented as the response this participant provided for this question.

Despite the written instructions, some participants did not provide a numeric value for text entry questions on the frequency of volunteering and the number of family and friends they see each month. Instead, they responded with "a lot", "many", "a whole lot", etc. In the absence of robust criteria to interpret these responses, the lead researcher replaced these answers with the numeric value of 10, which was close to the third quartile of the non-missing responses to the frequency of meetings. Similarly, the lead researcher also replaced "a few times" with a numeric value of 4, which was the median of the non-

missing responses to the frequency of meetings. The numeric value of 4 was equivalent to one per week. The above substitutions were necessary to prevent the computer from dismissing these responses as missing data, and instead use the common-sense and consistent approximation.

When a participant provided the frequency of volunteering in a week, the lead researcher calculated the participants' frequency of volunteering in the past month by multiplying the answer by 4. When participants said they volunteer "daily" in a month, the lead researcher substituted the value of 30 as the frequency of volunteering. When participants wrote "at least…times" or provided a range of frequency, the lowest number was taken. When participants had missing data in the age column, the mean age of all participants was imputed.

In addition to the above data cleaning and curation performed on the socio-demographic information, the lead researcher also cleaned and curated data within the friendship nomination form. When egos (participants) did not provide their names per instruction, a new ID was assigned to the ego. Some egos were also nominated as alters (nominated friends) by other egos. When there was conflicting information on participant A's demographic characteristics, the information provided by person A directly was prioritized over the description of person A given by a friend. When a participant did not provide information on the number of times they interacted with an alter, a 0 was imputed as a response.

In the De Jong Gierveld Loneliness Scale (DJGLS), each answer was scored either 0 or 1. The neutral (more or less) and positive (yes) answers were scored as 1 in the negatively worded questions (e.g., "I often feel rejected"). In contrast, The neutral (more

or less) and the negative answers (no) were scored as a 1 for positively worded questions ("There are enough people I feel close to"). A higher score indicates higher levels of loneliness (De Jong Gierveld & Van Tilburg, 2008). Participants were asked to circle only one answer in DJGLS. However, when participants selected a "more or less" and a definite answer ("yes" or "no") for questions in DJGLS, the lead researcher entered the neutral answer as the final response to avoid skewing loneliness scores to either extreme.

A total of 83 names including egos (participants) and alters (nominated friends) were identified through the friendship nomination form. Because of COVID-related restrictions and concerns, only approximately half of the senior companions attended the data collection. The missing edges resulting from non-participation can bias the estimates of network structures in SNA. For example, person A and person B were friends, only A was asked to nominate friends. A nominated B as a friend. Because B did not have an opportunity to nominate A as a friend, their reciprocal tie can become non-reciprocal due to B's non-participation. The bias in the data was confirmed by the negatively significant reciprocity in the preliminary count Exponential Random Graph Model (ERGM) (N=83). For the readers' information, the network graph with 83 nodes is presented in Appendix J. The preliminary ERGM with negatively significant reciprocity is presented in Appendix K. Results from the preliminary ERGM suggested that SCP volunteers preferred to form friendships with people who did not reciprocate, which was contradictory to the finding of the prevalence of positive reciprocity in most relationships (Breheny & Stephens, 2009; Sharifian et al., 2019). As explained above, the negatively significant reciprocity in the preliminary ERGM was because 42 nominated alters were not present at the data collection. These alters not present at the data collection did not have an opportunity to

reciprocate a nomination, biasing the network towards negative reciprocity. To avoid unreasonably claiming negative reciprocity and to minimize other potential biases from non-participation, the lead researcher decided to focus on friendships among participants who were present at the data collection, resulting in N=41 for the quantitative SNA.

Quantitative SNA. Quantitative SNA consists of ego/personal network analysis (networks of individuals in different settings) and whole network analysis (a network of all individuals in one setting) (Valente & Pitts, 2017). Whole networks involve all members within a given boundary (e.g., nursing home, a senior program), whereas ego/personal networks analysis is appropriate for investigating individuals' social contact outside of a given boundary. As discussed earlier, the personal networks of older adults have received more attention than whole networks of older adults within a particular setting (Ayalon & Levkovich, 2019). To address the theoretical and methodological gap, this current study aims to understand the network of diverse older volunteers in SCP through whole network analysis.

Besides the distinction between ego networks and whole networks, social network analysis can be descriptive or inferential (Borgatti et al., 2009, 2013). Descriptive network statistics and sociograms describe network characteristics and visualize individual connections (Borgatti et al., 2013), whereas inferential network analysis tests the statistical significance of network structures (Cranmer et al., 2020). Aim 1 of this study called for descriptive analysis and ERGM, whereas Aim 2 was achieved through Linear Network Autocorrelation Models (LNAM). Both ERGM and LNAM can be considered inferential network analysis.

Exponential Random Graph Modeling. The lead researcher adopted ERGM (S. Wasserman & Pattison, 1996) to identify statistically significant network structures associated with the relationship formation and dissolution within a network. Building on descriptive network statistics, ERGM identifies what endogenous and exogenous factors are statistically significant to the formation of relationships among diverse older volunteers (Cranmer et al., 2020). The probability distribution in an ERGM is defined by the space of all possible networks that can be constructed from the vertices of the observed network (Cranmer et al., 2020). Through modeling various networks ranging from completely empty (no connections among nodes) to completely connected (all nodes connected) based on the fixed set of nodes, ERGM predicts the possibility of observing the current network over all possible networks that share the same number of nodes. ERGM uses the Markov Chain Monte Carlo methodology to simulate the networks (Cranmer et al., 2020).

Modeling the whole network enables ERGM to account for factors endogenous and exogenous to the network when predicting the probability of tie formation. As discussed earlier, factors endogenous to a network usually include edge-level properties, such as the possibility of people preferring to interact with popular peers or preferring to interact with those that reciprocate (Cranmer et al., 2020). Factors external or exogenous to a network usually include node-level properties, such as participants' characteristics (e.g., age, race, and gender) (Cranmer et al., 2020).

ERGM has two major advantages when applied to network data. First, ERGM models network structures that would otherwise be ignored in traditional regression analysis (Cranmer et al., 2020). The implementation of ERGM enables researchers to

better understand the endogenous network processes (e.g., reciprocity, transitivity) while accounting for exogenous factors (e.g., age, gender) in forming social relationships (Cranmer et al., 2020). Additionally, unlike regression analysis which assumes independence of observations, ERGM accounts for autocorrelation in the network data (Cranmer et al., 2020). Observations of a network structure are often dependent upon one another. For instance, the friendship tie between person A and person B cannot be reciprocal unless both A and B nominate each other as a friend. Because ERGM treats the entire network as a single observation, it avoids making assumptions regarding the independence of observations (Cranmer et al., 2020).

ERGM algorithms are suitable for a wide range of network sizes, node covariates, and edge properties (Cranmer et al., 2020). The statistical assumptions of ERGMs are minimal. The primary assumption of ERGM is that the probability of observing two networks with the same values on the selected statistics should be the same (Cranmer et al., 2020). The addition of exogenous or endogenous factors can increase the chance of observing a certain network over the other. The second assumption of ERGM expects any sample of networks from the fitted distribution to have their network statistics centered around the observed network (Cranmer et al., 2020). In other words, the observed network statistics should be representative of the population statistics in order to generalize. The Markov Chain Monte Carlo Maximum Likelihood Estimation (MCMC-MLE) produces goodness of fit statistics to evaluate ERGMs. Models violating the statistical assumptions of ERGM show poor fit (Cranmer et al., 2020).

A major challenge with ERGM is its numerical instability, referred to as degeneracy (Cranmer et al., 2020). Degeneracy occurs when the MCMC simulation

process moves from completely empty to completely connected networks and is thus unable to maximize the most possible parameter estimates given the observed network. In other words, when a model is degenerate, the parameter estimates are not trustworthy. Degeneracy is often caused by poor model specification. Forcefully fitting network structures that are highly unlikely in the observed network can result in model degeneracy (Cranmer et al., 2020). Fortunately, degeneracy can be easily detected through model fit analysis. A degenerate model has a very poor fit (Cranmer et al., 2020).

Besides degeneracy, collinearity among independent variables is also a common problem in ERGM. Collinearity can lead to degeneracy, skewed coefficients, biased standard errors, and inconsistent model estimates (Duxbury, 2021). To diagnose collinearity, the variance inflation factor (VIF) among independent variables, a key indicator for multicollinearity, is produced by the *vif.ergm* function from the R package *ergMargins* (Duxbury, 2021).

A count ERGM model was implemented for this weighted/valued network. As discussed in the measurement section, the question in the friendship nomination form "How many times have you interacted with (e.g., in-person, phone) this person in the past month?" provided weights to the edges of this network. Due to the nature of the frequency of meeting, the weighted edges in this network were count data represented by bounded integers.

Building on ERGMs for binary edge existence, count ERGM was implemented for this weighted network (Krivitsky, 2012). Despite similarities in assumptions and specification with binary ERGM estimating tie existence versus non-existence, count ERGM required the specification of a reference measure, a probability distribution that

provides initial constraints for dyad distribution and network parameters. The Poisson distribution was selected for this count ERGM, based on the large dispersion of the frequency of meetings across ties, as shown in Table 4. In these conditions, the count ERGM was expressed by the following probability function (Krivitsky, 2012):

$$P(\boldsymbol{y}) = P_{\boldsymbol{\theta};\boldsymbol{g},\boldsymbol{h}}(\boldsymbol{y}|\boldsymbol{x}) = \frac{h(\boldsymbol{y})\exp\big(\boldsymbol{\theta}\cdot\boldsymbol{g}(\boldsymbol{y};\boldsymbol{x})\big)}{\kappa_{g,h}(\boldsymbol{\theta};\boldsymbol{x})}, \quad \boldsymbol{y}\in\mathcal{Y},\ \ \boldsymbol{\theta}\in\mathbb{R}^p,\ \ \boldsymbol{g}:\mathcal{Y}\to\mathbb{R}^p,\ \ h:\mathcal{Y}\to[0,\infty), \tag{1}$$

where $P(\boldsymbol{y})$ was the probability of observing network $\boldsymbol{y}$ from among all networks that could be possibly constructed on the given set of nodes. The set of all these networks was called $\mathcal{Y}$. $P(\boldsymbol{y})$ depended on a vector $\boldsymbol{g}$ consisting of p network statistics, a vector $\boldsymbol{\theta}$ consisting of p fitted parameters, a function h (see below), and possibly some node data $\boldsymbol{x}$. We expressed this via the form $P(\boldsymbol{y}) = P_{\boldsymbol{\theta};\boldsymbol{g},\boldsymbol{h}}(\boldsymbol{y}|\boldsymbol{x})$, meaning that $P(\boldsymbol{y})$ was the probability of observing network $\boldsymbol{y}$ given node data $\boldsymbol{x}$, based on our selection of functions $\boldsymbol{g}, h,$ and fitted parameters $\boldsymbol{\theta}$.

Vector $\boldsymbol{\theta}$ had p components which were real numbers: $\boldsymbol{\theta}\in\mathbb{R}^p$. Vector $\boldsymbol{g}$ had p components as well and it was a map from space $\mathcal{Y}$ to a space of real numbers: $\boldsymbol{g}:\mathcal{Y}\to\mathbb{R}^p$. Vector $\boldsymbol{g}$ was a function $\boldsymbol{g}(\boldsymbol{y};\boldsymbol{x})$ consisting of network statistics on $\boldsymbol{y}$ that could include, for example, the count of transitive ties or the count of reciprocal pairs shown in Table 1. Function $\boldsymbol{g}(\boldsymbol{y};\boldsymbol{x})$ could also include node data $\boldsymbol{x}$ such as homophily based on race, gender, or site station.

The exponential argument to $P(\boldsymbol{y})$ was the scalar product $\boldsymbol{\theta}\cdot\boldsymbol{g}(\boldsymbol{y};\boldsymbol{x})$, a real number. The exponential term $\exp\big(\boldsymbol{\theta}\cdot\boldsymbol{g}(\boldsymbol{y};\boldsymbol{x})\big)$ was thus a positive value. Function $h(\boldsymbol{y})$ was chosen in a way that made it positively valued, and was used to specify the reference

measure, a baseline probability distribution for the dyad values such as the number of meetings (Krivitsky, 2012). The reference measure and the exponential term worked together as the probability weight $h(\boldsymbol{y}) \exp\big(\boldsymbol{\theta} \cdot \boldsymbol{g}(\boldsymbol{y}; \boldsymbol{x})\big)$. The weight was normalized using an appropriate normalization expression $\kappa_{g,h}(\boldsymbol{\theta}; \boldsymbol{x})$ as a denominator in Equation 1. To be exact, $\kappa_{g,h}$ was given by

$$\kappa_{g,h}(\boldsymbol{\theta}; \boldsymbol{x}) = \sum_{\boldsymbol{y}' \in \mathcal{Y}} h(\boldsymbol{y}') \exp\big(\boldsymbol{\theta} \cdot \boldsymbol{g}(\boldsymbol{y}'; \boldsymbol{x})\big). \tag{2}$$

Further details on the construction of count ERGMs can be found in (Krivitsky, 2012). The algorithms that fitted the parameters $\boldsymbol{\theta}$ and examined their significance were implemented in the *ergm.count* package for the R statistical environment. ERGM fits can be computationally demanding. Simple cases involving network structures could take hours on consumer-grade workstations. Due to its computational complexity, the bulk of the count ERGM work was conducted using the services of the Ohio Supercomputer Center (OSC). Only de-identified information was supplied to OSC.

According to SNT, the following variables were included in ERGM to test the research hypothesis for aim 1 (identify the network structures within SCP) regarding homophily and endogenous network processes in SCP. The homophily of age, gender, country of origin, race/ethnicity, education, and site stations were included in the ERGM together with endogenous network structures (i.e., reciprocity and transitivity).

The concept of statistical power was different in ERGM from the one in regression-type analyses (Krivitsky & Kolaczyk, 2015). Statistical power typically depends on the size of the sample that is collected from the field; but in ERGM, the sample was simulated; each point of the sample was a simulated network (Krivitsky &

Kolaczyk, 2015). Statistical power depended on being able to simulate networks in a substantial region of the space of networks (Cranmer et al., 2020). In ERGM, like most other MCMC applications, the simulated sample consisted of a chain of simulated networks, where each network is a slight variation of the previous one; simulated networks are not truly independent and identically distributed (IID) (Cranmer et al., 2020). To solve this problem, an effective sample was constructed, by discarding an initial number of simulated networks, the so-called burn-in, and then choosing only networks spaced by a certain interval in the chain, the thinning interval (Cranmer et al., 2020). The effective sample size, burn-in, and thinning interval were chosen so that the sample could be considered independent and also to reach a desired measure of reliability (Krivitsky & Kolaczyk, 2015). This choice was often dependent on the number of nodes in the network and network structures included in the model (Krivitsky & Kolaczyk, 2015). The ERGM package for R automated the process of finding an appropriate burn-in, thinning interval, and effective sample size, enabling the lead researcher to instead specify a desired precision for the statistical inference, and hence the desired level of trustworthiness of parameter estimates and their significance scores (Krivitsky & Kolaczyk, 2015).

Linear Network Autocorrelation Modeling. To achieve aim 2 in understanding the role of network autocorrelation in older volunteers' loneliness, Linear Network Autocorrelation Model (LNAM) was implemented in the *sna* package in R. Network autocorrelation models applied the spatial statistics to investigate the spread of behavior, emotion, or information across the networks rather than across space (Leenders, 2002; LeSage, 2008; Salway et al., 2018). Although regression analyses have also been applied

to hypotheses testing of certain network structures, regression analysis does not account for autocorrelation in the network data (Silk et al., 2017).

Network autocorrelation or dependencies have referred to how one person's decision, behavior, and attitude correlate with other people's decisions, behaviors, and attitudes within a network (Salway et al., 2018). Network autocorrelation models have been designed to quantify the dependencies among observations in a network (Salway et al., 2018; Silk et al., 2017). This study has adopted the *network effect models* (Leenders, 2002; Salway et al., 2018) to understand how the volunteers' loneliness correlates with one another, instead of introducing dependencies via the error terms in a *network disturbance model* (Leenders, 2002; Salway et al., 2018). The *network disturbance model* has illustrated network members' tendency to deviate from the norm when others are also deviating from the norm (Leenders, 2002; Salway et al., 2018). Because the purpose of the study is to understand how volunteers' loneliness has been correlated via their interactions, the *network effect model* below provides a clearer interpretation of the network correlation among participants than the *network disturbance model* (Leenders, 2002; Salway et al., 2018). The *network effects model* used a formula derived from that of linear regression and was given by

$$y = \rho W y + X\beta + \varepsilon, \qquad \varepsilon \backsim N(0, \sigma^2 I) \tag{3}$$

Here, y was a vector representing the dependent variable for all nodes, ρ was a coefficient expressing the correlation of network structure in combination with the dependent variable, W was the adjacency matrix representing the structure of the network, X represented the independent variables, β was the regression coefficient, and ε represented the error term, which was given by a normal distribution N with mean 0. As

seen in Equation 3 above, y was included in both sides of this equation, the model introduced the dependences of y into the model, allowing researchers to identify how participants' outcomes correlated with each other.

Unlike linear regression, LNAM allowed the specification of ρ and W, which quantified the network autocorrelation and connectivity among social ties within the network. The W matrix in this study was the frequency of meeting between egos and alters. Some researchers interpreted ρ as the "average level of dependence over the network structure" (Salway et al., 2018, appendix 1). A positive ρ suggested a positive correlation among individuals whereas a negative ρ indicated a negative correlation among members within the network (Salway et al., 2018). In addition to factors endogenous to the network (i.e., network autocorrelation), factors exogenous to the network, such as older age, being female, being born outside of the U.S., poorer health, older age of migration, shorter length of residence in the U.S., and living alone were also correlated with higher loneliness among older adults (National Academies of Sciences Engineering and Medicine, 2020). The specification of ρ and W improved the accuracy of β by accounting for network autocorrelation within the network (Leenders, 2002). Non-significant variables were removed from the final LNAM.

Mixed-Methods Analysis

There were two major approaches to mixed methods data analysis. The independent approach analyzed the quantitative and qualitative data separately and conducted the meta-inferences by comparing the qualitative and quantitative after an independent analysis of each strand (Fetters, 2019). Whereas interactive mixed-method

analysis unfolded iteratively throughout the collection and analysis of both qualitative and quantitative data (Fetters, 2019). The interactive analysis approach was often adopted by sequential or multi-phase mixed-method studies (Fetters, 2019).

In reality, mixed-method integration has fallen on a spectrum between completely independent and completely interactive (Fetters, 2019). This concurrent mixed-method study has adopted the independent analysis approach where qualitative and quantitative data have been analyzed separately. Meanwhile, the iterative quantitative and qualitative analysis interacted and informed each other throughout the data preparation and data analysis. As qualitative analysis unfolded, preliminary insights provided contexts for interpreting the mechanisms behind the quantitative network structures; whereas the preliminary results of quantitative network structures encouraged researchers to interpret the qualitative data from a structural perspective. Formal integration of the qualitative and quantitative data was conducted once the quantitative and qualitative analyses were completed. The mixed-method findings were the results of meta-inferences from comparing qualitative and quantitative results (Fetters, 2019).

The following recommended steps in the mixed-method analysis were adopted to ensure the rigor of the analysis: the lead researcher (1) entered, cleaned, and addressed the gaps in the qualitative and quantitative data sources; (2) framed the mixed-method analysis in accordance with the study purpose (i.e., compare qualitative and quantitative results); (3) identified patterns in the qualitative and quantitative data by underscoring commonalities and differences; (4) developed the joint display table as the organizational structure to summarize the mixed-method findings; (5) reviewed inconsistencies and conflicting findings after comparing quantitative and qualitative findings; (6) organized

the findings for dissemination in texts and tables; (7) interpreted and wrote up the mixed-method findings (Fetters, 2019).

In this study, the comparison of mixed-method results was achieved by integrating the qualitative and quantitative findings in joint display tables. After completing the analysis of both the qualitative and quantitative data, the lead researcher looked for common and divergent findings between the two sets of findings. For Aim 1, the joint display table illustrated how qualitative themes of social interactions compared with significant quantitative network characteristics. Regarding Aim 2, the joint display table compared factors contributing to loneliness according to participants' perceptions with the statistically significant predictors of loneliness. The mixed-method approach allowed one strand to complement and moderate the other while providing additional insights (Fetters, 2019) into the network formation and loneliness of SCP volunteers through data integration.

The results from comparing qualitative and quantitative findings were presented in joint display tables (Creswell & Clark, 2018). The convergence of qualitative and quantitative findings led to confirmation as a mixed-method result. In contrast, the contradiction between qualitative and quantitative findings led to discordance as a mixed-method result. When discrepancies between qualitative and quantitative findings were identified, the lead researcher carefully examined the discrepant quantitative and qualitative data to see if readers had reasons to trust quantitative or qualitative results more based on methodological rationales (Creswell & Clark, 2018). The discrepancies also shed light on future directions of inquiry (Creswell & Clark, 2018). Moreover, when one strand of data provided additional insights while overlapping with the other strand of

data, qualitative and quantitative findings expanded each other (Fetters, 2019). An expansion as a mixed-method result reflected the scenario in which one type of data provided more variation than the other (Creswell & Clark, 2018).

Chapter 4. Results

Demographic Characteristics

Table 2 displays the demographic characteristics of the 41 volunteers who participated in the data collection. The mean age of participants was 76.99 (*SD*=9.09). Approximately 52.63% of the sample was female. Older volunteers in the program identified with various countries of origin. For instance, 39.02% of participants were from the USA, 24.39% were from Russia,12.20% were from Cambodia, 7.32% were from Bhutan or Ukraine, and 4.88% were from Somalia. In terms of race and ethnicity, 51.22% of participants identified as White, 26.83% were Black or African Americans, and 19.51% identified as Asians or Pacific Islanders.

Participants' highest level of education was spread out across the categories. The percentage of participants with a graduate and professional degree (21.62%) was equal to that of those without a high school degree (21.62%) in the sample. The majority of participants (67.50%) were retired and not looking for work. Nearly half (47.50%) of participants were married. Concerning the multiple answer question on household composition, 48.72% lived with a spouse and whereas 43.59% lived alone.

On average, older migrants in this sample spent 26.12 years in the US (*SD*=11.73) and migrated at an average of 52.04 years old (*SD*=13.14). Being a refugee or asylee was the most common reason for migration among participants. Only around 5% of

participants rated their health as bad. Similarly, 5.13% of participants perceived their neighborhood environment as bad.

When surveyed about social connections outside of the program, participants reported connecting with an average of 8.31 family members (*SD*=6.84) and 7.97 friends (9.06) at least once a month. On average, participants volunteered 18.13 times (*SD*=9.06) in the past month.

Additionally, out of 31 valid answers regarding site station affiliation, five participants were affiliated with AACS, five participants with Connections/Helpline, and another five were affiliated with CRIS. Seven participants were affiliated with the Senior Services of Catholic Social Services. One participant was from the site station called Day Spring and another participant was affiliated with the Urban Strategies. Three participants identified Jewish Community Center as their site station and four participants were affiliated with the Jewish Family Services.

Table 2. *Descriptive Node Statistics*

Variable	Frequency	%	Mean	SD	*N*
Age			76.99	9.09	41
Gender					38
Female	20	52.63			
Male	18	47.37			
Country of origin					41
Bhutan	3	7.32			
Cambodia	5	12.2			
Ethiopia	1	2.44			
German	1	2.44			
Russia	10	24.39			
Somalia	2	4.88			
Ukraine	3	7.32			
USA	16	39.02			
Race					41
Asian or Pacific Islander	8	19.51			
Black or African American	11	26.83			
White	21	51.22			
Other	1	2.44			
Education					37

Variable	Frequency	%	Mean	SD	*N*
No high school degree	8	21.62			
High school degree or equivalent	6	16.22			
Some college no degree	8	21.62			
Associates degree	2	5.41			
Bachelor's degree	5	13.51			
Graduate or professional degree	8	21.62			
Employment					40
Employed part-time	3	7.5			
Retired and not looking for work	27	67.5			
Self-employed	1	2.5			
Unemployed but looking for work	3	7.5			
Other	6	15			
Marital status					40
Divorced or separated	5	12.5			
Married	19	47.5			
Never married	5	12.5			
Widowed	11	27.5			
Household composition					39
Live alone	17	43.59			
Live with spouse	19	48.72			
Live with children	6	15.38			
Live with grandchildren	2	5.13			
Live with other relatives	1	2.56			
Years of residence			26.12	11.73	24
Migration age			52.04	13.14	23
Reasons of migration					23
Reunite spouse	4	17.39			
Reunite children	4	17.39			
Refugee	13	56.52			
Looking for employment or Education	1	4.35			
Take care of Grandchildren	1	4.35			
Reunite with other families	4	17.39			
Lower crime	1	4.35			
Better living standards	1	4.35			
Self-rated health					40
Bad	2	5			
Good	17	42.5			
Moderate	15	37.5			
Very good	6	15			
Perceived neighborhood livability					39
Bad	2	5.13			
Fair	8	20.51			
Good	16	41.03			
Very good	13	33.33			
Number of family members			8.31	6.84	35
Number of Friends outside of SCP			7.97	9.06	33
Volunteer frequency			18.13	13.46	31
De Jong Gierveld Loneliness Score			2.53	1.67	32

Note. The number of family members refers to the number of family members seen or heard from at least once a month. The number of Friends outside of SCP refers to the number of friends seen or heard from at least once a month. SCP (Senior Companions Program).

Contexts: Findings from Expert Interviews

Interviews with the staff members of SCP provided rich organizational contexts in understanding the structures of the social network within SCP. The interview guide utilized in the expert interviews is presented in Appendix D. Three staff members participated in the expert interview. Participant 1 (white female, hired during the COVID-19 pandemic between 2020-2021) was the vice president of programs at Catholic Social Services, with which the SCP is affiliated; Participant 2 (black male, worked with SCP for approximately five years) was the program director of SCP; and Participant 3 (black female, hired during the COVID-19 pandemic between 2020-2021) was the volunteer coordinator of SCP, who directly coordinated stipends, training, and volunteering activities among senior companions.

Four major themes concerning organizational structures, social networks, and loneliness among older volunteers emerged from the interviews with staff members: (1) programmatic and social impact of COVID-19; (2) keeping volunteers and clients engaged during COVID-19; (3) organization structures shaping friendships in the program; (4) social networks in the volunteer program. A detailed description of the four themes is presented below with example quotes:

The Programmatic and Social Impact of COVID-19

COVID-19 impacted the programming of SCP and the lives of older volunteers. During the shutdown of the pandemic, in-person volunteering was paused. SCP

volunteers kept in touch with clients virtually, mainly over the phone. When discussing the impact of COVID-19 on the programming of SCP, one staff member discussed how safety concerns related to COVID-19 brought the program "to a halt" and raised challenges for recruitment and retention due to increasing uncertainties:

> *It puts the program to a halt, so we had a program that was up and running at about 105 senior companions and over 600 plus clients and what we've seen through the 18-months shut down… because our program is still not fully open we're still operating in a hybrid model, so what we saw is that… we didn't really lose many clients or companions to COVID-*19 *that we know of, however, we did see a reduction in the program participation, the companions our clients. So, we did see that we did our best [to] just really try to stay engaged with clients and companions through a phone tree, however, we realize that when you go from a face-to-face program to a phone program that impact is not the same. And I will say in closing that I think that we're still seeing more ramifications of the pandemic. We thought that you know, we would fly by and kind of be out of it, but I think our issues now are more on the recruitment of senior companions and the recruitment of clients. Because no one really knows what tomorrow kind of holds. So, we'll get a lot of interest, and then you know there'll be another COVID outbreak of you know 16…60…60400 cases here in Ohio and you'll start to see clients withdraw and that they don't want to see their companions come back into the home or you will see companions say that you know they just don't want to do the program and that's, also the case if there's ever an outbreak that one of our campaigns our client test positive for COVID-19. I think that would have would it has really done is reduced the numbers of the program and left the program kind of in a certain way because we're dealing with the most fragile seniors already, and who are most susceptible to catching COVID.* (Participant 2)

In addition to restraining in-person volunteering during the lockdown, the pandemic continued to limit the level of engagement as in-person volunteering gradually resumed. Safety and health concerns continued to restrict the length and activities of a companion visit:

> *What we see now is that the companions are doing the bare minimum so really what you're doing is just going into the client's home checking up on a client, making sure everything's okay, and then just leave for the day. So, which would have been a three-to-four-hour visit is now down to about an hour or an hour and a half.* (Participant 2)

Despite the direct impact on the programming of volunteering activities, one staff member also shared concerns about funding sustainability in the long term. Because the majority of the funding sources shifted to pandemic-related issues, it became uncertain what funding sources would be available to support non-pandemic-related programming needs moving forward.

In addition to the programmatic impact of COVID-19, staff members also shared their observations of how COVID-19 impacted the social connectedness of volunteers. The isolating impact of COVID-19 was reflected by companions' emotional response when in-person SCP meetings resumed. As the pandemic became relatively under control in the early summer of 2021, SCP organized an optional in-person event adhering to the safety protocols. During the event, one staff member who was recently hired during COVID witnessed a mixture of profound joy and grief when volunteers reunited after several months of separation:

> *What I found most remarkable was the joy of people being back together, but also the pain people have been through during the pandemic. Because people who have never met me before kept coming up to me saying I lost this person during the pandemic, this person died during the pandemic, and I suffered this hardship during the pandemic. So while there was a significant amount of joy that was able to be shared, there was also this residual pain that to me, in my experience, some of it was, it has been a long time, and I finally end up with another human being, that I can talk about it. And so, I think that speaks to the depth of the trauma, and how much people have been carrying on their own. And that this generation isn't comfortable in giving snippets like you know Facebook, and Twitter, TikTok and whatever, they need to be able to tell their narrative in a story fashion, and not in bits and pieces. And story fashion is how human beings are. Which is much more difficult to do when you can't be face-to-face with someone else.* (Participant 1)

One staff member shared two stories concerning loneliness arising from the longing for homeland among older migrants. The first story she shared below concerned

a gentleman and his sister from Russia and the other story concerned the experience of a woman from Ukraine.

> *One gentleman and his sister, who just started talking about how they came from their home country, and how hard it has been for them. And another woman came up to me, I guess, I hadn't expected to hear this, she said she has loved her time in the United States, and she wouldn't have changed that. Now that she's getting older, the only thing she longs for is her home of origin, her country of origin and that she misses…towards the end of her life, so many of those things that were comforting to her. And while she's been in this country for 25 or 30 years this country will still never be her home. And that made me sad.* (Participant 1)

The staff member further articulated how the pandemic might have intensified loneliness among older migrants by hindering international travels and deepening the longing for the homeland:

> *You always know it's an option, you may choose to never go back, but it's always an option, right? And then all of a sudden, it's not an option, and so you grieve for the freedom of that option, because in truth, you may have chosen never to go back. But now that you can't go back, you long for it furthermore.* (Participant 1)

Keeping Volunteers and Clients Engaged During COVID-19

This theme shed light on what SCP did to keep volunteers engaged in the program from the lockdown to the reopening of the program throughout COVID-19. During the statewide lockdown, SCP conducted wellness checks through a phone tree. Throughout the pandemic, the leadership of SCP constantly balanced safety with keeping connections. One staff member shared that the average age of companions was around 80 years and many of them had pre-existing conditions that increased their health risk during COVID-19. Therefore, SCP "had our hands tied" in organizing social activities for companions during the pandemic. Despite the challenge, staff members shared that the

volunteers were satisfied with the effort SCP made to keep them "afloat" during the pandemic through financial, informational, and virtual support.

> *We did that, by calling people daily by encouraging people to communicate. However, they could, by just doing all the really good thing that is rooted in the human dignity of social work. Call somebody up and say, how are you doing today, do you just need to hear somebody else's voice, because you're banging around your apartment and there is no one to talk to, can you…are you talking to your kids, have you talked to your neighbor have you called your neighbor, so encouraging those connections in ways that are safe.* (Participant 1)

In addition to encouraging people staying connected via the phone, SCP also focused on communicating trust-worthy pandemic-related information about vaccines and personal protective equipment. The wellness checks also helped SCP identify unmet needs in the community (e.g., food insecurity, financial challenges).

SCP also encouraged volunteers to keep in touch with each other and with their clients over the phone. When the program started to reopen, SCP also organized optional small group events with social distancing to continue balancing connections and safety. As one staff member shared:

> *I think that we just… we are as transparent as we can be, and we host events and we say that is open and, if you would like to attend, please do, and if you do not feel comfortable, please do not.* (Participant 2)

At the time of the interview, the program was reopening and entered a "hybrid operation model", where some volunteers resumed visiting clients in person, and some were still only checking in with clients over the phone depending on their comfort level and the policies in their residing facilities/communities.

Organizational Structures Shaping Friendships in the Program

This theme included codes that described how the program operated and the organizational contexts that shaped the social relationships among volunteers. Two critical structures of SCP shaping networks were: (1) dual beneficial program and (2) the importance of site stations.

As a dual beneficiary program, SCP volunteers earned stipends and social connections from the service they provide. The dual beneficiary nature of the program aimed to facilitate aging in place for both volunteers and their clients:

> *I think two of the most important things to remember is the main goal of our program is to keep seniors living independently in their own homes. And how we do that is that we provide a stipend to our companions to be able to go out and visit socially isolated clients, our hope is that the stipend that our companions receive allowed them to earn extra income that allows them to stay independent living in their own home. And then, on the client's side, we hope the support that is… our companions are giving to their clients, allows them to feel less lonely, less isolated, and more connected to their community, which then allows them to live independently in their own homes.* (Participant 2)

Another important organizational structure of SCP was the importance of site stations. Site stations played critical roles in the recruitment, supervision, and organization of volunteers in the SCP. On the one hand, the partnership of SCP with site stations (e.g., AACS, CRIS, and Jewish Family Services) that serve diverse populations contributed to the diversity of volunteers in SCP; on the other hand, volunteers tended to socialize mainly within the site station, contributing to relationship homophily.

> *So, the way the program works is that we have partner organizations, maybe 16 or 17 site stations, who are nonprofit um… or health affiliated organizations who helped… I guess overseeing groups of senior companions. So, for example, there's an organization called CRIS [Community Refugee and Immigrant Services]. They serve like refugees and immigrants, so their senior companions are, have diverse backgrounds. And then like the Jewish Community Center, they will have like Jewish companions.* (Participant 3)

The site station structured older adults' social networks by strengthening relationships of older adults within the same site station. When asked about friendships among volunteers, one staff member stated:

> *I think the groups, within the group, there is a lot of communication and a lot of friendships within site. There are not a lot of crossovers from site to site for various reasons. You know there are still language barriers. There are cultural barriers…* (Participant 2)

Although unpaid, site station supervisors provided another layer of supervision to volunteers and facilitate the communication between SCP staff members and volunteers. Staff members described site station supervisors as people who "see the value of the program". Site station supervisors facilitated the communication between SCP staff members and SCP volunteers. When asked about interactions with different groups of volunteers, one SCP staff member shared that:

> *Our relationships are really built with the site station supervisors. So, you know there's always been a pleasant exchange with each group of companions that we've had. We don't necessarily have any issues in that department, only because, again we really rely on our site station supervisor's supervision of our non-English-speaking companions and our site station supervisors are always fluent in each language and so they're able to send all the messages that we need. You know, to convey all the information. so that's kind of how we navigate those language challenges. You know that's kind of how we do it.* (Participant 2)

Social Networks in SCP

Older volunteers developed friendships with clients, other volunteers, and staff members. SCP intentionally facilitated the dyadic (one-on-one) interaction between clients and volunteers while leaving more discretion for socialization among volunteers. SCP and site station supervisors facilitated the initial matching process between clients and volunteers to ensure the fit between the clients and the volunteer. All interviewed

SCP staff members stressed the importance of matching in ensuring the quality of the relationship between clients and volunteers, below is one example:

> *I think that we engage in a matching process where we take the interests of…interest of one person and try to match them to these skills and ability to send the interest of the other person. I think that that's very helpful because, for instance, we have we got a recent request for a person who wants a senior companion, yeah, and it might be hard to find the right companion for this person because she wants someone who is Catholic and someone who's German… A great deal of thought and care were put into, are these two people a good fit, so then going into a relationship. You can build from strengths. You can build from things that you already have in common, as opposed to trying to fit a square peg in a round hole. And it makes a difference in terms of the success of these relationships.* (Participant 1)

Relationships among volunteers were facilitated by organized socialization opportunities for the volunteers such as the annual recognition event, monthly in-service training, and orientations for new volunteers. Orientation built initial trust among volunteers:

> *So, during our orientation process, you'll see friendships formed there because, again, this is kind of like companion A and companion B, they are spending a week and they're spending, you know 20 hours of training together over a three-day period. And so, you know they are coming back to our in-service for the first time they get to see familiar faces.* (Participant 2)

Regular in-service training throughout long-term engagement in the volunteering program further nurtured connections among various groups of volunteers although friendships formed mainly within site stations:

> *And so once a month that's just a chance, a chance, an opportunity for them to say hello to each other and even though they usually sit by site stations and, you know, stay with their friends, for various reasons… um… what we do see is like in an in-service, when you know, a companion is not there, then you'll get the question, is someone Okay, so if a companion, for you know, a couple of months straight, or maybe three months in a row, you're going to start to get the question like "is that person okay"? Again, because some of our companions have been in the program for 25-plus years, and they've seen the same people. You know, for upwards of 20 years.* (Participant 2)

Qualitative Findings from Focus Groups with SCP Volunteers

Five major themes concerning volunteering, social network, and loneliness of SCP volunteers emerged from eight focus groups in five languages: (1) Expanding and strengthening social networks through volunteering; (2) Experiencing and coping with loneliness; (3) Experiencing and managing the social impact of COVID-19; (4) Exploring and loving the program; and (5) Social connections outside of the program. To ensure the transparency of the theming process, the evolution of codes to categories and themes is presented in Table 3.

Table 3. *Translation of Themes*

Theme	Subtheme	Categories	Example Codes
Expanding and strengthening social networks through volunteering	(1) Deepening relationships with clients	• Reciprocated service-a "two-way street" • "We are here to help"	Helping with grocery shopping; Helping with transportation; Navigating the social and health service systems on behalf of clients; Clients as families; Life-long friendships; Talking about sending and receiving country with clients sharing similar cultures; "They are happy to see us"
	(2) Developing friendships with other volunteers	• Connecting with volunteers from various cultures • Recruiting friends into the program • The volunteers become friends: "We are family"	Connecting through organized activities by SCP; Interacting outside of the program (e.g., Going to churches or worshiping together; Running into each other in the community).
Experiencing and coping with loneliness	(1) Coping with loneliness	• Building a community of support • Communicating with people • "Helping others": "you do it for everybody" • "Staying busy" • Staying close with families • "Trusting God"	Bonding with people sharing similar cultures; Kindness and love towards everyone regardless of race, ethnicity, country of origin, etc.; Gardening, having pets, Reading and scrapbooking, volunteering, and watching TV.
	(2) Defining loneliness	• Being Lonely versus being alone • Too much aloneness can be lonely • "I don't feel lonely" • Loneliness as "feeling left behind" • Loneliness as lacking social interactions • Loneliness as "You get it mentally"	Needing time alone; "You want to be alone by choice"; "Feeling heavy"; "They are depressed"; "They think too much"; "Asians are not lonely".
	(3) Factors contributing to loneliness	• Aging and Loneliness • Immigration and Loneliness: language and cultural isolation • Loneliness across the lifespan: "Everybody needs somebody"	Changing physical capacities; Feeling distant from or rejected by the family; Losing social contacts as one age.

Theme	Subtheme	Categories	Example Codes
Experiencing and managing the social impact of COVID-19	(1) COVID-19 hinders social connectedness- "We miss everybody"	• Fear of COVID-19 limited social interactions • Lockdown due to COVID-19: "Something is missing, or someone is missing"	Missing family time during COVID-19; Limited contact with family members during COVID-19 Missing holidays Recovering from COVID-19 Self-isolation due to fear of COVID-19: A mental block for socializing
	(2) COVID-19 limits volunteering- "COVID has taken it away from us"	• COVID-19 related social losses within the program • Separated from clients during COVID-19 • Volunteering In-person and over the phone	Lost clients due to COVID-19; Lost other volunteers during COVID-19; Fear of COVID-19 hinders bonding with clients- "They are afraid"; Continue seeing clients with precautions Supporting clients virtually.
Exploring and loving the volunteering program	(1) Benefits of volunteering	• Contributing to the community • Enjoying meeting people • Happy with the Mileage reimbursement • Helpful staff members and services from the program • Navigating lives in a new country • Staying active after retirement	Meeting new people after moving and retirement; Training new volunteers; Serving on the council; Contributing to the community; Helpful staff members; Housing support from SCP.
	(2) Challenges in volunteering	• The ambiguous boundary between clients and volunteers • High need client • Worrying about clients	[Same as the categories listed to the left]
	(3) Initial experience with the program	• "Outreach" and recruitment effort by Catholic Social Services • Personal referral (by family, friends, current volunteers) • Referral through other human service organizations	Learned about the program at meetings; referred by daughter; referred by another volunteer; learned about the program through services for older adults.
	(4) Long-term engagement in the program	• Long-term engagement in the program	Long-term engagement; long-term friendship

Theme	Subtheme	Categories	Example Codes
Social connections outside of the program	Churches, temples, mosques, etc.	• Grandchildren" at church. • Socializing at church and other religious settings	[Same as the categories listed to the left]
	Family	• Cooking • Family is everything • Talking on the phone or video calling	[Same as the categories listed to the left]
	Friends and acquaintances	• Going to concerts • Meeting volunteers of Meals on Wheels	Going to concerts; Meeting volunteers of Meals on Wheels
	Neighbors	• Greeting everybody in the neighborhood • Unfriendly Neighbors	Speaking to everybody regardless of cultural, racial, and linguistic differences; Greeting everyone in the neighborhood; Unfriendly neighbors.

Expanding and Strengthening Social Networks through Volunteering

Older volunteers expanded and strengthened their social network through volunteering by deepening relationships with clients and developing friendships with other volunteers. Volunteers took pride in their ability to serve clients ("we are here to help") while acknowledging the reciprocal nature of their interactions with clients ("two-way street"). Volunteers' acknowledgment of reciprocity with clients coincided with the "dual-beneficiary" nature of the program as described by staff members.

Making a difference in clients' lives made volunteering meaningful. Some English-speaking participants discussed supporting clients with physical illness and disabilities by providing transportation and emotional support. Another volunteer discussed the importance of listening to clients and being available for them.

> *It's a good program to make sure when people get suicidal, they feel lonely, they might have lost their loved ones or, you know, just sitting there alone, you know, just listening to someone talk. You are not talking but you are listening to them.* (English-speaking focus group A)

Furthermore, having truthful conversations with clients and putting oneself in their position deepened the relationship between volunteers and clients.

> *You know, it's so good to be able to share concerns. You know, how the clients have concerns, you know, we have concerns, you know. It helps us to be more sensitive to the needs of others. Yeah, because if you are thinking like this, one day I may be needing a senior companion. So, if I treat people like I don't want to be true to them. They know. In that situation, they are fearful.* (English-speaking focus group A)

Some volunteers from the Russian-speaking focus group shared how they bridged the gap between clients with limited English proficiency and the larger service system by providing interpretation, translation, and navigating the complex service system with

clients. Several Russian-speaking participants discussed the challenge of assisting clients with ordering transportation services for medical appointments.

> *The biggest problem is the system of ordering the service is very complicated. In order for them to put in a request, they have to speak plain English and understand what they are being told or asked, and this is very complicated.*

By serving clients, volunteers gained a sense of satisfaction that they are needed and welcomed, making their relationship a "two-way street". As one English-speaking volunteer stated: "when they see you visiting them, they are happy, they have the smile on their face and say (laugh): 'Yeah, you are waiting for me?' 'Yeah, I am waiting for you!' (laugh)". A similar sentiment was shared by participants in the Russian-speaking focus group.

> *I like the Senior Companion very much, very much. First of all, when we come to our clients, we see the smile on their faces. We know that they're waiting for us. We know, we are absolutely sure that they would like to see us because they rely on us. They know that we will be helpful to them.*

Additionally, navigating the system with clients also benefited volunteers with migrant backgrounds by providing volunteers with opportunities to further navigate their own lives in the host country: "On the other hand, they help to inspire us when we don't understand or know the law and be aware of it, and how to live in this nation." (Khmer-speaking focus group)

Besides building relationships with clients through service and reciprocation, volunteers also established relationships with other volunteers. SCP events such as orientation and in-service training offered "opportunities to connect". Volunteers missed seeing each other during COVID-19 due to the absence of in-service training: "We missed each other, COVID took us away from the rail. We had meetings on Thursday in

regular. And we looked forward to seeing one another." One volunteer in the (English-speaking focus group B) stated that they met their best friend at the initial orientation and have been friends ever since. The socialization opportunities SCP provided for older volunteers offered a platform for them to establish a genuine appreciation for each other, which is another important foundation in volunteers' friendships regardless of their meeting frequency. In the follow-up interview, the lead researcher asked the volunteer why she only interacted with one of her nominated friends once in the past month, the volunteer explained that "we don't have to talk with each other all the time. We know that we are on each other's mind, we are in each other's heart. That goes without saying."

Furthermore, sharing the identity as senior companions fostered a sense of community among volunteers regardless of cultural differences. Several English-speaking participants addressed the importance of connecting with people regardless of "what color you are, what country you're from". One participant described another volunteer from a different cultural background whom she regarded as a friend because they are committed to the same cause:

> *Volunteers I know... I know [participant name] is doing that... at um...On the fourth street, there is a pantry… They would be closed too. Would you feel cozy? Or do you feel soothing? Now that things have changed. It used to be on Tuesdays, things have changed, but the way it does it, they come here and we get to go. And she does not speak English... Yeah. Just because of you know, we are all senior companions…*(English-speaking focus group B)

Volunteers in other language groups also appreciated the opportunities to interact with people from different cultural backgrounds. For instance, when asked about what they liked about the program, one Khmer-speaking volunteer shared: "the program is good. It lets us have close relationships with such various nationalities too."

The friendships among some volunteers expanded beyond interactions in SCP events. One volunteer shared her virtual interaction with another volunteer during COVID-19.

> *I know a senior companion; She is a…I interact with her through Bible study. Each morning, I text her, Bible, Bible messages, something like that. And during the day, she may send me again (laugh). This is the way we interact. Each time, each day.*

Volunteers checked in with each other through an informal phone tree. The following conversation happened between two participants in the English-speaking focus group B: "They are worried about you. [Participant 1] and [Participant 2] both called me, you heard from [Participant 3]?" This quote reflected those participants checking on one another through the friend of a friend.

For volunteers with migrant backgrounds, interacting with other volunteers sharing similar language and culture in the community helped nurture a sense of belonging. Nepali-speaking Bhutanese older adults shared their experiences bonding with those sharing similar language and culture. According to the interpreter:

> *What he is telling is that he mostly talks to people within the community who also volunteer over here. He says that because Nepalese people are friendly and they talk about family and food and culture and what's going on in life in general, so just like casual conversations.*

Some English-speaking participants shared that they saw a lot of their church members in this program and "We go to lunch together, we have luncheons, we go to church together, we worship together". When asked about whether volunteers spend time together beyond organized activities in SCP, one older adult from the English-speaking focus group A responded: "Oh yeah, all the time. We just had a trip. The Amish Country

(applause). Oh, it was so wonderful!" This participant shared another example of how some volunteers interact outside of the program:

> *We went to an amusement park, called…no not an amusement park, we went to Blacklick woods and spent the afternoon there. It was with senior companions. We got T-shirts and we colored them*.(English-speaking focus group A)

However, variations in the depth of relationships among volunteers exist. Some volunteers shared that they hardly interacted with other volunteers beyond the in-service training. Although they enjoyed running into other volunteers run within the community (e.g., grocery store, post office) between SCP events or occasionally called each other between in-service training, participants in English-speaking focus group B shared that they mainly focus on their clients while limiting other social interactions to preserve time alone. Spending time alone became more important during COVID-19 to stay safe and perform self-care.

> *I think I focus on the clients. And kind of like… then I have like, a day or two a week. So, I have time to do what I need to do. Yeah, you know, make appointments, doctors, and so you know, doctor. Yeah, yeah.* (English-speaking focus group C)

Experiencing and Managing the Impact of COVID-19

The way in which COVID-19 disrupted volunteering and social connections was another prominent theme across various focus groups. COVID-19 not only hindered social connections overall but also limited the connections within SCP, among volunteers as well as between clients and volunteers. When discussing the changes in social connectedness during COVID-19 in general, the fear of COVID-19 imposed a challenge in all types of social interactions. A sense of isolation was intensified by the lockdown

during COVID-19. As one Khmer-speaking participant shared “No parents, no children, no community work”. Similarly, one volunteer in the Somali-speaking group shared relying on phone connections during the lockdown of COVID-19: “So one year and a half, I stayed in my home. I never see some of my friends. Even my friend [friend’s name], we talked only by telephone every night. How is your health, and how you think about your Coronavirus? So, the Coronavirus, we get many, many, many problems, you know.” Another participant further expanded on the limitation of only connecting over the phone:

> *We miss everybody. We couldn't get out. You could bond with nobody, everything was closed. The only thing you could do was to stay in the house or talk on the phone, but then you get tired of that, talking on the phone, and want to go out, you don’t want to stay in, and nobody can "come in", because nobody got their shot*. (English-speaking focus group A)

The overall social impact of COVID-19 also affected social interactions within SCP. When asked about how COVID-19 impacted participation in the program, several volunteers shared the longing for in-person visits with clients as well as opportunities to see other volunteers through SCP events, such as the monthly in-service training. One participant in the English-speaking focus group A compared the experience of not seeing clients to the separation between significant others: “You are used to being around them and it's like a separation, you know, because of being away from your clients. Just the absence of them”. The lockdown during COVID-19 was perceived as “the hardest part” of the experience among participants in the English B focus group. Another participant described the social impact of COVID-19 as follows:

> *It "killed" everybody. It “killed” us, “killed” them. Everybody. Any relationship we have with them. Yeah…Before, we could go to their house, their facilities, everywhere shopping or moving or whatever. But when the COVID hit, we*

> *couldn't even see them! We couldn't even visit them* (English-speaking focus group A)

Similarly, Russian-speaking participants also shared that COVID-19 limited in-person volunteering opportunities. In conversations facilitated by interpreters, Russian-speaking participants discussed helping clients over the phone and assisting clients to search for information over the internet during COVID-19, however, non-verbal communication and human presence were irreplaceable.

> *The biggest problem, obviously, came when COVID separated people. They cannot see each other in person. It used to be that they would see a person. They would see. They would mimic the expression on their faces. They will talk to each other. They will see that somebody cares, and now, basically, all the communication, most of the communication is over the phone, which is terrible.* (Russian-speaking focus group)

Even when in-person visits gradually resumed in SCP, several participants shared that in-person interactions between clients and volunteers were still limited due to fear of COVID-19. Some clients were hesitant to let volunteers into their homes: “She didn’t want anybody breathing in her house”. To re-connect with clients, some volunteers chose to spend time with clients outdoor. Others suggested “drop them a little card” and “give them some time”. Nepali-speaking and Khmer-speaking volunteers shared the desire to expand their clientele and increase their caseload, which was impeded by COVID-19.

Experiencing and Coping with Loneliness

Besides discussing social networks within SCP, volunteers also shared their direct and indirect experiences with loneliness. The following sections present the definition, factors, and coping strategies for loneliness from participants’ perspectives.

Defining Loneliness. When defining loneliness, several participants distinguished feeling loneliness versus being alone. Volunteers recognized the value of being alone (e.g., enjoying time alone, staying apart from certain family members to avoid fights) while acknowledging that too much aloneness can feel lonely, "you want to do it by choice". Other volunteers defined loneliness as a mental and emotional experience: "You get it mentally". Loneliness was described as "Feeling heavy", "they are depressed", or "They think too much".

Although some older adults discussed the difference between being lonely and being alone, others defined loneliness as "Just simply being alone. Being alone. Just you and your thoughts" (English-speaking focus group A). Lacking social interactions and being lonely, especially after aging-related major life transitions (e.g., retirement and widowhood) is considered a barrier to feeling connected.

> *But you still need connections. But when you just… when you're not working anymore, how do you think you make contact? You make contact when you come here to meet other people. When you go home, you have a wife and kids, most of the time, but all of us here in this age group, we are mostly single. So, we don't have a partner at home we don't have any kids to raise anymore and so you have nobody to talk to, you don't go to work anymore to meet new people, so you are isolated.* (English-speaking focus group C).

Loneliness was also experienced as feeling abandoned, rejected, and left behind by important social contacts. Distance between older parents and adult children contributed to loneliness. Khmer-speaking older adults noted that "children stop visiting" during COVID-19. Russian-speaking participants further elaborated on how their clients were disconnected from family members:

> *During the years of volunteering, I have seen many clients who lost contact with their relatives, particularly their children. Because, in general, they all work and live far away. It is extremely important for them to visit their parents as much as*

> *possible. This situation implies that some of the senior parents are abandoned, to say the least.* (Russian-speaking focus group)

This sentiment of feeling disconnected from immediate family members was also echoed by older adults in English-speaking focus groups. The sense of separation and loneliness was further intensified during COVID-19.

> *I get lonely with my immediate family because they are all well off and doing good. But I don't get to see them like I should. So, holidays are important for us so that we can get together. But it's been cut short now, because of COVID. You know, so…* (English-Speaking focus group A)

Factors Contributing to Loneliness. Three types of risk factors contributed to the loneliness of participants: (1) immigration, (2) aging, and (3) loneliness across the lifespan. Older adults with migrant backgrounds discussed language and cultural barriers to social participation and integration. Several volunteers discussed feeling lonely immediately after migration, according to the Nepali interpreter: "One participant mentioned that when he first arrived in Columbus, he felt lonely. But after spending many years, he had a circle of family and friends". Similarly, some Russian-speaking volunteers discussed not feeling lonely after forming long-term friendships: "When we just arrived at the USA, I made a couple of life-long friends with whom we still are keeping in touch. So, I don't have a lack in communication." Despite having established a circle of support, language barriers were still frequently associated with feeling alienated and othered. For instance, Bhutanese participants shared that "language has been the biggest barrier in terms of communicating", and that sometimes made them feel "alienated and different from others."

Russian-speaking older adults also connected language barriers with feeling isolated among clients. The SCP volunteers served as the bridge between clients and the

larger service system and the community by assisting with interpretation, translation, and service navigation:

> *Part of isolation is the language barrier. That's why for our clients who cannot speak English, cannot get information in English, it is very important that they rely on senior companions in all of these issues, connection with agencies, information about what's going around in the country, in everything, in their personal issues. That's what I like about Senior Companion Program, to make people less isolated. That's what we do.*

Although some Russian-speaking volunteers helped clients "translate letters", completed paperwork, and served as the bridge between clients and the larger community, they still stressed the importance of having acceptable interpretation services in connecting older migrants with services in the community:

> *It can be great if the transportation company could provide us with an interpreter who can help us to do the transportation request. A person who can precisely tell us: what we need to do, how to do it, and when. Elderly people do not speak English.* (Russian-speaking focus group)

In addition to social changes associated with migration, some older adults discussed aging as a contributing factor to loneliness. To be specific, changing physical capacity, feeling distanced from family members, and aging-related social losses were three categories under the theme of aging and loneliness.

The physical and sensory changes associated with aging limited one's capacity to stay active, which was associated with feelings of loneliness. According to one English-speaking volunteer:

> *Because you want to do something, and you are not able to do. You want to go to places, and your legs do not work. And you're not able to go places...Your hands do not do what you would like to do, your eyes are not able to read as much as you used to before and understand them. Yeah.*

Moreover, several groups of older volunteers discussed feeling distant and rejected by family members as a major factor contributing to loneliness. Some volunteers strongly agreed with the statement "as people get older, they get lonelier". Feeling rejected by family members gave rise to doubts of one's worth as one ages, thus contributing to feelings of loneliness:

> *Yeah, some people, they do not have family members close to them. Or I don't know. Kids sometimes do not like to be near with parents. For example. It's the same thing everywhere. Whether you don't have this kind of relationship or people near you. You become lonely. Because everybody's rejecting you. Because everybody's rejecting you. You see? So you will feel lonely. What's wrong with me? What happened? They liked me because I was doing…making money, giving to them. Something like that. Now I don't have money and they don't like to be near of me. You know. We are human beings; we have many questions.* (English-speaking focus group A)

Similarly, Russian-speaking participants discussed how feeling estranged from adult children was associated with loneliness among clients they serve. SCP volunteers conveyed the importance of adult children taking an interest in parents' lives.

> *Another thing that is very important that many of these elderly people, they have children that are working, and that are very busy. They have busy lives. Many of them don't live close, or live very far, maybe even another city, but it's very important to remind the children that they have parents that are basically abandoned, and they need more time or more understanding from their children, and this is part of the job to explain to the children not to forget their parents because they are so lonely, and they feel that they don't have families any more interested in their lives.* (Russian-speaking focus group)

Moreover, aging-related social losses, particularly the death of loved ones were associated with the experiences of loneliness. As participants described: "As you age, your friends pass away" (English-speaking focus group D). Some participants described their emotional experiences when clients and other volunteers die in the SCP as a "hurting thing". When asked to elaborate on the experience, participants shared:

I mean the emotional part you know? Just…Just that their absence from us, you know, we can't touch them anymore, we can't socialize, we can't call them, you know, we can't meet with them, because when you form a bond… You can't walk with them, walk with them around, outside of the building.

It is interesting to note that loss and bereavement were considered the only factors contributing to loneliness among Khmer-speaking participants. Both Nepali-speaking and Khmer-speaking participants shared that Asians were not lonely because they have always been connected closely with family and friends. Khmer and Nepali-speaking participants not only denied experiences of loneliness among themselves but also among the clients they serve. However, the loss of family members, particularly a spouse, was associated with loneliness according to Khmer-speaking participants: "Yeah, so the only ones who would feel lonely are those whose partners had passed away…When they have no spouse, they seemed to be lonely." Other Khmer-speaking participants further explained that losing family members contributes to loneliness through the yearning for a lost connection, because people "love and unable to forget":

It is normal for human beings when losing a family member, they are always lonely and miss… Our human beings are like that, whenever there is a family or children, whenever someone in a family is lost, they always feel lonely and miss that person.

In contrast with the perspective that associated aging with loneliness, other participants regarded loneliness as a universal experience among people across the lifespan and social-economic status: "Whether they are rich or poor or whatever. Everybody needs somebody to talk to". One participant specifically discussed loneliness among teenagers as they learn to navigate the complexity of the world:

I learned that teenagers get lonely. Yeah, and we as parents have to listen to our children. Listen to their mind, it's not always about us. Listen to your children, because they need to talk things out because they are still learning…Yeah, they get stuck in the good, bad and ugly, because It's a crazy world out there. They

> *don't know what to do because they... want to interact with a friend, they are not fitting in with a friend, or whatever. So, they need to talk to somebody, too. Everybody needs somebody, everybody needs love.* (English-speaking focus group A)

Coping with Loneliness. Older volunteers employed various coping strategies when experiencing loneliness. When they or their clients experienced loneliness, volunteers coped with loneliness by: "staying busy", staying close with families, building a community of support, communicating with people, and "trusting God", "helping others".

All groups of older adults stressed the importance of "staying busy" in coping with loneliness. Engaging in meaningful activities helped prevent loneliness. Example activities included gardening, having pets, reading and scrapbooking, volunteering, and watching TV. Staying busy matters to older adults: "You are busy. You feel like you are OK. You are going to work. You have to do something." Several older volunteers shared that they are not lonely because they stay busy through services: "When you talk about loneliness. We got no room for it. Because we are out there helping other people." Likewise, when asked what they would recommend for people feeling lonely, one participant underscored the importance of volunteering: "I recommend them to do the same work I am doing." Other participants engage in gardening as a way to stay active and connect with families and friends:

> *So, he also has a small land, his family land, they have a small garden. So together with his family, they come out and do some gardening, and grow vegetables. So that's how they enjoy time together nowadays. Because spending a long time in the house, it takes a toll on your mental health. So that's why they come out and freshen up and just to connect with each other.* (Nepali-speaking focus group)

However, volunteers also engaged in other non-social activities as distractions to cope with loneliness when social contacts are not readily available. The following participant lives alone and shared:

> *I think in the evening I rely on having the TV on for noise. Yeah. I watch way too much TV. But it's something because I don't want to go out when it's evening too much, when it's dark, I do not like to drive.* (English-speaking focus group C)

Thus, living with or staying in close contact with families provided opportunities to socialize and thus prevent loneliness. One volunteer from the English-speaking focus group C shared that some of her friends moved in with family to avoid living alone. As more family members work from home during COVID-19, the closeness among family members was enhanced during the pandemic for some participants. According to several Bhutanese volunteers: "Yeah, they've been saying that because they always have family members with them. That part was compensating the vacancy COVID had created in terms of meeting friends and relatives".

Another important coping strategy when feeling lonely was to build a community of support by bonding with people sharing similar cultures and languages while getting to know people from various cultures. Bonding with people sharing similar language and cultural backgrounds helped older immigrants to maintain a sense of connection with their sending country while integrating into the receiving society. Some Bhutanese volunteers described connecting with clients through shared memories:

> *So, what he is saying is that because some of the older folks can not walk, and they cannot just go outside their home, but when volunteers go and visit them and talk about the old days, about Bhutan and Nepal, it just makes them feel very happy and connected.* (Nepali-speaking focus group)

Somali-speaking participants also talked about connecting with the Somali community through religious and social activities:

> *So better come to Mosque. Better come to restaurants, they can stay with people from Somalia. They took like this table is about eight persons they are sitting, drink the tea and water. They are talking, some they are talking story, some talking history, that is good.*

Khmer-speaking volunteers also discussed how the Cambodian community supported members experiencing loneliness due to loss and bereavement: “some ladies whose husbands have recently passed away, brother [name] who gets vegetables, delivers the vegetables to their houses free of charge.”

In addition to connecting with people from similar cultural and language backgrounds, spreading kindness to people regardless of their cultural identities was also recognized as an important remedy for loneliness. When asked about how to address loneliness among older adults, several participants highlighted the importance of kindness without discrimination: “Just love each other and basically help each other. Learn to help and be sympathetic. Because there’s no good, bad, black, white, rich, poor, just helping everybody.” (English-speaking focus group A).

Besides building community, honest and transparent communication about life challenges reduced perceived disconnectedness. In a follow-up interview, one participant shared how “Talking it out loud” helped her regain optimism and laughter while connecting her with people who experienced similar challenges in life:

> *I believe you should share, get comfortable enough to share what's going on in your life, what you have been through, because that's how I got through it. ...and when you come to the meetings, you know, well, I did this, and I've been through this and my problems, this and this. But then they'll be able to say what's gone on with them, you know, in their life, little by little, and then they'll learn to trust people and talk it out. And if not, you know, you're not going to be able to laugh,*

> *you're going to abuse your children, be scared of your husband, you don't know when to say anything. That's what I had gone through with my husband, I didn't know what to say, when to say, and how to say it, or anything. You can stop it. That's something they have to go through themselves, you know, then the laughter will come on.*

Besides socializing and confiding, religious participation (e.g., going to church, temple, mosques) and religious beliefs also shape participants' coping strategies in face of loneliness. One Khmer-speaking participant shared "As a Christ-follower, I always take God's speech to lead." Likewise, when asked about how to support lonely clients, one English-speaking volunteer stated that: "Well, you just hold their hands, hold their hands and tell them very softly, and just tell them that everything will be alright. Trust God…Let them know if they don't know Jesus. You know you tell them a little something. Some of them might say no, no, no, no, no, no. Okay. You just say a little bit something, just enough to get it to cling in their head".

Furthermore, helping others, giving, and contributing were important ways to cope with loneliness among participants. Some participants highlighted the importance of being inclusive when providing help: "as long as you can move, you do it for everybody". The following participant explained how helping addresses loneliness:

> *Sometimes if we take that loneliness and revert it out there, or you are sitting there feeling lonely, try calling someone and make them feel less lonely, have a conversation with them and that'll kill two birds with one stone.* (English-speaking focus group A)

Interestingly, other participants pointed out the limitation of helping others to cope with loneliness. However, regardless of whether one's own loneliness is alleviated through an act of generosity, benefiting others still came first:

> *Sometimes when you help other people at the end of the day you still get lonely. but people come first thing, your client comes first. You are the last to think about.*

> *I know I am, I am the last to think about. I think about everybody else.* (English-speaking focus group A)

Acknowledging the prevalence of loneliness in life regardless of coping strategies, focus group participants identified the positive value of loneliness. In their perspective, loneliness might be a reminder of interconnectedness among human beings: "with God, this is a lonely world, and he has it that way so we can communicate with other people". Another participant further elaborated on the positive meaning of loneliness in the context of COVID-19:

> *At first, we didn't… we act like we didn't need to need each other. But somehow the world changed overnight and everything, now we need each other. No matter what color you are, what race you are, whatever. Just love each other and help each other. Don't be mean to each other* (English-speaking focus group A).

Exploring and Loving the Volunteering Program

To disentangle the relationship between volunteering, social networks, and loneliness, participants were invited to share how they were recruited into the program, how they navigated volunteering initially, and their sustained engagement in the program.

Initial Engagement in the Program. Many volunteers learned about SCP through "the word of mouth" from friends who were involved with SCP or family members who had connections with the leadership of the program. Some volunteers "recruit our friends into the program".

> *He was introduced to this program by another volunteer who had been affiliated with the program for quite some time. And because he knows driving, so his friend thought it would be easier for him to connect with other people in the community. He started like that. While working in this program, he's been going out and talking to people who are old and lonely in the community and cannot go out and work on their own. The younger family members go out for work and senior citizens look forward to having company. So it's been really good to go and*

> *connect with them and communicate with them on a regular basis. Senior clients enjoy our company and feel replenished.* (Nepali-speaking focus group)

Other volunteers got involved through the recruitment talks and engagement events organized by SCP. Because of the close relationships between SCP and other non-profit organizations in the community, many older adults were introduced to SCP through leaders of other non-profit organizations, such as Job and Family Services, and the Senior Services program. One participant discussed how previous volunteering experiences and attendance in citizenship classes brought him to this current volunteering opportunity.

> *So, what he is saying is that he has volunteering experience back in Bhutan and also in the refugee camp in Nepal. While attending his Citizenship classes, one of the community leaders came to him and said that there are these different opportunities to volunteer with senior citizens. The leader pointed out that if at this age he could read and pass the exam to get a citizenship in a new country, he can help the community in various ways and the community is in need of volunteers like him. That's how he came into the program.* (Nepali-speaking focus group)

Factors Contributing to Sustained Volunteering. Several volunteers shared that they have had more than 10 years of experience volunteering in SCP. All groups of volunteers shared that meeting new people, contributing to the community, navigating lives in a new country, helpful organizational structures, and opportunities to stay active after retirement contributed to their sustained volunteering over time.

When asked about what they liked the most about volunteering for SCP, meeting new people through the program was a frequently mentioned benefit by volunteers. For example, "Because I am single. And don't have much family. And so, it's nice to make new friends. You know, it's just, it's just nice, very nice." (English-speaking focus group D).

Furthermore, volunteers valued the opportunity to contribute to the community through volunteering: “That has been helping people a lot and they feel more connected to the community. They also feel like they are contributing to the community.” (Nepali-speaking focus group). For some older adults, volunteering has been an opportunity to continue their commitment to services building on previous experiences:

> *So, with him, he was also volunteering back in Bhutan. So, he has a long history of volunteering, and some of his friends earlier joined this program. And they had a very good experience volunteering. And they thought he would also be a very valuable member of this program. That's how he's been affiliated with the program. He’s very happy and grateful to serve the community.*

Other volunteers highlighted several helpful organizational structures of SCP when discussing their positive engagement with the program. These helpful structures included helpful staff members, mileage reimbursement, opportunities to serve on the council, and train new volunteers. The presence of supportive staff members who were responsive to the needs of volunteers, clients, and the community has been a major reason for volunteers’ continual participation in the program.

> *I would like to add that the management of the Senior Companion Program always responds to all the questions we have. When we call and ask something, they are always extremely helpful. We value this a lot, and we are incredibly grateful to the management team of the Senior Companion Program.* (Russian-speaking focus group)

Similarly, Somali-speaking volunteers also mentioned positive interactions with SCP staff members as reasons for continual engagement in the program.

> *So many managers are good, for the woman and the men, like the [name of volunteer coordinator] now she left the program, she is very, very good. And another woman is in [name of a staff member]. She's a very good woman. She left the program. So, I’d like to stay in this program as long as I am alive.* (Somali-speaking focus group)

Other volunteers highlighted the importance of site station supervisors in finding a good match for clients and volunteers, which lays the foundation for a high-quality relationship between clients and volunteers.

> *I think it all starts with [name of the site station supervisor]. She's so thorough and understanding and she takes her time to try to match you to the right person. Yeah, I think that begins everything.* (English-speaking focus group C)

Some SCP volunteers expressed their appreciation for being reimbursed for mileage during their volunteering services while enjoying the company of clients: "I get company. I enjoy that. Um, I get reimbursed for my mileage. Can't complain about that." (English-speaking focus group C)

Other volunteers valued the opportunities to serve on SCP councils to stay informed: "and it's good to be on the inside of things going on a lot of friends call me because I was on the advisory council. And I could tell them about things that I know." English-speaking focus group A)

Besides benefiting from the organization structures, volunteering has been an opportunity for older adults to stay active after retirement. One Bhutanese older adult shared that "The program provides him with the opportunity to be physically active and to meet with others regularly*"*. Similarly, some Somali-speaking volunteers enjoyed volunteering for SCP because it provided them with opportunities to stay productive without feeling overwhelmed.

> *The program is so good for my age, they provide a good system where you do what you do, and you are comfortable. Doesn't disturb your anything physically and it's good for your brain. You do something.* (Somali-speaking focus group)

Challenges of Volunteering. When asked about what made it challenging to volunteer, participants discussed the ambiguous boundary between clients and volunteers.

The following participant shared the challenge of meeting all expectations of clients:

> *The challenging part is when you have a person that is very demanding. And some of them think that you are not a companion. Because we have that title, a companion, yeah, to them, that is, well, why don't you go ahead and do my laundry, and this and do that. And while you're at it, can you find the shovel and dig out that plant that I don't want anymore?* (English-speaking focus group C)

The participants further described the challenge of navigating ambiguous boundaries between clients and volunteers: "We walk a very thin line. I have seen it, seems like we give an inch and then come in again, and then again, and another one. Where do you stop?" Other volunteers shared referring to their role as a "senior friend" to avoid varying expectations for a "companion".

Moreover, senior companions also discussed the challenge of working with clients who need higher levels of care due to physical and cognitive health conditions. Volunteers shared worrying and feeling concerned about these clients outside of the scope of their work:

> *I had one lady who was at the beginning of dementia. That was a challenge. And then I finally talked to [name of the site station supervisor] about it, and I'm just like, I can't do it. Yeah. I mean, it was just she was a negative type of person. And, you know, we did last a while and it was okay, but I would come home, worrying about her so much. I mean, you just can't help not to do that. If you're, you know, being close. I mean, I was the only one that took her anywhere. So…*

Social Connections Outside of the Program. Older volunteers' networks within and outside of the SCP were interrelated. Some volunteers recruited friends into the program or were recruited by friends who were volunteers. Volunteers' social networks outside of the program facilitated the initial engagement with the program. Volunteers also made new friends or strengthened their existing friendships through SCP, some friendships extended beyond the program.

Aside from the SCP network, volunteers' social networks outside of the SCP provided them with important opportunities and support. Volunteers' support network outside of SCP consisted of neighbors, friends, acquaintances, family members, and members of religious institutions (e.g., churches, temples, and mosques). The following paragraphs discuss volunteers' interaction with different types of social contacts external to SCP.

Relationships with neighbors, friends, and acquaintances were usually maintained through social and entertainment activities, such as going out for walks and going to concerts. Some participants stressed the importance of keeping an open heart and making friends with whoever they meet. Some people shared that they sit outside of their apartment and greet all their neighbors. The following participant explained the importance of greeting everybody they see and encounter in life:

> *Yeah, it's important to say hello, goodbye, or give away something. You have no idea what that person is going through that day. And that word you say to them "Hi, how are you today?" might be the only thing they have going on* (English-speaking focus group C).

Although volunteers enjoyed connecting with people of similar age through SCP, they also discussed the importance of intergenerational relationships outside of the program. Besides interactions with "little ones" within the family, one participant talked about enjoying the company of children at church because grandchildren lived far away. Being able to see and interact with children at church brought joy to both the older adult and the children.

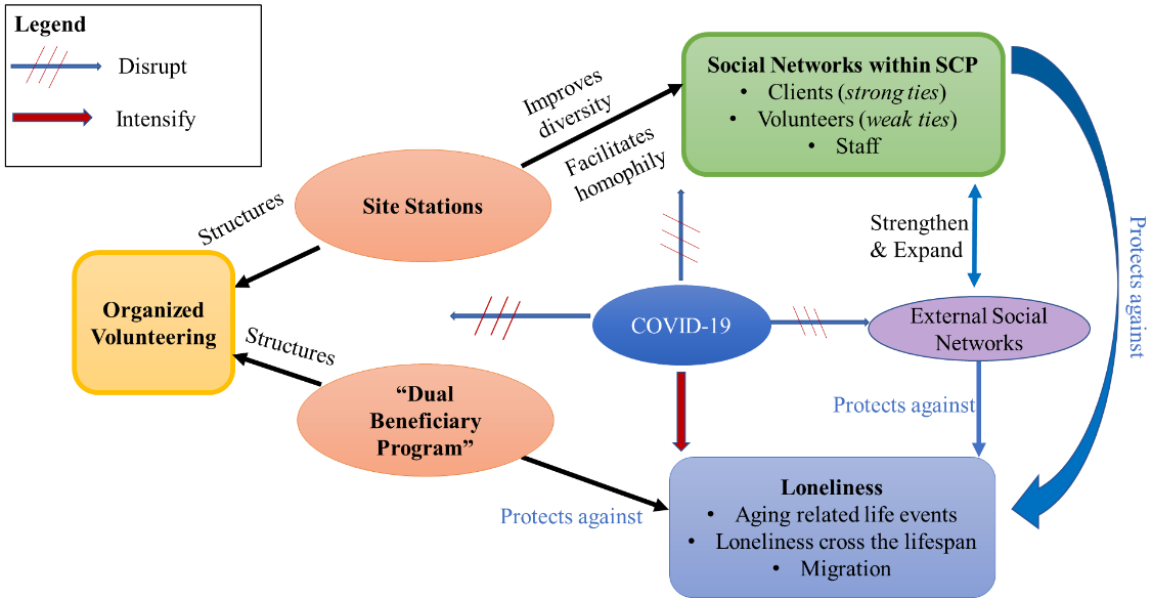
> *Yeah…I have five great-grandsons, but they are scattered all over the world…(not audible). But at church, I would have all the grandchildren …(not audible) When we see each other we hug each other, that makes my day…(not audible), I even took a picture, yeah, they are on my mind. They enjoyed my company…*

To some participants, “family is everything”. They missed cooking, going to sports games, and celebrating holidays with family members due to COVID. Cooking and enjoying a meal with family were mentioned by all language groups. For instance, the Khmer-speaking group shared that “we do nothing besides cooking food such as soup and BBQ for eating.” Some English-speaking participants shared a sense of satisfaction from cooking for large groups of people before COVID-19. Participants still maintained connections with families through phone calls and video calls during the pandemic.

Relationship Between Volunteering, Social Networks, and Loneliness

A conceptual framework on the relationship between volunteering, social networks, and loneliness (Figure 3) is generated by integrating major themes from expert interviews and focus groups. The two major organizational features of SCP shaping the volunteering experiences and the social networks of diverse older volunteers were presented by two ovals in Figure 3. To start with, site stations of SCP engaged in the recruitment and supervision of volunteers. The diverse clientele of site stations contributed to the diversity of older volunteers in SCP. Meanwhile, the pre-existing friendships among older adults within the same site station before joining SCP enhanced the homophily of relationships by site stations.

Figure 3. Relationships among Volunteering, Social Networks, and Loneliness



Additionally, as "a dual beneficiary program", SCP has been mainly focused on fostering the reciprocity between clients and volunteers, leaving more flexibility and autonomy for relationships among volunteers. In contrast with the frequent weekly contact with clients, programmatic interactions among volunteers took place on a monthly basis. As a result, the strength of ties among volunteers was likely weaker than the relationship between clients and volunteers. Furthermore, differing from the dyadic interaction between clients and volunteers, the socialization among volunteers mostly took place in group settings within the program, such as orientation for new volunteers, and monthly in-service training. Building on SNT and the existing empirical research, this conceptualization suggested that volunteers' network structures (e.g., homophily, weak ties among volunteers) within SCP is likely shaped by the organizational structure of SCP (Casey et al., 2016).

Social networks within and outside of SCP complemented one another in protecting against loneliness among older volunteers. Word of mouth recruitment has been essential for sustaining the SCP program. Some volunteers were recruited by family and friends connected with SCP. Once involved, they further recruited their external network into the program. Moreover, some relationships formed among volunteers extended beyond the program boundary. Socializing with other older volunteers outside of the program (e.g., going to the church, temple, and mosques together, calling each other between meetings) further strengthened the volunteers' support network and prevented loneliness.

Besides addressing loneliness by strengthening volunteers' social networks, the dual beneficiary nature of SCP has been another protective factor against loneliness. Because some volunteers joined SCP after experiencing aging-related major life events (e.g., retirement, moving, widowhood, and migration), suggesting that the SCP network became a source of new relationships following aging- and migration-related social changes. Older volunteers gained a sense of satisfaction by making meaningful contributions to clients' lives. This finding reflected the connections among the major principles of LCP by illustrating how one's human agency (volunteering) to social changes (linked lives) after major life transitions can shape one's experience with loneliness (Gong et al., 2011).

Moreover, COVID-19 disrupted all types of relationships and intensified loneliness through external policies and self-isolation. Relationships within the program were disrupted in two major ways. Connections with other volunteers were disrupted because of the discontinued monthly in-service training. Meanwhile, in-person

interactions with clients were also paused due to COVID-19-related safety concerns. The quantity and quality of relationships were both impacted. Although calling to keep in touch with clients and other volunteers ameliorated loneliness, volunteers expressed the desire to resume in-person service provision to clients as well as monthly in-service training for volunteers.

Quantitative Results

Descriptive Results

Participants' average DJGLS score was 2.53 (*SD*=1.67) as presented in Table 2. When an individual scored over 2 on the DJGLS loneliness scale, that individual was considered lonely (De Jong Gierveld & Van Tilburg, 2008). Figure 4 further displays the distribution of loneliness among participants. Those who scored 2 or more on the DJGLS were considered lonely (De Jong Gierveld & Van Tilburg, 2008). Out of 35 valid responses to DJGLS, 17 participants (48%) experienced loneliness.

Figure 4. Histogram of De Jong Gierveld Loneliness Score Distribution

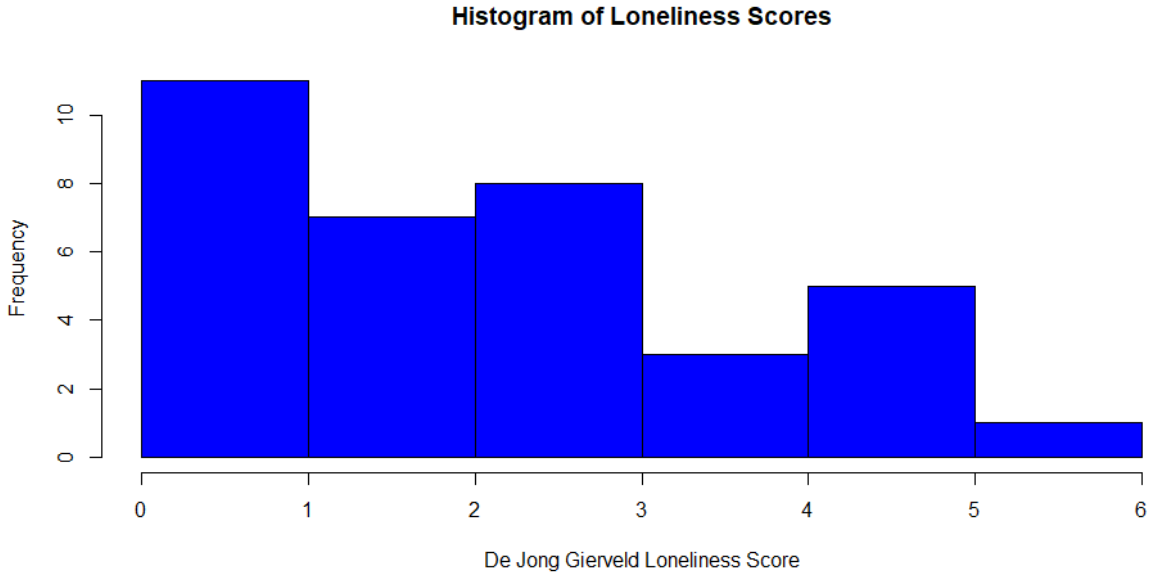


Table 4 below illustrated the descriptive characteristics of edges (ties) in the network. When considering the nature of the relationship between egos and alters, around 80.65% of the participants nominated another volunteer of SCP as a friend. Additionally, 61.9% of participants introduced the friend they met at SCP to friends and family members outside of SCP, indicating that these relationships transcended program boundaries. However, the average frequency of interaction between the ego and the alter in the past month was relatively low (*Mean*=3.22), with an *SD* of 4.98; suggesting that the relationships within SCP had limited depth and the frequencies of meeting varied among participants. It is possible that COVID restrictions at the time of data collection limited the frequency of interactions among volunteers.

Table 4. *Descriptive Edge Characteristics*

Variable	Frequency	%	Mean	SD	*N*
Introduced alter to families/friends outside of SCP					21
No	8	38.1			
Yes	13	61.9			
How the ego first met the alter					31
This alter is a client from the SCP	2	6.45			
This alter is also a volunteer of the SCP	25	80.65			
Other	4	12.9			
Meetings			3.22	4.98	32

Note. SCP (Senior Companions Program). Egos refer to survey participants whereas alters refer to nominated friends. The "Frequency of interaction with the alter in the past month" refers to the frequency of interaction between an ego and one specific alter. When participants did not provide information on the number of times they met with an alter, their frequencies of the meeting are imputed that as 0, fourteen values were imputed.

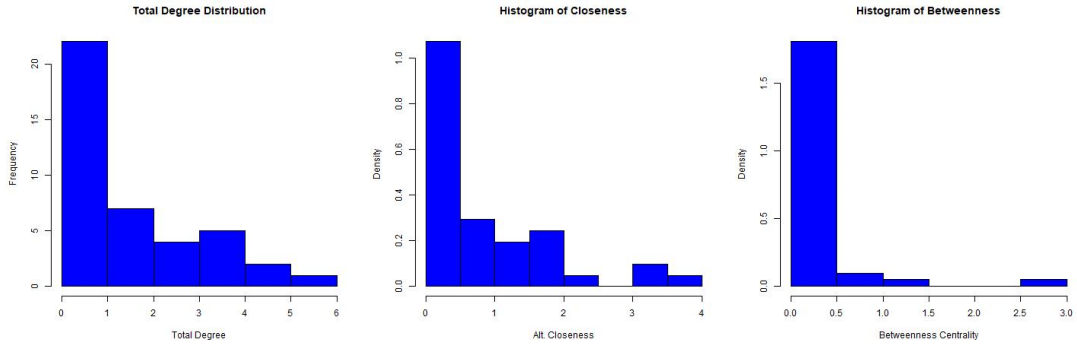
Network Descriptive Information and Graphs

The density of the network (i.e., the proportion of existing ties over all possible ties in the network given the same number of actors) was 0.02, suggesting that only 2% of ties were connected among all possible ties within the network. Because network size has been a primary determinant of network density, comparing the density of the SCP

network with other networks of similar sizes can help interpret its density. A well-known network in SNA is Zachary's karate club, which consisted of 34 members at a university in the U.S. The density of Zachary's karate club was 0.139 (Living Data Lab, n.d.), higher than the SCP network. Connections among volunteers as a secondary goal of the SCP and managing volunteers through separate site stations might have limited the density of the SCP network.

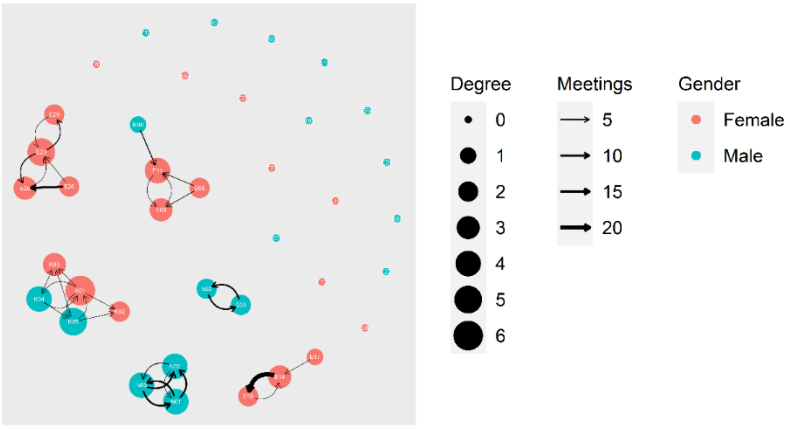
Among all edges in the network, 62.5% of them were reciprocal. The network had 32 edges, and 18 of them (56.25%) were classified as *transitive ties* according to the definition in Table 1. Figure 5 below displays the distribution of different types of centralities (degree centrality, closeness centrality, and betweenness centrality) among nodes in the network. As discussed in Chapter 3, centrality refers to the prominence or the structural importance of a node (Borgatti et al., 2009). According to the histograms, 0 had the highest frequency in all centrality measures, indicating that many individuals did not nominate friends and were not nominated by other participants. The particularly low betweenness centrality reflects limited brokering nodes within the SCP network. Volunteers with high closeness centrality in the SCP network can reach other network members efficiently (Borgatti et al., 2013; Brandes et al., 2016).

Figure 5. Histogram of Different Types of Centralities



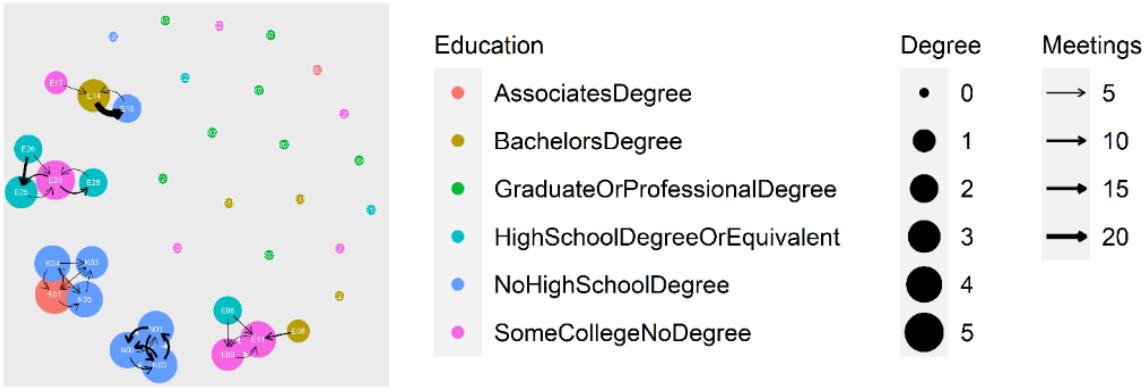
The low frequency of sending and receiving ties was further demonstrated by a large number of isolates within the network graphs (Figure 6, Figure 7, Figure 8, and Figure 9). As explained in Chapter 3, only older volunteers who were present at the data collection were included in the network visualization and analysis. Isolates refer to people with no ties and are arranged on the right side of each network graph (Borgatti et al., 2009). The SCP network consisted of several disconnected components and isolates. Separate network graphs were constructed to visualize different types of homophily or heterophily based on gender, education, country of origin, race, and site stations within SCP. The size of each node in the network graph reflected the degree (in degree plus out-degree) of each ego, which was also referred to as the Freeman degree (Freeman, 1979). The larger the node, the higher degree it had. The thickness of the arrows represented the frequency of interactions in the past month. A thicker arrow represented a higher frequency of meetings. The direction of the arrows represents who nominated whom. In addition, each participant's ID started with the first letter of the language group they were in during the data collection. To be specific, an ID starting with "E" belonged to the English-speaking focus group, an ID starting with "N" represented Nepali-speaking focus groups, an ID starting with "K" referred to the Khmer-speaking focus group, an ID starting with "S" referred to the Somali-speaking focus group, and an ID starting with "R" referred to Russian-speaking focus group.

Figure 6. Network Graph by Gender



Females and males were represented in different colors in Figure 6. No participants of this study selected "other" as gender in the survey. Figure 6 illustrated homophilous gender-based clusters with a few exceptions. Comparing participants' gender among various focus groups (as indicated by their IDs), the figure also illustrated that all nodes in the Nepali-speaking and Somali-speaking groups were male whereas the majority of nodes in English-speaking groups were female. The cross-cultural gender differences are discussed in Chapter 5.

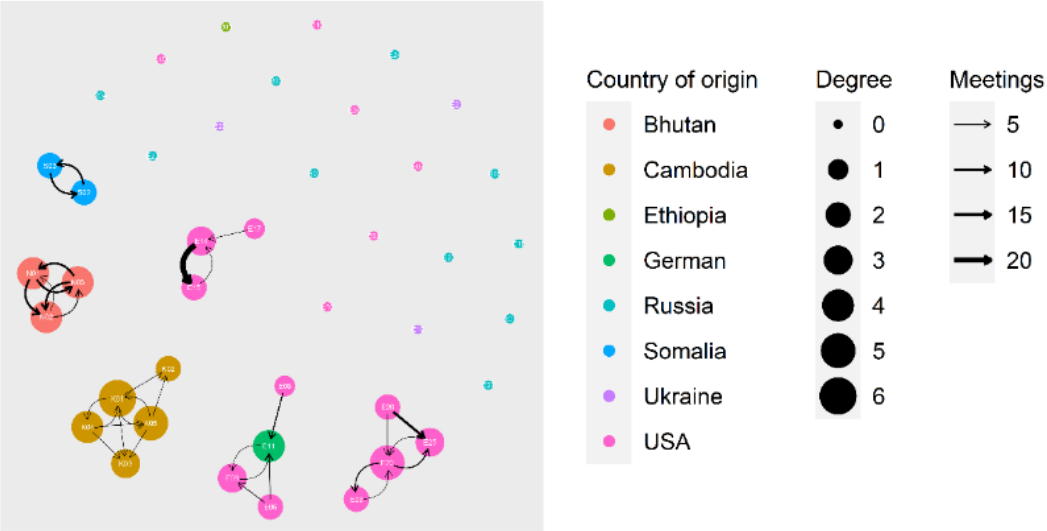
Figure 7. Network Graph by Education



Different levels of education were presented in different colors in Figure 7. Clusters of individuals with the same level of education can be identified in the network. However, four clusters consisted of individuals with both the same and different levels of

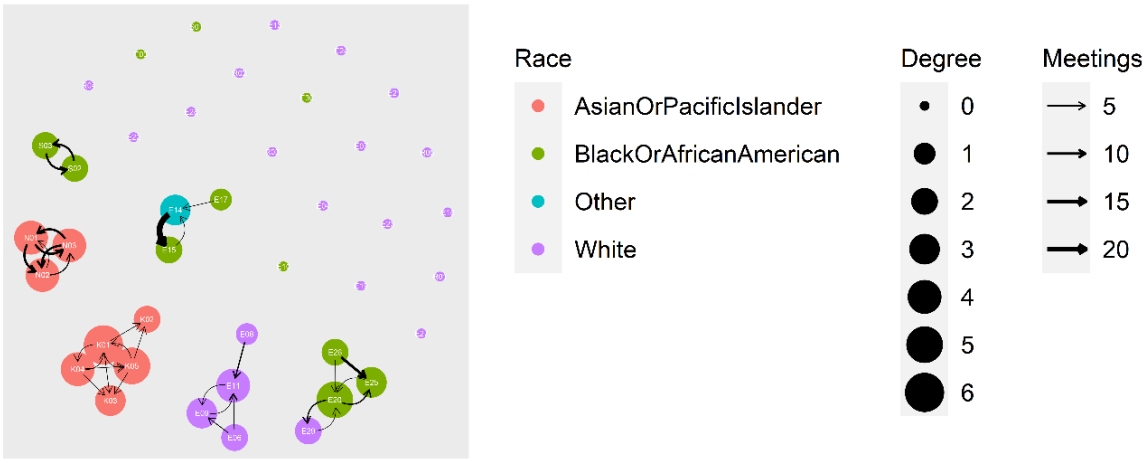
educational attainment. Whether and in what direction might education-based homophily be significant in SCP required inferential network analysis using ERGM discussed later. Furthermore, the figure also illustrated that educational level varies among different language groups. For instance, all nodes in the Nepali-speaking focus groups had no high-school degree whereas the majority of nodes in the Russian-speaking focus groups had graduate or professional degrees.

Figure 8. Network Graph by Country of Origin



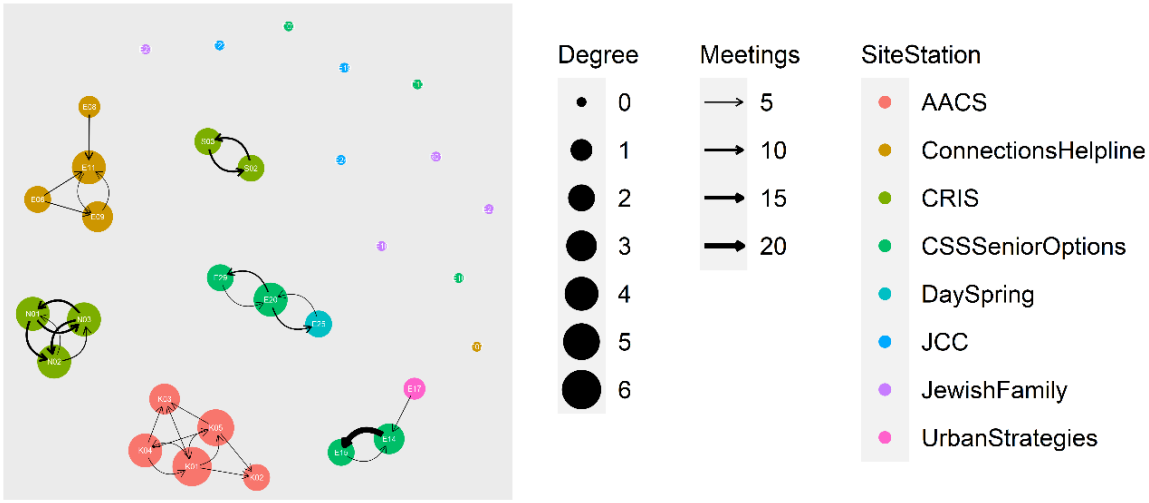
In Figure 8, each country was represented by a color. As indicated by clusters with the same color, the SCP network displayed a clear tendency of homophily based on country according to the network graph. Similar to other network graphs, there was no tie across clusters. The IDs within each cluster also suggested that participants from the same country were mostly in the same focus group during the data collection.

Figure 9. Network Graph by Race



In Figure 9, each color represented a racial category. The majority of clusters demonstrated race-based homophily with two exceptions. Whether race-based homophily was positively significant when accounting for other variables was further examined via inferential network analysis using ERGM.

Figure 10. Network Graph by Site Stations



In Figure 10, each color represented a site station of SCP. Cambodian participants were all from the AACS, whereas all Bhutanese and Somali participants were from CRIS. Cambodian participants formed a homophilous cluster based on their site stations. Interestingly, although both Bhutanese and Somali participants were served by CRIS

according to the name roster provided by SCP, there was no cross-over between the above two clusters in the graph. English-speaking participants also formed site station-based homophily with two exceptions.

Exponential Random Graph Models (ERGM)

Results from the valued ERGM are presented in Table 5. With the exception of age and race, all homophily variables were positively significant in this network. In other words, volunteers were more likely to be friends with those from the same country, of the same gender, with the same educational level, and from the same site station. Although country-based homophily was significant, race-based homophily became non-significant once site station-based homophily was introduced. The ERGM model including the site station-based homophily was selected because it had a better model fit indicated by its smaller AIC and BIC than the model without (Cranmer et al., 2020). The VIFs of all independent variables (e.g., homophily based on country, race, and site stations) were below 20 in the final ERGM, suggesting that multicollinearity did not unduly influence the results (Duxbury, 2021).

As discussed in Chapter 3, network formation was not only influenced by factors exogenous to the network but also shaped by processes endogenous to a network (Cranmer et al., 2020). Among endogenous processes, reciprocity was not statistically significant in this network, suggesting that the tendency to form friendships with those who reciprocate was not prominent in this network. Additionally, the negative significance of transitive ties suggested that there was a tendency to avoid forming triads within this network. That is to say, if two participants were friends with one another, they

were unlikely to have agreed on a third person as a common friend. The lack of positively significant endogenous network processes left homophily as the major mechanism behind relationship formation among SCP volunteers.

Variables were added to ERGM one by one, and the final model had the smallest Akaike information criterion (AIC) and Bayesian Information Criteria (BIC), indicating a better fit for the model (Cranmer et al., 2020). The final model had an MCMC sample size of 524, 288 and the MCMC burn-in was 30, 720. A large MCMC sample size and long MCMC burn-in facilitated model convergence. The convergence of each model parameter was also illustrated by the non-trending MCMC trace plots (Cranmer et al., 2020) displayed in Appendix L.

Table 5. *Results from the Valued ERGM*

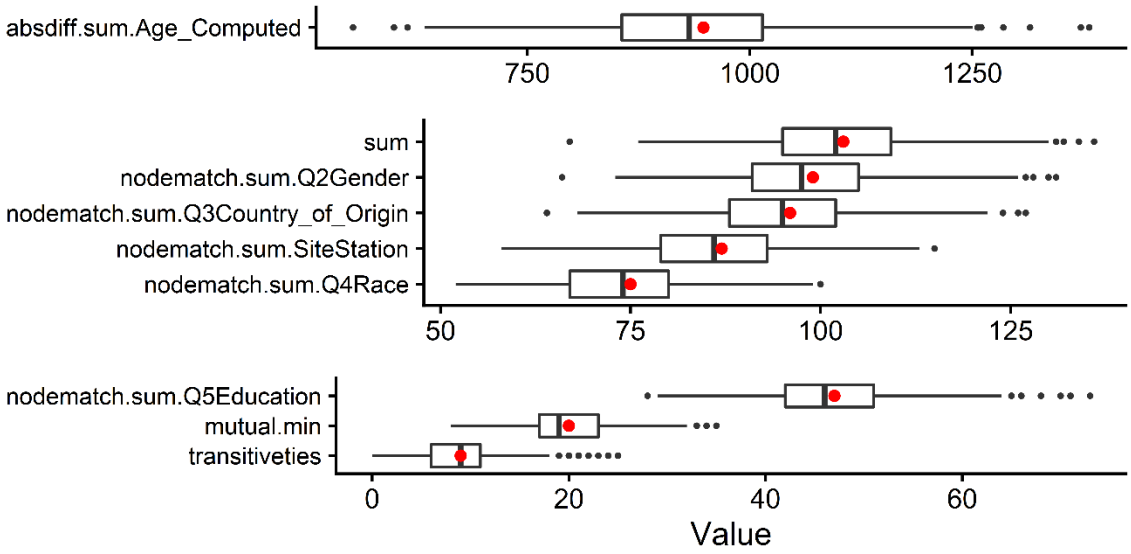
	Estimate	Std. Error	z value	Pr(>|z|)	
Sum of the frequency of meetings	-8.8	0.73	-11.96	< 1e-04	***
Homophily of country of origin	2.89	0.44	6.5	< 1e-04	***
Homophily of gender	3.27	0.55	6	< 1e-04	***
Homophily of education	0.71	0.21	3.37	0.0007	***
Homophily of site stations	2.77	0.31	8.94	< 1e-04	***
Transitive ties	-1.01	0.27	-3.69	0.0002	***
Homophily of race	0.03	0.22	0.14	0.89	
Homophily of age	0.02	0.02	1.31	0.19	
Reciprocity	-0.1	0.31	-0.33	0.74	

Note. p***<0.001***; p**<0.01, p*<0.05, p·<0.1. AIC: -2971; BIC: -2922.

Aside from the MCMC trace plots, another set of tools for assessing the fit of ERGM is the goodness of fit statistics and goodness of fit plot, which are currently unavailable for count-ERGM in R. However, the lead researcher was able to construct the goodness of fit plots (boxplots) comparing the characteristics of simulated networks with the observed network visually (Cranmer et al., 2020). In Figure 11, the boxplot represented a random sample of 1000 simulated networks using the parameter estimates from Table 5. The networks were simulated from the exponential probability distribution

with the same Poisson reference used in the ERGM fit. The simulated networks also had the same number of nodes as the observed network. The box plots summarized the properties (e.g., homophily, transitive ties) of the 1000 simulated networks, whereas the red dots in Figure 11 represented the corresponding property in the observed/actual network. The proximity between each red dot and the medians of the boxplots was indicative of the ERGM algorithm's successful effort to closely describe the network properties, reflecting a good model fit (Cranmer et al., 2020).

Figure 11. The Goodness of Fit Plot



Linear Network Autocorrelation Model (LNAM)

As illustrated in Table 6, LNAM was conducted to explore the relationship between network autocorrelation in the network and loneliness, accounting for individual-level predictors of loneliness (e.g., age, gender, education). Non-significant variables were removed one by one if their removal did not change the direction and significance of other coefficients. The frequency of volunteering was kept in the final

model because removing it changed the significance of education. In other words, although the frequency of volunteering was not significant, it was still serving the function as a statistical control variable in the model. The full model specified based on empirical research on loneliness is presented in Appendix M.

Table 6. *Results from the Linear Network Autocorrelation Model*

	Estimate	Std. Error	Z value	*p*	
Age	0.05	0.008	6.61	4e-10	***
Gender	1.01	0.43	2.38	0.018	*
Education	-0.28	0.13	-2.17	0.03	*
Number of family and friends	-0.08	0.02	-4.51	6e-06	***
Frequency of volunteering	0.02	0.02	1.39	0.17	
ρ	-0.06	0.03	-2.21	0.03	*

Note. p***<0.0001***; p**<0.001, p*<0.05, p·<0.1. "The number of family and friends" refers to the number of friends and family interacted with at least once a month. For gender, male=0 and female =1. Because Education has more than five ordered categories (no high school degree, high school degree or equivalent, some college, no degree, Associate degree, Bachelor's degree, and graduate or professional degree), it was treated as a continuous variable (H. Wu & Leung, 2017). AIC: 88.31 BIC: 96.84; Multiple R^2: 0.58, Adjusted R^2: 0.45. Also, ρ quantifies the network autocorrelation in a network.

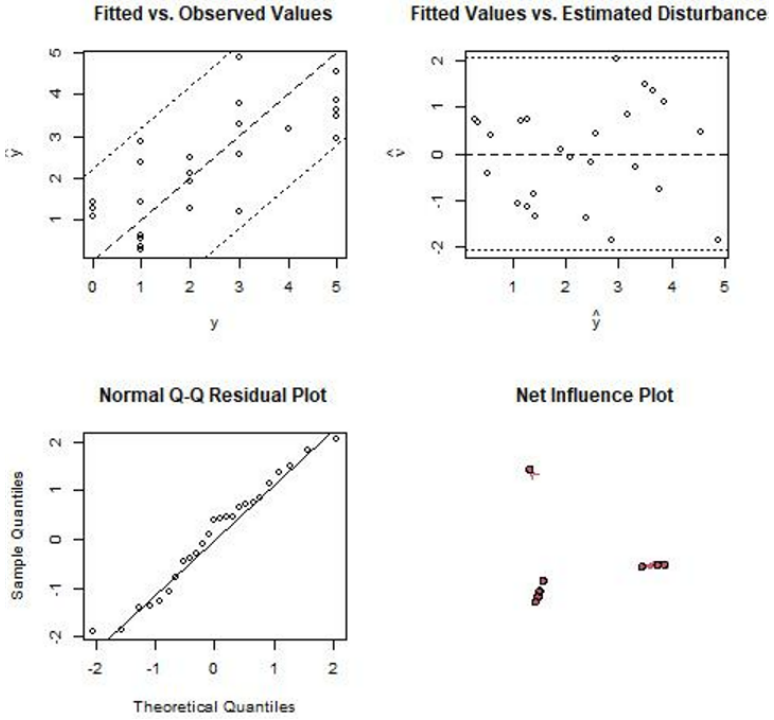
According to the LNAM, older age, being female, having lower levels of education, and interacting with fewer family and friends in a month were associated with higher levels of loneliness. The direction and significance of the above loneliness predictors were consistent with the existing literature (National Academies of Sciences Engineering and Medicine, 2020). As explained in Chapter 3, ρ reflects the average level of dependence in the loneliness among volunteers in the SCP network. In other words, ρ measures how clustered or correlated volunteers' loneliness was. A negative ρ in this network indicated that participants tended to cluster with those with differing levels of loneliness. In other words, volunteers with lower levels of loneliness preferred to interact with those experiencing higher levels of loneliness. It is possible that less lonely volunteers reached out to lonelier individuals due to their commitment to service and

altruism. It is also possible that volunteers with high loneliness connected with less lonely individuals to cope with loneliness. After removing non-significant variables one by one, the final LANM had a higher adjusted R^2, lower AIC, and lower BIC than the full model, indicating better model parsimony and better model fit.

The adjusted R^2 of LNAM was 0.45. The *plot (lnam)* function in *sna* produced residual plots and a net influence plot as displayed in Figure 12. The upper left plot displayed the fitted ($\hat{y}$) versus observed values (y) of loneliness. On the diagonal in this plot, $\hat{y}$=y. All points in this first plot were close to the diagonal, suggesting that our LNAM successfully produced loneliness estimates resembling the observed loneliness values in this network (L. Wasserman, 2005). The upper right plot comparing the fitted values ($\hat{y}$) and estimated disturbance $\hat{v}$ (errors) indicated that the error terms were randomly distributed in this model (L. Wasserman, 2005). An inspection of the normal quartile to quartile (Q-Q) residual plot in the lower left suggested that our sample quartiles were consistent with the theoretical quartiles that assume a normal distribution (L. Wasserman, 2005). In other words, the data were approximately normally distributed. The Net Influence Plot on the lower right of Figure 12 is a plot of the network, but with most edges omitted. Only edges that represent the strongest network correlation were depicted in the plot (Butts, 2008). Strongly positive edges were marked green, while strongly negative edges were marked red (Butts, 2008). The net influence plots of this network suggested that most edges had a mild correlation with one another and only a few edges had a strong negative correlation with others. The name "net influence plot" reflected the purpose of LNAM to quantify the social influence within a network (Salway

et al., 2018). Nonetheless, there is little causal evidence in this exploratory cross-sectional study.

Figure 12. Residual Plots and Net Influence Plot from LNAM



Mixed-Method Results

Social Network Structures among Senior Companions

Table 7 is a joint display table comparing statistically significant network structures with qualitative findings. The first column in Table 7 presents statistically significant network structures, the second column presents the corresponding qualitative finding, and the third column presents the result from a mixed-method comparison. Homophily by country of origin was statistically significant in ERGM, suggesting that participants were inclined to form relationships with other volunteers from the same country. However, the qualitative findings suggested that volunteers not only form

friendships with people from the same country but also enjoyed meeting people from other countries. The qualitative finding expanded the quantitative finding on country-based homophily. Both the qualitative and quantitative strands supported country-based homophily as a facilitator of relationship formation within SCP. In addition, the qualitative finding expanded the quantitative finding by adding that older volunteers also enjoyed meeting people from various cultural backgrounds. Several volunteers stressed the importance of treating everybody with kindness regardless of their identities is also valued by SCP volunteers. This expansion might have reflected the difference between friendship and appreciation. In other words, treating all human beings with kindness might be different from regarding them as friends, especially when asked to nominate a limited number of friends. Furthermore, language barriers among older volunteers from various countries might have hindered their appreciation to evolve into actual friendships by restricting the depth of their communication.

Both quantitative and qualitative results suggested a tendency to form relationships with people of the same gender. Gender homophily had a significantly positive contribution to tie formation in ERGM. Gender homophily was also supported by focus group interviews and field observations. Based on field notes taken during the data collection, all participants in the Somali and Bhutanese focus groups were male, whereas all participants in English-speaking focus group A were female. Another example of gender homophily from the qualitative data is that one female participant shared that she often spent time with other women in the program.

The significance of site station-based homophily in ERGM was confirmed by the qualitative findings from expert interviews. Staff members discussed in detail how

friendships among volunteers were constrained within the boundary of each site station due to language and cultural barriers. This confirmed finding underscored the importance of organizational structures in shaping the networks among volunteers.

Although participants did not discuss forming relationships with people sharing similar educational backgrounds in detail, when asked to summarize the characteristics of friends in a follow-up interview, one participant shared that all her nominated friends had high school degrees just like her. According to Figure 7, education-based homophily might be related to the homogeneity of educational level within each language group.

Despite the negative significance of transitive ties in ERGM, a few pairs of friends in the focus group mentioned having a common friend. That is to say, the qualitative findings were inconsistent with the quantitative findings by suggesting that when two volunteers were friends, they were likely to agree on the third person as a common friend. The conflict between the qualitative and quantitative findings might be because most transitive ties were within homophilous groups, so when homophily was accounted for statistically, transitive ties became negatively significant. Additionally, because only about half of the network was present at the data collection, missing nodes and edges in the SCP network might have contributed to the negative significance of transitivity (Green et al., 2019).

Table 7. *Joint Display Table on Social Network of Diverse Older Volunteers (Aim 1)*

Statistically Significant Network Structures	Qualitative Findings	Mixed methods comparison
Homophily (Country)	*So better come to Mosque. Better come to restaurants, they can stay with people from Somalia.* (Somali-speaking focus group) *We have been in close relationships with other nationalities and have been getting along with each other.* (Khmer-speaking focus group)	Expansion
Homophily (Gender)	*A couple of times I've seen some of the girls at Catholic Social Services. I don't know their name, but I know their faces. They have been at their church or whatnot.* (A follow-up interview with an English-speaking female participant)	Confirmation
Homophily (Site Station)	*So, they're very connected together and they're all friends within that circle of, you know, their site station. There are just not a lot of crossovers from site station to site station. Again, because of you know, language cultural issues and things of that nature.* (Expert interview)	Confirmation
Homophily (Education)	When asked to summarize the characteristics of nominated friends in the follow-up interview, one English-speaking woman shared that all her nominated friends had high school degrees like her.	Confirmation
Transitive ties	*They are worried about you. [Participant 1] and [Participant 2] both called me, you heard from [Participant 3]?*	Discordance

Social Network and Loneliness among Senior Companions

The first column in Table 8 displays the statistically significant variables in the LNAM, whereas the second column represents the corresponding qualitative theme. The final column is the mixed method result that emerged from comparing the qualitative and quantitative findings. Although aging and aging-related major life transitions (e.g., social loss and alienation with family members) were identified as important factors contributing to loneliness among participants in the focus groups, other volunteers highlighted the prevalence and impact of loneliness for all age groups across the lifespan. For instance, one participant mentioned that adolescents experienced loneliness due to social rejection and confusion navigating the world. Thus, the qualitative finding expanded the quantitative result that older age was associated with higher levels of loneliness.

Furthermore, several female older adults talked about feeling lonely and relying on noises from the TV at night after widowhood in the focus group, confirming the positive statistical significance of gender in LNAM. Additionally, focus group participants discussed learning, reading, and receiving education as ways to stay busy and prevent loneliness, confirming the negative correlation between education and loneliness.

Furthermore, qualitative findings confirmed the quantitative result that the interactions with the support system outside of SCP (e.g., family, friends) were negatively associated with the loneliness of volunteers. Qualitative findings suggested that volunteers' support systems outside of SCP consisted of friends, family, neighbors,

volunteers of non-profit organizations, churches, etc. Reaching out to the support network was identified as a major coping strategy for loneliness among participants.

The negatively significant network autocorrelation (ρ) in the LNAM suggested that volunteers with lower loneliness were inclined to interact with those who had higher loneliness. The qualitative findings identified social outreach as a coping strategy for loneliness using an example quote from a participant from the English-speaking focus group B. In other words, experiencing an elevated level of loneliness might have motivated individuals to reach out for or to accept social opportunities (virtually and in-person) to cope with loneliness. An example of how volunteers reached out to one another was presented in the table below. Another explanation for the negative network autocorrelation was that the less-lonely volunteers connected with those experiencing a higher level of loneliness out of altruism. The qualitative findings corroborated volunteers' commitment to altruism and their willingness to help those who were lonely. An example of altruism from one Somali-speaking participant in the focus group is displayed in Table 8 below. The example from the English-speaking focus group B illustrates how volunteers reached out to one another during the pandemic.

Table 8. *Joint Display Table on Predictors of Loneliness among Diverse Older Volunteers (Aim 2)*

Statistically Significant Predictors of Loneliness	Qualitative Findings	Mixed methods comparison
Age	*You become lonely. Because everybody's rejecting you. You see? So, you will feel lonely. What's wrong with me? What happened? They liked me because I was doing…making money, giving to them. Something like that. Now I don't have money and they don't like to be near of me. You know. We are human beings, we have many questions.* (English-speaking focus group A) *I learned that teenagers get lonely. Yeah, and we as parents have to listen to our children. Listen to their mind, it's not always about us. Listen to your children, because they need to talk things out, because they are still learning.* (English-speaking focus group A)	Expansion
Gender	According to one female participant in the English C focus group: *…All of us here in our age group, we are mostly single. So we don't have a partner at home we don't have any kids to raise anymore and so you have nobody to talk to, you don't go to work anymore to meet people, so you are isolated.*	Confirmation
Education	Receiving education and training is regarded as a way to be connected to community engagement opportunities that prevent loneliness: "There was an education, a training for that. That's how she got introduced to this program." (Khmer-speaking focus group)	Confirmation
Number of Friends and Family Interacted with Each Month	*We are never lonely because friends always visit…* *Yeah. Our friends or daughters, sons or granddaughters call, so we are not lonely. We are always happy.* (Khmer-speaking focus group)	Confirmation

Statistically Significant Predictors of Loneliness	Qualitative Findings	Mixed methods comparison
Network Autocorrelation (ρ)	Interviewer: *How did you all stay connected during COVID? What are you missing?* Participant: *I call her every day. She and I knew [volunteer name].* (English-speaking focus group B) *I describe loneliness as something not good. I grew up in a huge crowd. I love talking and conversating with people. When I see people by themselves or I see them lonely, I get shocked, and I'd like to help them.* (Somali-speaking focus group)	Confirmation

Chapter 5. Discussion

Structures of the SCP Network (Aim 1)

Interpretation of the Qualitative Results

The qualitative theme “expanding and strengthening social network” through volunteering suggested that connecting with both clients and other volunteers of SCP expanded and strengthened the volunteers’ network. However, the program prioritized resources to support the interaction between volunteers and clients over interactions among volunteers as discussed in the expert interview. Relationships with other volunteers depended on whether their networks external to SCP overlapped. Focus group participants discussed socializing with other volunteers in SCP who were from the same church or the same ethnic community. However, SCP volunteers expressed appreciation for the opportunity to meet with people from various countries.

In addition, the qualitative findings demonstrated the mutually enhancing relationship between networks outside of SCP and within SCP. On the one hand, the volunteers' external network expanded the SCP network because some companions recruited their friends into the program and/or were recruited by volunteers within the program. On the other hand, some volunteers formed relationships that extended beyond SCP. This finding is coherent with the literature that older adults with larger social

networks and stronger social support were more likely to volunteer in the first place (K. J. Johnson & Lee, 2017; Principi et al., 2016).

Consistent with the existing literature, the qualitative findings supported the notion that volunteering strengthened the social network of diverse older adults and supplemented the social losses due to migration and aging (e.g., death of loved ones) (Torres & Serrat, 2019). Because the qualitative literature on volunteering among migrant older adults mainly focused on how their informal engagement with their co-ethnic community enhanced their psychological well-being (Wright-St Clair et al., 2018), this study is one of the few studies that examined their participation in an organized volunteering program outside of their co-ethnic community.

However, findings also suggested that even when diverse older adults participate in organized volunteering outside of their co-ethnic community, their networks within the organization were still highly homophilous. The mere access to volunteers from other countries/cultures did not necessarily contribute to cross-cultural friendships. The segregation observed among subgroups of volunteers in SCP likely mirrored the separation migrant older adults experience when participating in the larger society and seeking social/health services (Neville et al., 2018). To enhance diverse older volunteers' access to a variety of services and resources beyond their co-ethnic community, incentives and facilitation are needed to expand diverse older adults' ties beyond their co-ethnic community within the formal volunteering programs and in the larger multicultural society.

Interpretation of the Quantitative Results

The quantitative hypothesis for aim 1 posited that all homophily variables, reciprocity, and transitivity were positively associated with tie formation within SCP. The hypothesis was partially supported by the quantitative findings. Although homophily based on country of origin, gender, education, and site stations were positively significant as expected, the endogenous network structures (i.e., transitivity, reciprocity) did not positively contribute to the tie formation as expected. Reciprocity and transitivity were usually critical mechanisms within friendship networks (Reynolds & Crea, 2017). However, these two endogenous processes were not significant in the SCP network. This unique feature of the SCP network might be explained by the limited depth of the relationships among SCP volunteers. When asked to nominate friends, volunteers nominated the ones within their social circle (e.g., site stations), with whom they had actual interactions. Egos and alters might or might not have considered each other as friends outside of SCP. Without positively significant endogenous network structures, homophily was the major mechanism holding the SCP network together.

As mentioned above, several trait-based homophily variables were positively significant to tie formation as hypothesized. Race-based homophily was positively significant in previous versions of the ERGM (controlling for country-based homophily) before the site station homophily variable was introduced. However, race-based homophily was no longer significant after site station-based homophily was introduced, indicating the site station-based homophily explained away race-based homophily in the SCP network. Each site station was an independent non-profit organization that served a

particular population with often shared racial identities (e.g., AACS serves primarily Asian older adults). The overlap between site station and race might have explained why race-based homophily became non-significant once site station-based homophily was introduced. Additionally, the lack of significance of age suggested that participants did not tend to form relationships with those of the same age. Although homophily can be problematic when it intensifies segregation among identity groups within a society, some studies suggested that homophily fosters cooperation within the group (e.g., Melamed et al., 2020). In the SCP network, homophily was the basis of social interactions among volunteers.

Interpretation of the Mixed-Method Results

Both qualitative and quantitative results supported that the older volunteers preferred to form friendships with those of the same gender, from the same country, sharing similar levels of educational attainment, and from the same site stations. As a result, the SCP network graph was characterized by disconnected subgroups. The above findings were consistent with the existing literature that homophily facilitated cooperation while contributing to between-group segregation (Melamed et al., 2020). Homophily contributed to segregation among subgroups by reinforcing the preference for within-group ties over across-group ties (Melamed et al., 2020).

The mechanisms behind forming different types of homophily in the SCP network may differ. For instance, forming friendships with those of the same gender may reflect the gender norm of volunteering across cultural groups. As shown in Figure 6, there were no female participants in the Bhutanese and Somali focus groups, whereas the majority of

volunteers were female in the English-speaking focus groups. The prevalence of male volunteers in the Bhutanese and Somali focus groups contradicted the existing literature on volunteering in western countries, which generally documented a relatively higher rate of volunteering among female older adults compared with their male counterparts (Gil-Lacruz et al., 2019; Jongenelis et al., 2020; Yamashita et al., 2019). As some Somali participants described, volunteering was the second-best choice because full-time employment was not feasible at their age. Thus, the prevalence of male volunteers in the Somali and Nepali focus groups might have reflected a higher expectation for men than women to be socially engaged outside of the household (either via employment or volunteering) in communities with more traditional gender roles (Centers for Disease Control and Prevention [CDC], 2021a, 2021b).

Variations in the gendered patterns of volunteering were also observed among different groups of first-generation immigrant volunteers in California (S. H. Lee et al., 2018). Among Chinese, Korean, and Vietnamese communities in California, women were not more likely to volunteer than men (S. H. Lee et al., 2018). Nevertheless, Filipino women were significantly more likely to volunteer than their male counterparts (S. H. Lee et al., 2018). The authors suggested that the positive correlation between being female and volunteering among Filipinos was likely associated with the more egalitarian gender norms in the Filipino communities, where women were encouraged to be community leaders (S. H. Lee et al., 2018). In contrast, the Chinese, Korean, and Vietnamese communities had a higher emphasis on women's roles within the family (S. H. Lee et al., 2018).

According to LCP, the life course (e.g., the transition from education, employment, to retirement) was gendered (Leupp, 2017; Moen, 1996; Sue, 2019) and the gender roles differed across cultures (Leupp, 2017; Moen, 1996; Sue, 2019). Hence, the gender patterns in volunteering differed by volunteers' country of origin in SCP. Because the average age of migration among older volunteers with migrant backgrounds was 52.04 (*SD* =13.14), they likely had histories of working and socialization in the sending country before migration. The gender roles learned from previous employment and community participation in one's sending societies can continue to exert influence on the motivation to volunteer in the host country among older migrants (Sue, 2019; Torres & Serrat, 2019). More studies should explore the gender composition among older volunteers from various countries in different contexts (e.g., formal volunteering, informal volunteering). Furthermore, information on how different migration purposes (e.g., seeking employment/education versus seeking asylum) interacted with the gendered patterns of volunteering was also scant. Future studies should further explore the interaction among gender, country of origin, and volunteer participation among older immigrants. Identifying the gender roles as well as employment history of older migrants' in their sending and receiving countries provides important context for understanding their motivation for volunteering later in life (Conkova & Lindenberg, 2020).

As mentioned earlier, education-based homophily in the SCP likely reflected the variation in the highest level of education among different language groups. All Nepali-speaking participants had no high-school degree whereas most Russian-speaking focus groups had graduate or professional degrees. More studies should investigate pre-

migration and post-migration factors, such as the educational systems/resources in the sending and receiving country as well as the integration policies for different groups of migrants in the receiving country (Fokkema & de Haas, 2015; Thela et al., 2017). These factors,contribute to the variation in the educational and employment attainment among older immigrants from various countries.

Participants might have preferred forming friendships with those from the same country because they enjoyed socializing with people who share similar cultural backgrounds and life experiences. In addition, it is well-documented that migrant populations form country-based homophilous ethnic communities (e.g., ethnic enclaves, ethnoburbs) to protect and advance their economic, social, and political interests in face of social exclusion (Gao-Miles, 2017; Guo, Steinberg, et al., 2018; Rhee, 2019; Stroope et al., 2015; Zhou, 2017). In other words, social structures can also induce relationship homophily (Thomas, 2019). Because SCP volunteers discussed how language and cultural differences escalated feelings of being othered in society in the focus group, it is also possible that language, cultural differences, and structural barriers have contributed to the country-based homophilous relationships among the volunteers.

To further understand the roles of personal choice versus structural barriers in forming country-based friendships among older migrants, future longitudinal and intervention studies should explore how ties evolve after addressing the structural barriers. Comparing the proportion of cross-cultural relationships versus within-cultural relationships among migrants with varying levels of English proficiency, acculturation, and SES can also shed more light on whether personal preference or structural barriers contributed more to country-based homophily among diverse older adults.

Homophily by site stations was a prominent theme in the qualitative findings and also a statistically significant variable in ERGM. Site station homophily was positively significant in the SCP network because older adults in the same site stations were more likely to interact with one another within and outside of the SCP. On the one hand, volunteers were recruited and retained through each site station and thus were more likely to interact with each other concerning SCP-related tasks. On the other hand, older adults also received services (e.g., housing, interpretation, translation, government benefits assistance) from a certain site station, increasing the opportunity for socializing among older adults within the station.

As discussed above, the organizational structure of SCP played an important role in the relationship homophily among volunteers. The indispensable role site stations played in organizing SCP volunteers is illustrated by their facilitation of the regular communication between volunteers and the SCP staff members. SCP staff members relied on the cultural and linguistic expertise of site station supervisors to communicate with diverse volunteers. Each site station was an independent non-profit organization that served a particular population with often shared identities (e.g., race/ethnicity, country of origin), reinforcing homophily-based relationships within site stations. Thus, the homophilous identity (e.g., race/ethnicity, country of origin) of older adults within each site station was likely imported into SCP through their site-station-based recruitment and retention. Additionally, new volunteers were mainly recruited into SCP through the recruitment talks at various site stations or via word of mouth, reinforcing site-station-based relationships among volunteers.

Because building cross-cultural relationships among volunteers has not been the focus of the program, these relationships were not intentionally facilitated. Furthermore, homophily reduced relationship maintenance costs, facilitates trust, and strengthens cooperation (Melamed et al., 2020), the relationships among volunteers were naturally homophilous. Homophily facilitated collaboration among network members while strengthening clustering within the homophilous groups (Melamed et al., 2020). The baseline homophily can further reinforce participants' preference for in-group ties over out-group ties when forming new relationships, maintaining homophily, and the segregation from outgroups over time (Melamed et al., 2020). Homophily also promoted communication and collaboration because it was easier to trust individuals sharing similar identities (Yenkey, 2018). Therefore, the ease of forming and maintaining homophilous relationships left little incentive for fostering cross-cultural relationships across site stations in SCP.

Furthermore, religious participation and belief played a critical role in forming social networks and coping with loneliness among participants. For instance, "trusting God" was an important coping strategy when experiencing loneliness among participants. Thus, future research can also consider including religion-based homophily and other types of value-based homophily when studying networks of diverse older volunteers (Paolillo & Lorenz, 2018).

The integration of the qualitative and quantitative findings also underscored the difference between friendship and appreciation. The qualitative findings suggested that not nominating certain individuals as friends did not necessarily mean not appreciating their presence. Although participants were more likely to nominate those from the same

country as friends, seeing and greeting companions from different cultural groups brought a "good feeling" according to the qualitative findings. The definition of friendship among diverse older volunteers might have explained why country-based homophily was statistically significant in ERGM while participants clearly acknowledged the importance of helping everyone regardless of their identities. Future studies need to further explore the meaning of friendship among various groups of volunteers in SCP. Subgroup comparisons can reveal the differences and similarities in who are considered friends and why.

Besides understanding how a dyad becomes connected, the reasons and mentalities behind the disconnection between a dyad also merit further investigation. For instance, when person A did not nominate B as a friend, it is unclear whether A did not know B, disliked B, enjoyed B's presence but did not regard B as a friend, etc. Moreover, because the frequency of interaction between volunteers can be influenced by feasibility constraints (e.g., physical illness, disabilities, COVID restrictions), other indicators of the emotional closeness between friends can also be considered in future network studies. In multicultural volunteering programs, understanding the mechanism that may contribute to the absence of cross-cultural edges and the limited strength of cross-cultural edges can provide more specific guidance to practitioners and non-profit organizations structuring these relationships.

In contrast with the documented strong ties within some homophilous groups (Ertug et al., 2022), the strength of ties among volunteers from the same cultural group was relatively weak in the SCP network, indicated by the negatively significant coefficient of the sum of the frequency of meetings in ERGM. In other words, people in

SCP tended to nominate those they met fewer times in the past month as friends. This result suggested that although the SCP network supplemented older adults' existing functional support system outside of the program, the depth of the friendship among volunteers was limited. However, despite the limited frequency of interactions among volunteers within and across cultural groups within SCP, the loneliness among volunteers was significantly correlated according to findings from the LNAM. Building on previous studies regarding how weak ties with colleagues and acquaintances were better at expanding the educational and employment opportunities than strong ties among younger immigrants (Q. Li, 2018), future studies shall further investigate the "strength of weak ties" (M. Granovetter, 1983) in diverse older adults' experiences with loneliness. Because social loneliness reflected a lack of social interactions, whereas emotional loneliness resulted from a deficiency in intimacy (De Jong Gierveld & Van Tilburg, 2016); more studies should investigate the strengths of within- and cross-cultural relationships and how they protect against different types of loneliness.

Despite the social benefits of SCP discuss in focus groups, the results from the descriptive and inferential quantitative SNA revealed a limited depth of friendship among volunteers within SCP. The descriptive SNA displayed the low density of the SCP network, whereas the frequency of meeting was negative in ERGM, indicating that ties tend to have a low frequency of meeting in the network. As highlighted in the staff interview, intentional matching and resources were provided to facilitate the weekly client and volunteer interaction, but the connections among volunteers were not emphasized in SCP. Several volunteers shared that supporting clients took up most of their time and energy, limiting the depth and strength of ties among volunteers.

The qualitative findings also suggested that the strength of relationships among volunteers varied. Whereas some participants referred to each other as "families" with regular interactions outside of the program, other volunteers did not interact with one another between meetings. For example, volunteers from the Nepali-speaking focus group shared going to temples and participating in cultural activities with clients and other volunteers whereas some English-speaking participants discussed going to churches, worshiping together, and attending the funeral of other volunteers. Other participants focused on their families and enjoyed the solitude between SCP-related activities to focus on their own health and daily lives. The variation in the strength of relationships among volunteers was likely related to pre-existing relationships based on the site stations as well as individuals' needs for social connectedness. Participants who knew each other before joining the program deepened their friendship through volunteering and religious/social activities outside of SCP while others did not interact with other volunteers outside of the program.

The limited depth of relationships among volunteers might have explained the lack of positive significance in the endogenous network processes. Because relationships among clients were not the focus of SCP according to the qualitative findings, their relationships had limited depth and were thus not reciprocal. Furthermore, transitivity was negatively significant in ERGM even when participants gave examples of the presence of transitive ties in focus groups. The discrepancy between the qualitative and quantitative findings is likely because transitivity mainly existed within homophilous subgroups. Thus, when homophily variables were accounted for, transitivity was negatively significant for the rest of the network.

Additionally, the missing data in the SCP network might further explain the discrepancy between the qualitative and quantitative findings regarding the endogenous network processes. Any level of missing data can increase the rates of both type 1 and type 2 errors for ERGM (Green et al., 2019). Structural variables (e.g., reciprocity) are more vulnerable to type 2 errors than homophily variables when there is missing data, particularly missing edges in ERGM (Green et al., 2019), as is the case in this study. Despite the research team's best effort to recruit, conduct follow-up, and minimize missing data through imputation and replacement procedures as explained in Chapter 3, the quantitative findings on reciprocity and transitivity need to be interpreted with caution because only half of the SCP network completed the friendship nomination form.

Network Autocorrelation and Loneliness (Aim 2)

Interpretation of the Qualitative Findings

Qualitative results revealed the definition, factors, and coping strategies for loneliness among participants. Participants discussed the differences between being alone and feeling lonely, the exacerbation of loneliness with aging as well as loneliness across the life span when defining loneliness. Qualitative findings also addressed situational factors (e.g., COVID-19, death of loved ones, migration) and interpersonal factors (e.g., alienation from family members) that contributed to loneliness. Older volunteers utilized both social (e.g., reaching out to a friend) and non-social methods (e.g., turning the TV on) to cope with loneliness.

Consistent with the existing literature, the qualitative findings of this study also highlighted the importance of addressing barriers to participation among diverse older

adults (Torres & Serrat, 2019). Several groups of non-English-speaking participants disclosed feeling lonely due to language barriers and challenges navigating needed services. For instance, Nepali-speaking participants expressed feeling different in their daily lives due to language barriers and their identities. Russian-speaking focus group participants also advocated for the incorporation of interpretation services in mainstream transportation services for older adults and simplifying application procedures for services. In other words, the availability of interpretation services in mainstream aging, social, and health services is a matter of social inclusion and equity. Improving the accessibility of interpretation services for older adults with limited English proficiency can help enhance connectedness and reduce othering even among highly homophilous groups.

Moreover, qualitative findings indicated that volunteers with migrant backgrounds served as the bridge between clients with limited English proficiency and the larger human/health service system. SCP volunteers provided interpretation, translation, and service navigation support for clients with limited English proficiency and those with hearing impairment. This finding builds on the concept of "bridge people" proposed by Liu and colleagues (2017) when studying the access to health and social services among Chinese older immigrants in the United Kingdom. Examples of bridge people include friends, family, and staff members of non-profit organizations, who help older immigrants navigate the social and health services usually at no cost (X. Liu et al., 2017). In the SCP network, older volunteers not only facilitated clients' use of health and social services but also communicated between clients and family members. For instance, one Russian volunteer discussed reminding adult children of clients to visit their parents

more. Future mixed-method studies can further investigate the homophily/heterophily in language proficiency and acculturation level between bridge people and clients.

Interpretation of the Quantitative Findings

As hypothesized, quantitative results from LNAM suggested that the loneliness among volunteers within SCP was significantly correlated. This was consistent with SNT that individuals' behavior, attitudes, and emotions correlate with one another in a network (Valente & Pitts, 2017). However, the direction of the correlation was negative rather than positive as expected. In this study, the network autocorrelation was defined as the correlation among network members' loneliness throughout the network. Previous studies suggested that lonely individuals passed on the emotion, cognition, and behavior associated with loneliness to other peripheral network members through social interactions (J. T. Cacioppo et al., 2009). The above process reflected a spread of loneliness within a network through a contagious process (J. T. Cacioppo et al., 2009). Contrary to the previous literature, the results of this study suggested that those with higher levels of loneliness tend to be friends with less lonely volunteers. In other words, the contagion process that spread loneliness was not significant in the SCP network. People did not tend to socialize with those sharing similar levels of loneliness in the SCP network. In this study, volunteers with lower loneliness preferred to socialize more with those with higher levels of loneliness. Because the commitment to help everyone in need was frequently mentioned in the focus groups, Altruism can probably explain why less lonely volunteers socialized with lonelier volunteers in the SCP network. Altruism is a plausible explanation because generativity has been established as a major motivation for

volunteering, particularly among older adults (Withall et al., 2018; Yamashita et al., 2017).

Moreover, the descriptive results demonstrated that the prevalence of loneliness in this network (48%) was higher than the reported prevalence of loneliness among older adults in the literature (ranging from 19.3% to 43%) (National Academies of Sciences Engineering and Medicine, 2020; Ong et al., 2016). The higher loneliness level among study participants can be explained by two contextual factors: (1) data collection was conducted during the COVID-19 pandemic, during which older adults experienced an elevated level of loneliness (Kotwal et al., 2021; Van Tilburg et al., 2020); (2) over 60% of the sample were born outside of the United States and only low-income older adults were eligible to become SCP volunteers. Thus, this sample has been disproportionately exposed to some risk factors of loneliness, such as financial, language, cultural, and structural barriers to developing and maintaining social connections (NASEM, 2020).

Furthermore, the loneliness score did not differ significantly between participants who identified the U.S. as their country of origin and those who did not, $t(32)= 0.60$, $p = 0.55$. LNAM also indicated that the country of origin did not have a statistically significant contribution to loneliness ($\beta= -0.26$, $p= 0.77$) according to Appendix M, which displayed the full LNAM model.

Interpretation of the Mixed-method Findings

Although previous studies found that individuals interacted more with those sharing similar levels of depression (Elmer, 2020; Prochnow et al., 2020), the negatively significant network autocorrelation in the LNAM of this study suggested that the SCP

volunteers had a tendency to interact with those who had a different level of loneliness. The qualitative findings supported the negatively significant network autocorrelation in LNAM. As presented in the aim 2 mixed-method results section in Chapter 2, qualitative findings suggested that the nature of this network (a network of older volunteers) and their commitment to altruistic services might have explained why less lonely volunteers were willing to connect with those experiencing higher levels of lonelier within SCP. It is also possible that lonely volunteers reached out to other volunteers as a coping strategy, resulting in the negative network autocorrelation within the network. Future studies should also explore whether and how organized socialization opportunities within volunteering programs might reduce barriers for lonely individuals to reach out socially.

The mixed-method results on other predictors of loneliness are discussed in this and the following paragraphs. All groups of participants highlighted the importance of staying busy through activities (e.g., gardening, volunteering) in addressing loneliness, indicating that they value staying active as they age (Bruggencate et al., 2018). However, participants provided nuanced explanations for what staying active means. For instance, Somali older adults addressed the importance of participating in age-appropriate activities that were not too physically demanding. Similarly, participants in several English-speaking focus groups discussed needing time alone to take care of themselves. Future studies should continue to investigate factors (e.g., age, cultural expectations, physical health) contributing to the preferences for different types and intensity of activities among diverse older adults and how these preferences contribute to loneliness.

Consistent with the emphasis on linked lives in the Life Course Perspective (LCP), both the qualitative and quantitative findings suggested that social connections

within SCP played a role in the loneliness among diverse older volunteers. Meanwhile, qualitative findings expanded the quantitative findings by highlighting the importance of linked lives in face of *major life transitions* such as retirement, widowhood, and moving (international and domestic) (Qualter et al., 2015). For non-migrant older adults, volunteering for SCP provided the needed social interactions after the move and/or widowhood. For migrant older adults, volunteering for SCP provided opportunities to socialize after migration. Being able to help and contribute alleviated loneliness for both migrant and non-migrant volunteers in SCP. However, because SCP has been designed to connect older adults with opportunities to connect with other older adults, volunteers pursued intergenerational connections beyond SCP. For instance, one participant referred to the children in his church as his "grandchildren" whereas other participants highly valued their interactions with grandchildren.

Furthermore, LCP suggests that the timing of transition (e.g., age of immigration) and the duration of the transition (e.g., length of residence in the U.S.) also determine the effect of major life events (e.g., migration) (Elder et al., 2003). Although the country of origin was not a significant loneliness predictor while the length of residence and age of migration did not yield sufficient valid responses to be included in the LNAM, qualitative findings suggested that the *timing of major life transitions* might have contributed to older olders' loneliness (Elder et al., 2003; Guo, Stensland, et al., 2018). Several older volunteers with migrant backgrounds discussed that they did not report feeling lonely because they made friends throughout the years. However, they recalled feeling lonely when first migrated. It is worth noting that the average years of residence in the U.S. among older migrants in this study was 26.12 (*SD*=11.73). The experiences with

loneliness among the study participants were unlikely to reflect those who just migrated to the U.S. Furthermore, diverse older adults' participation in volunteering reflected their *human agency* in LCP (Elder et al., 2003; Gong et al., 2011), which further strengthened linked their lives (social networks) with clients and volunteers in SCP and likely protected against loneliness.

Another important aspect of linked lives among SCP volunteers is their shared experience of feeling distanced from family members regardless of their cultural differences. According to themes and quotes displayed in Chapter 4, both Both English-speaking and non-English speaking participants talked about feeling rejected and distanced from immediate family members, particularly adult children who "have busy lives". Russian-speaking volunteers shared that their clients feel rejected and "abandoned". Several participants from an English-speaking focus group also discussed feeling lonely from immediate family members who are "all well off and doing good". The busy schedule of family members in combination with shortened or absent holiday celebrations during COVID-19 intensified the feelings of separation from family members. This finding is consistent with a previous study conducted with this local SCP on volunteers' transportation needs and resources. Older volunteers shared that families were always busy and families were the last resort when needing help getting around (Cao et al., 2021; Dabelko-Schoeny et al., 2021).

Some older adults interpreted being ignored by family members as a possible consequence of retiring and not making more money for the family. This belief further gave rise to doubts of self-worth as one age (i.e., "what's wrong with me"). As documented in the existing literature, family cohesion played an important role in older

adults' health, well-being, and service access, particularly among older migrants who likely experienced migration-related social losses, changes in social status, and different cultural expectations for intergenerational relationships (Guo, Sabbagh Steinberg, et al., 2019; Guo, Stensland, et al., 2020; Guo, Byram, et al., 2020; Guo & Stensland, 2018; M. Li & Dong, 2020; J. Liu et al., 2020; Muruthi & Lewis, 2017). Older immigrants who experienced emotional disconnectedness from their adult children were often unable to express their concerns due to the fear of being a burden or fear of conflicts (Guo, Stensland, et al., 2019, 2020). The lack of expression further escalated feelings of loneliness(Guo, Stensland, et al., 2019, 2020).

Fortunately, connections with clients and other volunteers in SCP supplemented the distancing from family members. SCP offered volunteers a meaningful way to stay active and build social connections. As presented in Chapter 4, one participant of the follow-up interview suggested that honest and open conversations about family challenges with people outside of the family can also ameliorate one's loneliness by normalizing the challenge as a shared human experience.

As an exception, although Bhutanese and Cambodian volunteers also expressed longingness for in-person volunteering to resume, these two focus groups reported that "Asians are not lonely". The Bhutanese focus group shared that families were close during the pandemic because younger generations were mainly working from home during COVID-19. The quantitative descriptive findings on the differences in the living arrangement between Asian and Non-Asian participants further explained their distinct loneliness experiences. Approximately 36.11% of participants from the U.S. lived alone, whereas no Bhutanese or Cambodian participants lived alone (excluding the missing

values). Because Bhutanese and Cambodian older adults hardly lived alone, they denied experiencing loneliness themselves or among clients. It is possible that although connections with clients and other volunteers at SCP are desirable, lacking these interactions did not result in loneliness among Bhutanese and Cambodian participants. In other words, interactions with family and friends were sufficient in preventing the unpleasant feeling of loneliness among these two groups of older adults. In contrast, participants in other focus groups reported observing loneliness among family, friends, and clients, even when not experiencing loneliness themselves.

The Validity of Mixed-Method Results

The validity of the mixed-method results depends on the quality of the data integration (Creswell & Clark, 2018). Designing parallel questions in the qualitative and quantitative data collection instruments facilitated the comparison of equivalent concepts in the qualitative and quantitative strands. The contiguous approach of data integration enabled thorough analyses of both the qualitative and quantitative data before the mixed-method comparison. As presented in the method section, the author followed the recommended steps for mixed-method data analysis and explained the results in the joint display table for each aim (Fetters, 2019).

Both the qualitative and quantitative strands of inquiries contributed to the aims of this study. To summarize, the mixed-method approach enabled the two strands of data to complement as well as moderate one another (Fetters, 2019). One example of the complementary relationship between the quantitative and qualitative inquiries is as follows: the qualitative findings on the SCP structure provided organizational contexts in

interpreting the significance of various homophily variables in ERGM. Additionally, because the importance of site stations was underscored repeatedly in the qualitative findings, site station-based homophily was added to the quantitative ERGM model. Below is an example of how quantitative data moderated the qualitative interpretation: although expanding and strengthening social networks was a significant qualitative theme, the low frequency of meeting between egos and alters in SCP in the quantitative SNA reminded the lead researcher to refrain from exaggerating the importance of the SCP network when interpreting the qualitative findings. To summarize, one type of data moderated and complemented the other, thereby improving the quality of both the qualitative and quantitative findings separately (Fetters, 2019).

Moreover, the validity of mixed-method studies depends on the quality of data integration (Creswell & Clark, 2018). The comparison of qualitative and quantitative findings provided triangulated evidence and additional insights on the social networks and loneliness of diverse older volunteers. The site station homophily was a prominent qualitative theme as well as a significant factor according to ERGM. The confirmation of qualitative and quantitative findings enhanced the lead researcher's confidence that this organizational structure played an important role in shaping volunteers' networks. In contrast, when the qualitative and quantitative findings were in disagreement, as seen in the finding regarding transitivity, the mixed-method result prompted the lead researcher to reflect on methodological procedures as well as theoretical explanations to explain the above discrepancy as presented in the mixed-method interpretation of aim 2. Future mixed-method network studies should further explore ways to inquire about equivalent

concepts of quantitative network structures (e.g., transitivity) in qualitative inquiries to further enhance the data integration.

Limitations and Challenges

The challenging nature of studying multiple language and cultural groups might have limited the comprehensiveness of the qualitative data collection. Considering space restrictions and the preferences of the community partner, all data collection was done in group settings. Conducting multiple focus groups in multiple languages at one location made it challenging to minimize the noise in the background and thus limited the clarity of some focus group recordings. Due to feasibility and resource limitations, speaker tracking was not possible in the focus groups, making it challenging to match qualitative data with the quantitative surveys on a case-by-case basis. Speaker tracking is particularly expensive and challenging in interpreter-assisted focus groups. Social desirability bias might have been present when discussing social relationships, volunteering experiences, and loneliness in the group. To address the above challenges in multi-lingual focus groups, debriefing among facilitators was completed immediately after the data collection so that major themes in each focus group were communicated among team members. The lead researcher also coded the field notes taken by each facilitator and reached out to the facilitators for clarification when a certain portion of the recording is unclear. The facilitators established rapport and disclosed one's own experiences with loneliness to create an environment conducive to sharing.

Additionally, limited funding also made it challenging to transcribe every non-English-speaking focus group in their original language before translating them into

English, which was a common practice in multi-lingual research to preserve cultural contexts (OSUCSW & Columbus City Council, 2018). Although only the English portion of the Nepali-and Somali- focus group was transcribed by the lead researcher, the transcript was reviewed and edited by the interpreters of both groups to ensure no content was misrepresented. Moreover, interpreters of the Khmer- and Russian-speaking focus groups were unable to attend in person due to concerns related to the COVID-19, making communication between facilitators, interpreters, and participants challenging. Phone interpretation for in-person focus groups likely restricted the length and depth of the focus groups.

Challenges for conducting a multicultural network study during the COVID-19 pandemic also impacted the quantitative inquiry. Although participants could choose to complete the quantitative surveys in the language they preferred and some participants sought help from interpreters and facilitators as they completed the surveys, the completeness of the network survey varied among participants, likely due to language barriers, variation in literacy level, the complexity of the friendship nomination form, and the potential privacy concerns. When participants omitted their own names in the friendship nomination form, accurately matching egos with alters became increasingly challenging. Additionally, because some participants filled out the network survey in their preferred language, reading and entering data was challenging, especially for text-entry questions. Future studies can further minimize the use of text-entry questions by providing a range of numbers as response options for variables concerning the frequency of social interaction or participation (e.g., the frequency of volunteering, the number of family and friends interacted with at least once a month). Consulting with staff members

and piloting enables researchers to construct a feasible list of numbers. Although SCP was gradually reopening during the data collection, the frequency of meeting between volunteers might still have been impacted by lingering pandemic-related safety concerns, potentially contributing to lower reported meeting frequencies compared with pre-pandemic.

More research is needed to explore strategies for improving the quality of network data among diverse older adults. Improving the design and facilitation of the friendship nomination form can enhance its clarity for older adults. During the data collection, the research team should more thoroughly review the friendship nomination to verify that those who are willing to complete the form have provided their own names at the beginning of the form. As discussed above, having the participants' names on the nomination form is essential for the accurate mapping of relationships within the network. Additionally, the first page of the nomination form provides an example of how to answer the questions in the form. Due to the complexity of the format, a few participants provided the names of all their alters on the first page while checking only one set of answers regarding the demographic characteristics of all alters. The follow-up interviews helped the lead researcher map the alters' characteristics to the correct person,

It is also worth noting that piloting with SCP was not possible for this study because the program was largely closed prior to the data collection. However, researchers might still benefit from piloting the friendship nomination form within the research team and providing feedback on each other's friendship nomination to deepen the understanding and familiarity of network data collection even when piloting with the

targeted community is not possible. The organizational setting (i.e., SCP in this study) can be adapted when piloting among people who are not part of SCP.

Furthermore, in-person interpretation is more ideal than phone interpretation for in-person focus groups whenever possible. Having interpreters as cultural liaisons between the facilitator and the participants in person can generate richer data. When services are provided in person, interpreters can also assist participants who have limited literacy and thus improve the completeness of the surveys. Receiving support from interpreters or team members with the language and cultural expertise has been instrumental in enhancing the accuracy of the entry, analysis, and interpretation of both qualitative and quantitative data. Therefore, it is also desirable to build a diverse research team with members who have some familiarity with the language and culture of study participants.

This study can be regarded as a case study of one SCP network and thus has limited generalizability to other SCPs or volunteering programs. Additionally, due to the impact of COVID, only approximately half of SCP volunteers participated in the data collection, contributing to the missing data in the friendship nomination form. The missing data in this network might have also influenced the statistical significance of other network structures such as transitivity and reciprocity when running ERGM (Green et al., 2019). Thus, more studies with a larger sample size and fewer missing data are needed to further understand the relationship between volunteering, networks, and loneliness. When analyzing aim 2, due to data collection challenges, length of residence and age of migration did not yield sufficient valid responses to be included in the LNAM.

The cross-sectional nature of this study limited the researcher's ability to draw conclusions on participants' changes in loneliness or network structures after joining SCP. Longitudinal network studies are needed to demonstrate the structural changes in volunteers' relationships over the years. Similarly, although LNAM in this study provided evidence of the correlation among network members' loneliness, causal influence can not be established in this cross-sectional study.

Advancement in analytical tools is still needed to further enhance the accuracy of quantitative SNA. As mentioned above, few options exist for handling missing data in quantitative SNA. For instance, multiple imputations are not a feasible option. More methodological research and software development are needed to better address missing data in SNA. Additionally, packages and functions to evaluate the model fit of valued ERGM models are limited. Quantitative SNA methodologists (e.g., social scientists, statisticians, computer scientists) shall further develop the goodness of fit function in R to comprehensively evaluate the model fit for valued ERGM.

Implications

Practice Implications

Despite the above limitations, findings from this mixed-method study have important implications for practitioners, policymakers, and researchers. The mixed-method findings contradicted the stereotype that older immigrants and refugees were solely welfare recipients by illustrating their willingness and capacity to contribute to the community and the society (Khvorostianov & Remennick, 2016; Torres & Serrat, 2019). In multicultural programs for diverse older adults like SCP, country-based homophily

naturally fosters connections, bypasses language and cultural differences encountered in cross-cultural relationships, and eases volunteering management. If cross-cultural friendship were to be the goal, regular interpretation and translation services might be needed to foster communication across language groups. Intentional socialization opportunities for people of different education, race, and gender also need to be facilitated with thoughtful content and activities. In other words, fostering cross-cultural relationships among volunteers require additional programmatic interest and commitment, which may not be compatible with the current focus on the client and volunteer relationship.

However, homophily among volunteers as well as the homophily-based relationships between clients and volunteers can limit SCP's goal to connect older adults with a wide range of economic, health, and social resources/services by restraining their connections to their co-ethnic community. As discussed in Chapter 2, bonding ties generate trust through similarities among members in a tight-knit community and can contribute to *structural closure*. In contrast, ties that connect different subgroups bridge *structural holes* and gain access to resources that would otherwise be unavailable (Claridge, 2018). Previous research found that immigrants with more *bridging social* capital across the various cultural groups had better economic outcomes (Lancee, 2020). However, the bonding social capital did not have a significant influence on participants' economic outcomes (Lancee, 2020). This was because bridging ties allowed access to other subgroups rich in certain resources that were otherwise scarce within one's immediate social circle (Lancee, 2020).

Because the long-term goal of SCP is to enable volunteers and their clients to age in their own homes and communities while staying connected to a variety of resources and services, the local SCP can initiate conversations among site station supervisors to coordinate complementary resources that may enhance migrant older adults' access to services (e.g., transportation, health) and opportunities (e.g., employment, community engagement opportunities) across sites. For instance, participating in both formal and informal volunteering was positively associated with the unretirement (returning to employment after retirement) among older adults because volunteering enabled them to network for potential employment opportunities (Gonzales & Nowell, 2017). Because financial necessities can prompt unretirement (Gonzales & Nowell, 2017), having access to a variety of engagement and employment resources from different sources can increase low-income diverse older volunteers' opportunities for community engagement as well as employment when desired (Gonzales & Nowell, 2017). Collaborations among site stations can lead to cross-site interactions among volunteers and between volunteers and clients. Because each site station usually serves older adults with a certain identity, increasing interactions across site stations can create socialization and communication opportunities among older adults with various identities. Despite the limited generalizability of the study findings, the leadership of SCPs serving multiple diverse communities across the U.S. can consider fostering and strengthening the bridging ties across structural holes among diverse communities with different resources (Lancee, 2020). SCPs across the U.S. can also consider intentionally strengthening the collaboration among various types of organizations (e.g., ethnic organizations and

mainstream social/aging/health services) with complementary resources while preserving homophily-based volunteer management if applicable.

Because of structural barriers (e.g., discrimination, language barriers, geographic disparities), low-income older migrants' networks within their families and neighborhood were prone to homophily (Gao-Miles, 2017; Zhou, 2017). Low-income older immigrants and refugees were more likely to live in homogeneous ethnic enclaves or ethnoburbs with limited economic resources compared with their immigrants with higher socioeconomic status (SES) (Fukui & Menjívar, 2015; Gao-Miles, 2017; Zhou, 2017). Therefore, multicultural volunteering programs serving low-income diverse older adults with migrant backgrounds are in unique positions to enhance income older migrants' access to bridging and linking social capital. In contrast to bridging capital which simply connected different cultural groups from the same socially constructed stratum, linking social capital connected people from different socially constructed hierarchies (e.g., SES) (Claridge, 2018). Therefore, networking opportunities in organized volunteering programs might further diversify the social network as well as the social capital of low-income older volunteers with migrant backgrounds. For instance, guest speakers or panelists at monthly in-service training can be carefully selected to offer linking social capital to low-income diverse older volunteers. More studies are needed to investigate how bonding, bridging, and linking social capital is generated among low-income diverse older adults with migrant backgrounds.

Furthermore, from a life course perspective (LCP), people's primary sources of friendship change throughout the life course (Thomas, 2019). Compared with young children and people in middle adulthood who socialize mainly at schools or in

workplaces, volunteering organization is an important source of new relationships for older adults (Thomas, 2019). Therefore, volunteering organizations are well-positioned to improve the diversity of social relationships among older adults (Thomas, 2019). Besides improving the social capital and social integration among diverse communities, volunteering programs that facilitate cross-cultural interaction also offer mainstream older adults (e.g., White, U.S born) a unique opportunity to diversify their social network, thereby enhancing the cohesion of a multicultural society (Q. Li, 2018; Thomas, 2019).

Although homophily can minimize the effort of managing diverse older adults within organizations, it can also reinforce identity-based homophily at the societal level. Therefore, it is important for policymakers, non-profit organizations, and social workers serving diverse communities to be cognizant of the benefits and costs of homophily among clients within their service, organization, and community. Practitioners and policymakers need to carefully weigh the pros and cons when inducing or reinforcing homophily. Social workers and leaders of non-profit organizations can also intentionally coordinate resource sharing, conversations, and socialization across various cultural groups or service organizations to achieve a common community goal. The coordination does not have to aim to foster strong ties across communities to be beneficial because the strength of weak ties is inherent in their "weakness" and flexibility in bridging diverse groups/systems/communities (M. S. Granovetter, 1973; Higgins et al., 2021).

Considering the prevalence of homophily within social services and in the larger society, the training and education of social workers, healthcare professionals, gerontological, and geriatric workforce should include the historical, cultural, political, and structural factors (e.g., spatial segregation, discriminatory policies) that contributed

to the formation homophilous co-ethnic communities within the society (e.g., ethnoburbs) (e.g., Gao-Miles, 2017; Zhou, 2017) as well as homophilous subgroups within an organization. It is important for practitioners to be aware that relationship homophily can be caused by a combination of personal preference (choice-homophily) and structural constraints (induced-homophily) (Thomas, 2019). To provide person-centered care, practitioners should consider barriers to high-quality interpretation and translation services as a social justice issue and be prepared to advocate for culturally and linguistically diverse older adults whenever needed. Non-profit organizations and healthcare services should carefully evaluate their organizational structure, culture, and resources to ensure the provision of necessary interpretation/translation services as well as culturally sensitive services.

Moreover, because the increased propensity for identity-based homophily may strengthen value-based homophily, which further contributes to segregation and polarization in the larger society (Paolillo & Lorenz, 2018), policymakers should consider allocating financial, human, and social resources to bridge conversations across diverse identity-based communities. Policy support for workforce development and diversification will become increasingly important as older adults become increasingly diverse (Administration for Community Living, 2021).

In addition to homophily, practitioners can benefit from an increasing awareness of endogenous network structures within their organization or community. Despite its lack of significance within the SCP network, reciprocity not only plays a critical role in maintaining meaningful relationships it can also preserve a needed sense of independence among members of an interconnected network (Bruggencate et al., 2018). Therefore,

programs with relationship building as a goal can integrate reciprocity into their regular program evaluation as a key indicator of programmatic success (Bruggencate et al., 2018). As demonstrated by this study, practitioners can evaluate reciprocity in relationships quantitatively and/or qualitatively. Fostering reciprocity is essential when generating and maintaining meaningful connections among older adults (Morgan et al., 2019; Wiles et al., 2019b). For example, if SCP were to intentionally foster cross-cultural relationships among volunteers as well as between volunteers and clients, creating a mutually beneficial mechanism (via financial incentives, social benefits, etc.) for volunteers to connect with other volunteers or clients from different cultural groups will be a critical intermediate step in creating and maintaining cross-cultural relationships.

Transitive ties were negatively significant in ERGM, suggesting that people avoided triads when forming relationships within SCP. However, because qualitative findings suggested that transitivity was present in the network, a plausible explanation is that the transitivity in this network was only within homophilous clusters. To take advantage of the positive role clustering plays in fostering perceived supportiveness (Campbell et al., 2019; Kadushin, 2012), practitioners can explore facilitating groups activities among diverse older adults from various cultures based on common interests or values to see if it is possible to foster non-identity based clusters or triads. Future studies can further investigate how the interaction between transitivity and homophily contributes to network cohesion as well as segregation among diverse populations.

Because findings from LNAM suggested that less lonely volunteers tended to interact with those experiencing higher levels of loneliness, future longitudinal network studies need to identify whether the aforementioned socialization pattern increased or

reduced loneliness in the network over time. In addition, network-level loneliness might have prompted social outreach, thereby negatively contributing to loneliness. Thus, future research shall continue to investigate social avoidance and social outreach associated with experiences of loneliness (Layden et al., 2018).-Because the negative network autocorrelation found in this study might be explained by altruism, practitioners can further encourage outreach from less lonely volunteers to those who might be experiencing higher levels of loneliness within SCP. Furthermore, the existing literature also suggested that altruism is not only a motivator for volunteering but can also minimize the dropout of volunteers over time (Withall et al., 2018; Yamashita et al., 2017). Therefore, encouraging altruism among older adults within human and health services might protect against the spread of loneliness in the system and facilitate the recruitment and retention of volunteers.

Additionally, findings on the significance of network autocorrelation supported the development and integration of social network interventions into loneliness interventions for older adults. Besides adding/deleting network members of an existing network (e.g., van Waes et al., 2018), social network interventions can rewire or change the relationships in a network by strengthening, weakening, adding, and deleting ties between peers to achieve the desired behavioral or psychological outcomes (e.g., smoking cessation, social connectedness) (Steglich et al., 2012; van Asselt-Goverts et al., 2018). Network interventions can also intervene at the triad or cluster level, such as building connections among segregated homophilous clusters as seen in the SCP network (Henry, 2021; Saetnan & Kipling, 2016). Network interventions have been successfully integrated into psychotherapy (e.g., cognitive-behavioral therapy) (Cervin et al., 2019).

Existing therapeutic or clinical tools, such as network mapping (e.g., eco-maps), can enhance an individual's awareness of their immediate and larger support system and assist people in identifying stressful versus helpful social relationships (Band et al., 2019; Y. Ma et al., 2019). Because cognitive/behavior and neurological mechanisms contribute to loneliness (J. T. Cacioppo & Hawkley, 2003; Käll et al., 2020), social work practitioners can consider integrating interventions targeting network structures with existing clinical interventions to address the emergence as well as the spread of loneliness among older adults. Future network studies should further investigate specific network structures that contribute to older adults' loneliness to enable more targeted interventions.

Research Implications

This study confirmed the applicability and feasibility of the mixed-method approach to SNA (Yousefi Nooraie et al., 2018). In aim 1, statistically significant network structures highlighted prominent features of the SCP network regardless of the variations whereas qualitative findings provided a complex picture of the human agency and organizational contexts for friendship formation within the network. In other words, quantitative findings identified the typical patterns of social interaction in SCP; whereas qualitative findings explained, expanded, and provided exceptions to the quantitative patterns. In aim 2, without the quantitative analysis, the significance of the network autocorrelation could have been lost in the complicated storylines within the qualitative findings. However, if it were not for the qualitative findings on the definition, factors, and coping strategies of loneliness, participants' subjective experience and wisdom in interpreting and coping with loneliness could have been dismissed.

The mixed-method approach is not only beneficial in improving the quality of quantitative and qualitative results separately but also provides additional insights through the integration of the two strands (Creswell & Clark, 2018). Both types of data made an indispensable contribution to developing a comprehensive understanding of volunteers' networks and their impact on loneliness. In other words, mixed-methods research provides unique insights into network structures and how networks influenced well-being and health through data integration (Yousefi Nooraie et al., 2018). Moreover, the integration of qualitative and quantitative data is especially instrumental when studying culturally and linguistically diverse populations (Creswell & Clark, 2018). By carefully merging the statistical results with participants' perspectives, this mixed-method study has revealed structural patterns of social while honoring their voices and lived experiences (Creswell & Clark, 2018).

To further facilitate the mixed-method data integration in studies concerning network structures, future scholars can consider including more questions or probes regarding specific network structures such as homophily, reciprocity, and transitivity in qualitative interviews. Additionally, thoughtful consideration and planning continue to be needed in matching qualitative transcripts to quantitative surveys. When resource allows, researchers can consider conducting one-on-one semi-structured interviews or speaker tracking in focus groups to match each qualitative interview transcript to the corresponding quantitative response to allow more precise comparison and in-depth integration between the two types of data. Future mixed-method network analysis shall continue exploring ways to facilitate data integration due to the challenge of inquiring about specific network structures in a qualitative interview.

Considering the prominence of homophily within the SCP network, future studies should conduct a detailed inquiry on causes and mechanisms contributing to different types of homophily to understand the nature of homophily-based relationships. Determining why and how various types of homophily (e.g., external barrier versus self-determination) formed within a network can further inform whether, how, and when homophily might need to be interrupted. More studies should investigate the role of homophily versus endogenous network structures in the network of culturally and linguistically diverse older adults.

This study also advanced our knowledge of older adults' volunteering by revealing the role of social networks in older adults' loneliness. Building on the existing volunteering literature that mainly focused on how sociodemographic characteristics and organizational structures influenced older volunteers' well-being (Greenfield et al., 2016; Lowenberg-deboer & Akdere, 2018; Yamashita et al., 2017), findings from this study suggested that the interaction among volunteers is an integral part of the volunteering experience. Therefore, future research on organized volunteering can consider further investigating the interactions among older volunteers in various organizational contexts (e.g., type of volunteering activities) particularly when there are organized socialization opportunities among volunteers (e.g., monthly in-service training). Depending on the programmatic emphasis, social network studies regarding the structures of social interactions between clients and volunteers or volunteers and staff members can also be beneficial.

Conclusion

As one of the first mixed-method whole network studies on social relationships among diverse volunteers in organized volunteering, findings supported that country, gender, education, and site station homophily were the major mechanisms behind friendship formation among SCP volunteers. This study highlighted the importance of understanding how organizational/community structures versus individual preferences contributed to homophily among diverse populations (Ertug et al., 2022). Future mixed-method studies can inquire about older adults' perceptions of various types of homophily to understand whether each type of homophily is more structurally induced or choice-based (Ertug et al., 2022). More studies are also needed to identify the role of both weak and strong ties in the health of well-being of diverse older adults. Furthermore, the lack of positive significance in endogenous network structures (i.e., reciprocity and transitivity) reflected the limited depth of interaction among volunteers in the program and heightened the need for ongoing methodological improvement in mixed-method network studies among diverse populations.

Despite the sparsity of the SCP network, the network autocorrelation was negatively significant in this study. Because less lonely volunteers tended to interact with those experiencing higher levels of loneliness likely out of altruism, practitioners can consider intentionally encouraging altruism among older adults to limit the spread or escalation of loneliness within an organization or network. Findings also corroborated the importance of integrating network interventions when addressing loneliness among older adults. Future network studies and intervention research should examine what specific network structures shall be targeted with what types of network interventions.

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Appendix A. Recruitment Flyer

The Social Networks and Loneliness of Diverse Older Volunteers

From: Katy Cao (cao.847@osu.edu)

Dear POTENTIAL PARTICIPANTS,

I am a graduate student from the Ohio State University College of Social Work and I am looking for your help with my research to understand the relationship between social network, volunteering, and loneliness of diverse older volunteers.

If you are or have been a volunteer in the Senior Companion Program, I would like to invite you to participate in the focus group and complete some surveys for me. You will receive a $10 gift card for your participation in the survey and focus groups. You can also choose to participate in a one-on-one interview with the researcher. You will also receive a $10 gift card for a follow up interview. You will have the opportunity to be entered into a lottery system for a chance to win a $100 gift card.

Your participation will advance our understanding of loneliness and the social networks of older volunteers.

If you are interested in participating in the study, please call or text me at 614-300-0656 or email me at cao.847@osu.edu.

Thank you very much.

Sincerely,
Katy Cao

Appendix B. Verbal Consent for Staff Members

Hello, my name is Katy Cao. I am a doctoral student at The Ohio State University, college of social work. I am undertaking a research project regarding the social network of Senior Companion Program volunteers.
This study aims to understand the social support network of senior companions during the COVID-19 pandemic within and outside the program and explore how the Senior Companion Program influence the social network and loneliness of volunteers.
You are invited to participate in a 60-minute one-on-one interview with the researcher for an in-depth conversation via ZOOM, over the phone, or in person based on your preference. We look forward to learning from your expertise as the staff members of the Senior Companion Program.

The information you share with me will inform future interventions to enhance social connectedness and psychosocial well-being of diverse older adults. You will receive a $20 gift card for your participation.
All efforts will be made to keep the information you share in the strictest confidentiality. We will not use your name or other identifying information in any type of presentations, publications, or reports of the study. Your de-identified information may be used or shared with other researchers without your additional informed consent. If you participate online (i.e., via ZOOM), then we will work to make sure that no one sees your online responses without approval. But, because we are using the Internet, there is a chance that someone could access your online responses without permission. In some cases, this information could be used to identify you. When there are reasonable causes to believe that an adult is being abused, neglected, or exploited (or is in a condition that is the result of abuse, neglect, or exploitation), we will report the suspected situation to the county department of job and family services or the local designated adult protective services agency.
You participation is voluntary. If you decide not to participate, there will be no penalty or loss of benefits to which you are otherwise entitled. You can always skip questions you don't want to answer, or stop participating at any time, without any penalty.
If you have any additional questions concerning this research or your participation in it, please feel free to contact me, my supervisor, or our university research office at any time. You will receive a contact information card via email or mail based on your preference.
If it is Ok with you, I would like to make a recording of our discussion, so that I can have an accurate record of the information that you provide to me. Once the transcription is complete, I will erase the tape.
Do you have any questions about this research?
Do you agree to participate?
May I record your responses now? Thank you.

Appendix C. Verbal Consent for Volunteers

Hello, my name is Katy Cao. I am a doctoral student at The Ohio State University, College of Social Work. I am undertaking a research project regarding the social support network of volunteers in the Senior Companions Program.

This study aims to understand the social networks of senior companions throughout the COVID-19 pandemic within and outside the program. We are interested in learning about how the Senior Companions Program influences your social networks and loneliness. You might find some benefit by reflecting on your role in the program. You are invited to:

- Complete a survey on social networks and loneliness that takes approximately 30 minutes.
- Participate in a focus groups that take 60-90 minutes.
- You can also participate in a one-on-one interview with the researcher for an in-depth conversation.

You will receive a $10 gift card for your participation in the survey and focus groups. A follow-up interview might be conducted depending on the completeness of information in the initial data collection. An additional $10 incentive will be provided if you participate in follow-up interviews. You will also be entered into a lottery system to win a $100 gift card.

The information you share with me will inform future interventions to enhance social connectedness and psychosocial well-being of diverse older adults. All efforts will be made to keep the information you share in the strictest confidentiality. We will not use your name or other identifying information in any type of presentations, publications, or reports of the study. Your de-identified information may be used or shared with other researchers without your additional informed consent. While we ask other group participants to keep the discussion in the group confidential, we cannot guarantee this. Please keep this in mind when choosing what to share in the group setting. If you participate online, then we will work to make sure that no one sees your online responses without approval. But, because we are using the Internet, there is a chance that someone could access your online responses without permission. In some cases, this information could be used to identify you. When there are reasonable causes to believe that an adult is being abused, neglected, or exploited (or is in a condition that is the result of abuse, neglect, or exploitation), we will report the suspected situation to the county department of job and family services or the local designated adult protective services agency.

You participation is voluntary. If you decide not to participate, there will be no penalty or loss of benefits to which you are otherwise entitled. You can always skip questions you don't want to answer, or stop participating at any time, without any penalty.

If you have any additional questions concerning this research or your participation in it, please feel free to contact me, my supervisor, or our university research office at any time. You will receive a contact information card.

I would like to record our focus group if it is OK with you. Once the transcription is complete, I will erase the tape.

Do you have any questions about this research?
Do you agree to participate?
May I record your responses now? Thank you.

Contact Information Card

Katy, Cao
Doctoral Candidate, College of Social Work
The Ohio State University
Columbus, OH 43210
USA
Phone: 1-614-300-0656
Email: cao.847@osu.edu

The principal investigator of this research project is:

Dr. Holly, Dabelko-Schoeny
College of Social Work
The Ohio State University
Columbus, OH 43210
USA
Phone: 1- 614-292-4378
Email: dabelko-schoeny.1@osu.edu

You may contact Dr. Dabelko-Schoeny with questions or if you think that you have been harmed as a result of your participation.

For questions about your rights as someone taking part in this study, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-614-688-4792 or 1-800-678-6251. You may call this number to discuss concerns or complaints about the study with someone who is not part of the research team.

Note. The same contact information card was offered to staff members and volunteers.

Appendix D. Expert Interview with Staff Members of SCP

Ice-Breaking Question

Please tell me about your role and experiences working for the Senior Companion program and how the program has been influenced by the COVID-19 pandemic.

Organization Contexts

- How does your organization communicate with older volunteers (before and after the outbreak of COVID-19)?
- What's the most recent event that your organization hosted (before and after the COVID-19 pandemic)? Did it attract diverse older volunteers? Why or why not?
- How does your organization recruit and attract diverse older adults, particularly older immigrants to volunteer?
- What methods worked and what didn't? Why?

Organized Socialization

- What activities, opportunities, and support does SCP provide for older volunteers (before and after the COVID-19 pandemic)? Can you give me some examples, please? Probes:
  - Networking
  - Training
  - Financial support
- How do you assist with the volunteering of senior companions (before and after the COVID-19 pandemic)?
- What are some socializing opportunities for senior companions (before and after the COVID-19 pandemic)?
- How do you structure socializing/networking activities for senior companions (before and after the COVID-19 pandemic)?
- What are your experiences interacting with different groups of older volunteers (e.g. Chinese, Somali, Russian)? Can you give me an example? Probes:
  - What is the most impressive, pleasant, and stressful experience you had interacting with diverse older volunteers?
- Based on your observations, do older volunteers show or talk about their feelings of loneliness?
- What are some ways the SCP may assist with reducing older volunteers' feelings of loneliness?
- How would you describe the relationships among the older volunteers? Probes:
  - Can you please give me an example of conflict or misunderstanding among the volunteers (What happened, how did conflict resolve)?
  - Can you please give me an example of friendship or support among volunteers (What happened, how did the friendship develop)?

Closing Questions

- Is there anything else that we haven't discussed that you think might be important for me to know in understanding the organizational context of senior companions' social connectedness?

Appendix E. Focus Group Interview Guide

Ice-Breaking Question

- Please tell me about your experiences volunteering with the Senior Companion program. Probes:
  - How did you learn about the opportunity to volunteer for this program? Or how did you start volunteering for this program?
  - What's your first impression of the program?
  - What made you continue/discontinue participating in the program?
  - What do you like the best/least about volunteering in this program? Why?
  - What makes volunteering for this program easy? What makes volunteering for this program challenging?
  - How has COVID-19 impacted your experiences volunteering with the Senior Companion Program?

Perception of Social Interactions

- Please tell me more about how you interact with other volunteers in the program. Probes:
  - What activities do you do together?
  - Where do you usually interact?
  - How do you usually interact (e.g. phone, online, in-person)?
  - Can you give me an example of a recent interaction?
  - How has COVID-19 affected your interactions with other volunteers in the program?
- Have you made any new friends that are close to you since joining the volunteer program? Please give me some examples. Probes:
  - Can you give me an example?
  - How did you meet this person?
  - What's your first impression of this person?
  - Do you consider this person as your close friend, why?
  - When was the last time you hang out together, what did you do?
  - When was the last time you chat with this person, what did you talk about?
  - Have you invited this person to your home before, vice versa?
  - How do you feel about your interaction with this person?
  - How has COVID-19 affected your interactions with this person?
  - From your perspective, what are some important things when making friends, and how so?
- P

  lease tell me more about how you interact with other people important in your life (e.g. adult children, spouse, friends): Probes:
  - What activities do you do together?
  - Where do you usually interact? How do you usually interact (e.g., phone, online, in-person)?
  - Can you give me an example of a recent interaction?

Loneliness

- How would

  you describe loneliness? Or What's your definition of loneliness?
  - Some people say that as people get older, they get lonelier, do you agree with this statement? Why or why not?

- What are your or your friends' experiences with feelings of loneliness? Probes:
  - Can you give me an example of a time when you felt a bit lonely?
  - What has been helpful for you or people you know in handling loneliness?
  - What advice do you have for people feeling lonely?
    - What do you think the family members can do to reduce people's feelings of loneliness; how about friends, aging service workers, and community/ volunteer program workers?
- According to your experiences and observation, how has the COVID-19 pandemic influenced your friends' (or your own) loneliness? Probes:
    - Do you feel like the pandemic has made it more challenging for you to maintain connections with your friends/ someone? Why or why not?
    - Since the pandemic, has any of your friends talked with you about feeling lonely? What did they say?

Closing Questions

- Is there anything else that we haven't discussed that you think might be important for me to know in studying the social network and loneliness of senior companions?

Qualitative participants' characteristics:

- What is your age?
- What is the gender you identify with?
- What is your highest level of education completed?
- What is your relationship status (e.g., married, never married, divorced, cohabitating, widowed)?
- What is your employment status (e.g., part-time work, full-time work, retired, self-employed?)
- How many adult children do you have? How often do you interact with your adult children?
- Whom do you live with?
- What is your country/region of origin?

Appendix F. Socio-Demographic Questions

Please answer the following questions about **yourself**. Thank you.

1. What year were you born?_____

2. What is the gender you identify with (please darken ● only one circle):
   ○ Male ○ Female ○ Other

3. What is your country/region of origin (please darken only one circle):
   ○United States
   ○ China
   ○ Bhutan
   ○ Cambodia
   ○ Nepal
   ○ Russia
   ○ Somalia
   ○ Other _____

4. What is your race and ethnicity (please check ☑ all the boxes that apply)?
   ☐ White
   ☐ Black or African American
   ☐ American Indian or Alaska Native
   ☐ Asian or Pacific Islander
   ☐ Hispanic or Latino/Latina/Latinx
   ☐ Other (please specify)_____

5. What is the highest level of education you completed (please darken only one circle)?
   ○ No high school degree
   ○ High school degree or equivalent
   ○ Some college, no degree
   ○ Associate's degree
   ○ Bachelor's degree
   ○ Graduate or professional degree

6. What is your current employment situation (please check all the boxes that apply)?
   ☐ Employed full-time
   ☐ Employed part-time
   ☐ Self-employed
   ☐ Retired and not looking for work
   ☐ Unemployed but looking for work
   ☐ Other _____

7. What is your current marital status (please darken only one circle)?
   ○ Married
   ○ Divorced or separated
   ○ Never married
   ○ Widowed

○ Cohabitation (living with a partner without being married)

8. Who lives in your household? (check all the boxes that apply):
- ☐ I live alone
- ☐ I live with a spouse/partner
- ☐ I live with my children
- ☐ I live with my grandchildren
- ☐ I live with other relatives
- ☐ I live with non-relatives
- ☐ Other _____

9. If you were not born in the United States, how many years have you been in the United States? _____

10. If you were not born in the United States, how old were you when you first migrated to the United States? _____

11. Why did you immigrate to the U.S. (check all the boxes that apply)?
- ☐ Reunite with spouse
- ☐ Reunite with adult children
- ☐ Reunite with other family members
- ☐ Take care of grandchildren
- ☐ Looking for employment and/or educational opportunities
- ☐ Better living standards
- ☐ Lower levels of crime
- ☐ Refugee or asylee
- ☐ Other _____

12. How is your health in general? Please darken only one circle.
- ○ Very good
- ○ Good
- ○ Moderate
- ○ Bad
- ○ Very bad

13. Thinking about your neighborhood as a whole, how would you rate the neighborhood you live in?
- ○Very good
- ○Good
- ○Fair
- ○Bad
- ○Very bad

14. How many family members do you see or hear from at least once a month? _____

15. How many friends outside of the Senior Companion Program (SCP) do you see or hear from at least once a month?_____

16. How many times did you volunteer for SCP in the past month? _____

Appendix G. Friendship Nomination Form

Can you please name up to 5 people you met through Senior Companion Program (SCP) whom you regard as friends? Please only name people you consider as friends and you do not have to name the full ten.

*Please answer the following questions regarding your **friends** a through j when applicable. Thank you.*

Your first and last name in print:_____

1. Full names of people you met through SCP whom you regard as friends. *Please print their first and last name.*	2. What is the person's gender? *Please darken only one circle.*	3. What is the person's age?	4. What is the person's race? *Please check all that apply.*	5. What is the person's country/region of origin? *Please darken only one circle.*	6. What is the highest level of education the person received? *Please darken only one circle.*	7. How did you **first** meet the person? *Please darken only one circle.*	8. Have you introduced this person to your friends or family members outside of SCP? *Please darken only one circle.*	9. How many times have you interacted with (e.g., in-person, phone) this person **in the past month**?
Example: Jane Doe	● Female ○ Male ○ Other (please specify): _____	62	☐ White ☑ Black or African American ☐ American Indian or Alaska Native ☐ Asian or Pacific Islander ☐ Hispanic or Latino/Latina/Latinx ☐ Other (please specify): _____	● United States ○ China ○ Bhutan ○ Cambodia ○ Nepal ○ Russia ○ Somalia ○ Other (please specify): _____	○ No high school degree ○ High school degree or equivalent ○ Some college, no degree ○ Associate's degree ● Bachelor's degree ○ Graduate or professional degree	● This person is also a volunteer of the Senior Companion Program (SCP) ○ This person is a client from the SCP ○ This person is a staff member of the SCP ○ Other (please specify): _____	● Yes ○ No	5

1. Full names of people you met through SCP whom you regard as friends. *Please print their first and last name.*	2. What is the person's gender? *Please darken only one circle.*	3. What is the person's age?	4. What is the person's race? *Please check all that apply.*	5. What is the person's country/region of origin? *Please darken only one circle.*	6. What is the highest level of education the person received? *Please darken only one circle.*	7. How did you **first** meet the person? *Please darken only one circle.*	8. Have you introduced this person to your friends or family members outside of SCP? *Please darken only one circle.*	9. How many times have you interacted with (e.g., in-person, phone) this person **in the past month**?
a.	○ Female ○ Male ○ Other (please specify): _____		☐ White ☐ Black or African American ☐ American Indian or Alaska Native ☐ Asian or Pacific Islander ☐ Hispanic or Latino/Latina/Latinx ☐ Other (please specify): _____	○ United States ○ China ○ Bhutan ○ Cambodia ○ Nepal ○ Russia ○ Somalia ○ Other (please specify): _____	○ No high school degree ○ High school degree or equivalent ○ Some college, no degree ○ Associate's degree ○ Bachelor's degree ○ Graduate or professional degree	○ This person is also a volunteer of the Senior Companion Program (SCP) ○ This person is a client from the SCP ○ This person is a staff member of the SCP ○ Other (please specify): _____	○ Yes ○ No	
a.	○ Female ○ Male ○ Other (please specify): _____		☐ White ☐ Black or African American ☐ American Indian or Alaska Native ☐ Asian or Pacific Islander ☐ Hispanic or Latino/Latina/Latinx ☐ Other (please specify) _____	○ United States ○ China ○ Bhutan ○ Cambodia ○ Nepal ○ Russia ○ Somalia ○ Other (please specify): _____	○ No high school degree ○ High school degree or equivalent ○ Some college, no degree ○ Associate's degree ○ Bachelor's degree ○ Graduate or professional degree	○ This person is also a volunteer of the Senior Companion Program (SCP) ○ This person is a client from the SCP ○ This person is a staff member of the SCP ○ Other (please specify): _____	○ Yes ○ No	

1. Full names of people you met through SCP whom you regard as friends. *Please print their first and last name.*	2. What is the person's gender? *Please darken only one circle.*	3. What is the person's age?	4. What is the person's race? *Please check all that apply.*	5. What is the person's country/region of origin? *Please darken only one circle.*	6. What is the highest level of education the person received? *Please darken only one circle.*	7. How did you **first** meet the person? *Please darken only one circle.*	8. Have you introduced this person to your friends or family members outside of SCP? *Please darken only one circle.*	9. How many times have you interacted with (e.g., in-person, phone) this person **in the past month**?
a.	○ Female ○ Male ○ Other (please specify): _____		☐ White ☐ Black or African American ☐ American Indian or Alaska Native ☐ Asian or Pacific Islander ☐ Hispanic or Latino/Latina/Latinx ☐ Other (please specify) _____	○ United States ○ China ○ Bhutan ○ Cambodia ○ Nepal ○ Russia ○ Somalia ○ Other (please specify): _____	○ No high school degree ○ High school degree or equivalent ○ Some college, no degree ○ Associate's degree ○ Bachelor's degree ○ Graduate or professional degree	○ This person is also a volunteer of the Senior Companion Program (SCP) ○ This person is a client from the SCP ○ This person is a staff member of the SCP ○ Other (please specify): _____	○ Yes ○ No	
a.	○ Female ○ Male ○ Other (please specify): _____		☐ White ☐ Black or African American ☐ American Indian or Alaska Native ☐ Asian or Pacific Islander ☐ Hispanic or Latino/Latina/Latinx ☐ Other (please specify) _____	○ United States ○ China ○ Bhutan ○ Cambodia ○ Nepal ○ Russia ○ Somalia ○ Other (please specify): _____	○ No high school degree ○ High school degree or equivalent ○ Some college, no degree ○ Associate's degree ○ Bachelor's degree ○ Graduate or professional degree	○ This person is also a volunteer of the Senior Companion Program (SCP) ○ This person is a client from the SCP ○ This person is a staff member of the SCP ○ Other (please specify): _____	○ Yes ○ No	

1. Full names of people you met through SCP whom you regard as friends. *Please print their first and last name.*	2. What is the person's gender? *Please darken only one circle.*	3. What is the person's age?	4. What is the person's race? *Please check all that apply.*	5. What is the person's country/region of origin? *Please darken only one circle.*	6. What is the highest level of education the person received? *Please darken only one circle.*	7. How did you **first** meet the person? *Please darken only one circle.*	8. Have you introduced this person to your friends or family members outside of SCP? *Please darken only one circle.*	9. How many times have you interacted with (e.g., in-person, phone) this person **in the past month**?
a.	○ Female ○ Male ○ Other (please specify): _____		☐ White ☐ Black or African American ☐ American Indian or Alaska Native ☐ Asian or Pacific Islander ☐ Hispanic or Latino/Latina/Latinx ☐ Other (please specify) _____	○ United States ○ China ○ Bhutan ○ Cambodia ○ Nepal ○ Russia ○ Somalia ○ Other (please specify): _____	○ No high school degree ○ High school degree or equivalent ○ Some college, no degree ○ Associate's degree ○ Bachelor's degree ○ Graduate or professional degree	○ This person is also a volunteer of the Senior Companion Program (SCP) ○ This person is a client from the SCP ○ This person is a staff member of the SCP ○ Other (please specify): _____	○ Yes ○ No	

Appendix H. De Jong Gierveld Loneliness Scale[1]

The following questions inquire about your experiences with loneliness. please darken ● only one circle.

1. I experience a general sense of emptiness [EL]
○ Yes
○ More or less
○ No

2. I miss having people around me [EL]
○ Yes
○ More or less
○ No

3. I often feel rejected [EL]
○ Yes
○ More or less
○ No

4. There are plenty of people I can rely on when I have problems [SL]
○ Yes
○ More or less
○ No

5. There are many people I can trust completely [SL]
○ Yes
○ More or less
○ No

6. There are enough people I feel close to [SL]
○ Yes
○ More or less
○ No

If you are interested in participating in a follow-up interview, please provide your name and phone number below. You will receive another gift card for the follow-up interview.

Name (first, last): _____
Phone Number: _____
What language do you prefer to be contacted in? _____

[1]Source: Gierveld, J. D. J., & Tilburg, T. V. (2006). A 6-item scale for overall, emotional, and social loneliness: Confirmatory tests on survey data. *Research on Aging*, *28*(5), 582-598

Appendix I. Senior Companions focus group Codebook

Name	Description
1. Expanding and strengthening social networks through volunteering	This theme focuses on the social relationships volunteers gained, deepened, or strengthened through the volunteering program. There are two subthemes under this theme: "Deepening relationships with clients" & “Developing friendships with other volunteers".
2. Deepening relationships with clients	The category describes interactions and dynamics between clients and volunteers. Note that volunteers provide services to clients (e.g., transportation support) and form friendships with clients that may extend beyond the formal service.
3. Reciprocated relationship-a 'two-way street'	Companions and clients support each other mutually. For volunteers, their services are reciprocated through human interactions and the opportunity to help.
'Your companions become your friends'	Beyond providing services, volunteers become friends with the clients they serve over time.
Attending funerals	
Calling clients over the phone	
Clients as families	
Clients as neighbors	
Focusing on clients	Some volunteers shared that they focus on building relationships with clients and do not see other volunteers often between meetings.
Going for a walk	
Introducing clients to one and other	
Life-long friendships	
Matched with clients	Volunteers are matched with clients (or companions) based on their mutual interests and agreement. Matching happens before volunteers start serving a particular client.
Sharing concerns	
Talking about home and host country with clients sharing similar cultures	

Name	Description
'They are happy to see us'	Clients look forward to seeing the volunteers. Seeing smiles on their clients' faces makes the volunteers happy as well.
3. 'We are here to help'	This category summarizes services SCP volunteers provide.
Families of clients are also clients	Families of clients are also clients. Volunteers support the family members of clients and facilitate the communication between clients and clients" families.
Helping with grocery shopping	
Helping with transportation	
Complicated transportation service system	Complicated transportation service system for older adults with limited English proficiency. Too many steps and questions to apply for transportation services.
Inflexibility transportation services	Inflexible transportation service system that does not meet older adults' needs when visiting doctors or accessing health services. For instance, if a doctor"s visit is extended, the older adults would miss the trip home.
Unreliable transportation	Unreliable transportation that does not provide services as on time or as expected.
Navigating the social and health service systems on behalf of clients	Volunteers navigate the social and health service systems on behalf of clients to address language, cultural, mobility barriers some clients face when accessing services.
Facilitating the communication between clients and social services-Translating and interpreting	
Helping with computers	
Providing information	
Visiting and 'showing love'	
2. Developing friendships with other volunteers	Developing friendships with other volunteers of the senior companion program (SCP) through SCP-organized opportunities (e.g., monthly in-service training) and interactions outside of the program.
3. Connecting through organized activities by SCP	
Connecting with people from various cultures	Connecting with volunteers from various cultures and countries through SCP.
3. Interacting outside of the program	
Connecting virtually between meetings	

Name	Description
Going to churches or worshiping together	
Going to places together	
'Laugh is good medicine'	
Recruiting friends into the program	Recruiting friends into the program and having pre-existing relationships with other volunteers before joining the program
Running into each other in the community	
Sharing information and concerns	
'We are on each other's minds, we are in each other's heart'	
1. Experiencing and coping with loneliness	This theme covers the definition, factors, and coping strategies for loneliness according to participants.
2. Coping with loneliness	What participants do or suggest others do when feeling lonely.
3. Building a community of support	Building a community of support by bonding with people sharing similar culture/interests/language and forming a sense of community by getting to know people from various cultures.
Bonding with people sharing similar cultures	
Kindness and love towards everyone regardless of race, ethnicity, country of origin, etc.	
3. Communicating with people	Communicating with people in-person or virtually to combat loneliness.
'Talking it out'	
3. 'Helping others'-'you do it for everybody'	“Helping others”- generosity and being able to give play an important role in combating loneliness. Participants highlighted the importance of being inclusive when providing help.
3. 'Staying busy'	'Staying busy' combats loneliness.
Gardening	
Having pets	
Reading and scrapbooking	
Volunteering	
Watching TV	

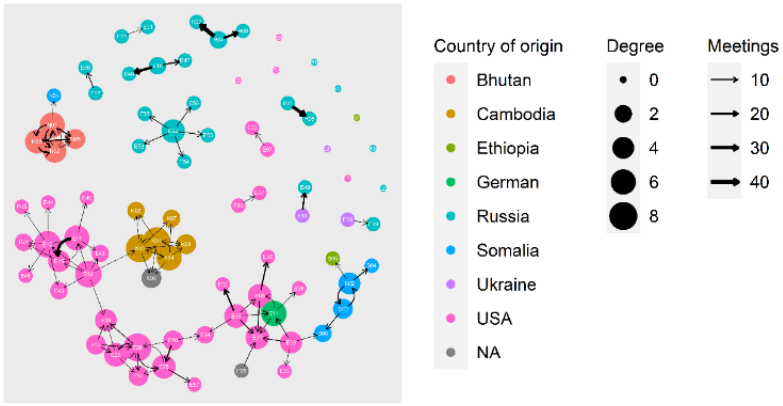
Name	Description
3. Staying close with families	Living with or staying in close contact with families. Some participants also discussed how having a big family (e.g., many children) improves connectedness.
3. 'Trusting God'	Trusting God and resorting to faith-based coping strategies when experiencing loneliness one selves and when helping lonely clients.
2. Defining loneliness	How participants define and describe experiences with loneliness.
3. Being Lonely versus being alone	Being alone may contribute to loneliness and meanwhile, aloneness is different from loneliness. The two subcategories reflect the difference as well as the overlap of aloneness and loneliness.
The value of being alone	
Needing time alone	
Staying apart to avoid fights	
Too much aloneness can be lonely	
'They are by themselves'	
'you want to be alone by choice'	
3. 'I don't feel lonely'	Participants denied experiencing loneliness.
'Asians are not lonely'	Nepali- and Khmer-speaking participants shared how they and clients are not lonely owing to the closeness of family members.
Living with families	
3. Loneliness as 'feeling left behind'	Loneliness as “feeling left behind. Older adults feel left behind or "abandoned" by busy family members.
3. Loneliness as lacking social interactions	Loneliness is lacking social interactions and human contact.
3. Loneliness as 'You get it mentally'	The mental and emotional experiences of loneliness.
'Feeling heavy'	
'they are depressed'	
'They think too much'	
2. Factors contributing to loneliness	Factors that contribute to loneliness for self and others.
3. Aging and Loneliness	Lifespan changes throughout aging that might contribute to loneliness.
Changing physical capacities	
Feeling distant from or rejected by the family	
Losing social contacts as one ages	'Love and unable to forget'

Name	Description
3. Immigration and Loneliness-language and cultural isolation	Immigration-related social changes, language, and cultural isolation contribute to loneliness.
3. Loneliness across the lifespan-'Everybody needs somebody'	The importance of social interactions and human contact across the lifespan.
1. Experiencing and managing the social impact of COVID-'We missed everybody'	The impact of COVID on social relationships (within and outside of the program) and how people maintained social relationships during COVID to manage its" impact. The two sub-themes cover COVID"s impact on volunteering and its general impact on social connectedness.
2. COVID hinders overall social connectedness-'We miss everybody'	COVID hinders social connectedness in general, including interactions with family and friends.
3. Fear of COVID limited social interactions	Fear of COVID and self-isolation due to safety concerns limited social interactions. This code is about how subjective fear for COVID limits social interactions.
Missing family time during COVID	
Limited contact with family members during COVID	
Missing holidays	
Recovering from COVID	
Self-Isolation due to fear of COVID-A mental block for socializing	
3. Lockdown due to COVID-'Something is missing or someone is missing'	Shutdown and other safety measures/policies restricted social interactions. This code is about objective policies and restrictions at the program, county, state, or national level that limits social connections.
2. COVID limits volunteering-'COVID has taken it away from us'	COVID limits volunteering opportunities (e.g., switching from in-person to phone check-ins). This category also encompasses social losses within the program (among volunteers or clients) due to COVID.
3. COVID related Social losses within the program	
Lost clients due to COVID	
Lost other volunteers during COVID	
3. Separated from clients during COVID-'We missed everybody'	

Name	Description
Fear of COVID hinders bonding with clients- 'They are afraid'	
Limited clientele	Limited sources of clients and unable to expand volunteering services due to COVID.
3. Volunteering In-person and over the phone	
Continue seeing clients with precautions	
Supporting clients virtually	
Phone communication does not replace in-person contact	
1. Exploring and loving the volunteering program	This theme explains how people are recruited into the program and how they navigated volunteering when they first started.
2. Challenges in volunteering	The ambiguous boundary between clients and volunteers
3. High need client	
3. The ambiguous boundary between clients and volunteers	Ambiguous boundaries between clients and volunteers make it challenging to volunteer. Some clients have requests and expectations that are beyond the capacity/responsibility of volunteers.
3. Worrying about clients	
2. Initial experience with the program	How participants first learned about the program and how they started volunteering.
3. 'Outreach' and recruitment effort by Catholic Social Services	
3. Personal referral (by family, friends, current volunteers)	The volunteers learned about the volunteering program from family members.
3. Referral through other human service organizations	
2. Long-term engagement in the program	Long-term engagement in the volunteering program. For instance, some participants have been a volunteer for over 20 years.
2. Positive Experiences with Volunteering	Benefits of volunteering for SCP according to participants.
3. Contributing to the community	Participants value volunteering as a way to contribute to the community as older adults.
3. Enjoying meeting people	Enjoying meeting people through the volunteering program.

Name	Description
Meeting new people after moving and retirement	Meeting new people after moving and retirement.
3. Helpful Organizational Structures	Exploring and getting involved with the senior companion program.
Helpful staff members and services	Helpful staff members and services from the program motivate older adults to stay in the program.
Mileage reimbursement	Happy with the Mileage reimbursement from SCP.
Serving on the council	
Training new volunteers	
3. Navigating lives in a new country	Volunteering offers volunteers who are immigrants themselves an opportunity to learn new information and navigate lives in a new country.
3. Serving older adults	
3. Staying active after retirement	Staying active after retirement through volunteering.
1. Social connections outside of the program-'we leave no strangers'	Interactions with friends, families, and neighbours outside of the program.
2. Churches, temples, mosques. etc	Socializing at church and other religious settings.
'Grandchildren' at church	Enjoying interactions with children at church.
2. Family	Socializing with family members.
Cooking	
Family is everything	
Talking on the phone or video calling	
2. Friends and acquaintances	Socializing with friends and acquaintances.
Going for walks during COVID	
Going to concerts	
Making friends with whoever you meet	
2. Neighbours	Socializing with neighbours.
Greeting everybody in the neighbourhood	"I speak to everybody"
Speaking to everybody regardless of cultural, racial, and linguistic differences	
Unfriendly Neighbours	

Appendix J. Network Graph by Country of Origin (*N*=83)

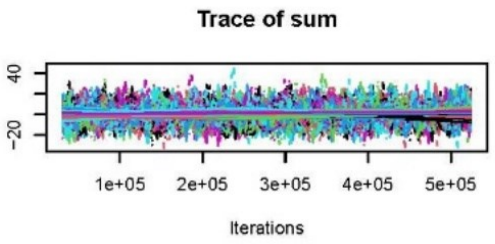


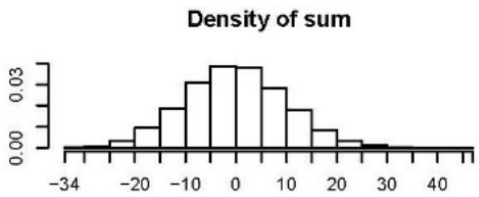
Appendix K. Results from the Exponential Random Graph Model (*N*=83)

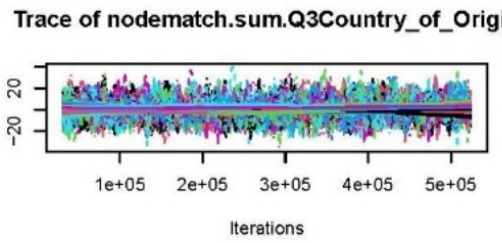
	Estimate	Std. Error	z value	Pr(>|z|)
Sum of the frequency of meetings	-6.6	0.25	-25.96	<1e-04 ***
Homophily of country of origin	2.44	0.19	12.96	<1e-04 ***
Homophily of gender	0.84	0.13	6.37	<1e-04 ***
Homophily of education	1.46	0.11	13.02	<1e-04 ***
Homophily of race	1.9	0.19	10.27	<1e-04 ***
Homophily of age	-0.0032	0.0063	-0.51	0.609
Reciprocity	-1.3	0.27	-4.78	<1e-04***

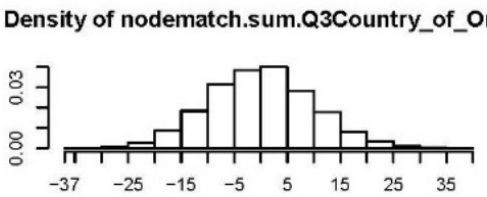
Note. p***<0.0001***; p**<0.001, p*<0.05, p.<0.1. AIC: -11759; BIC: -11711

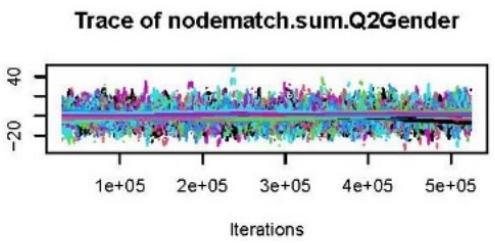
Appendix L. ERGM MCMC Trace Plot

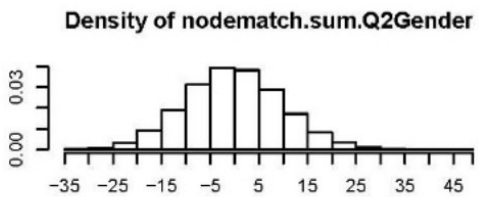


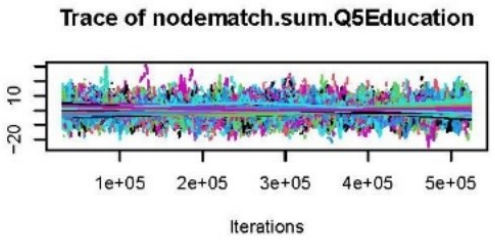


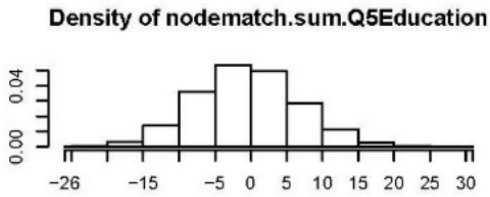


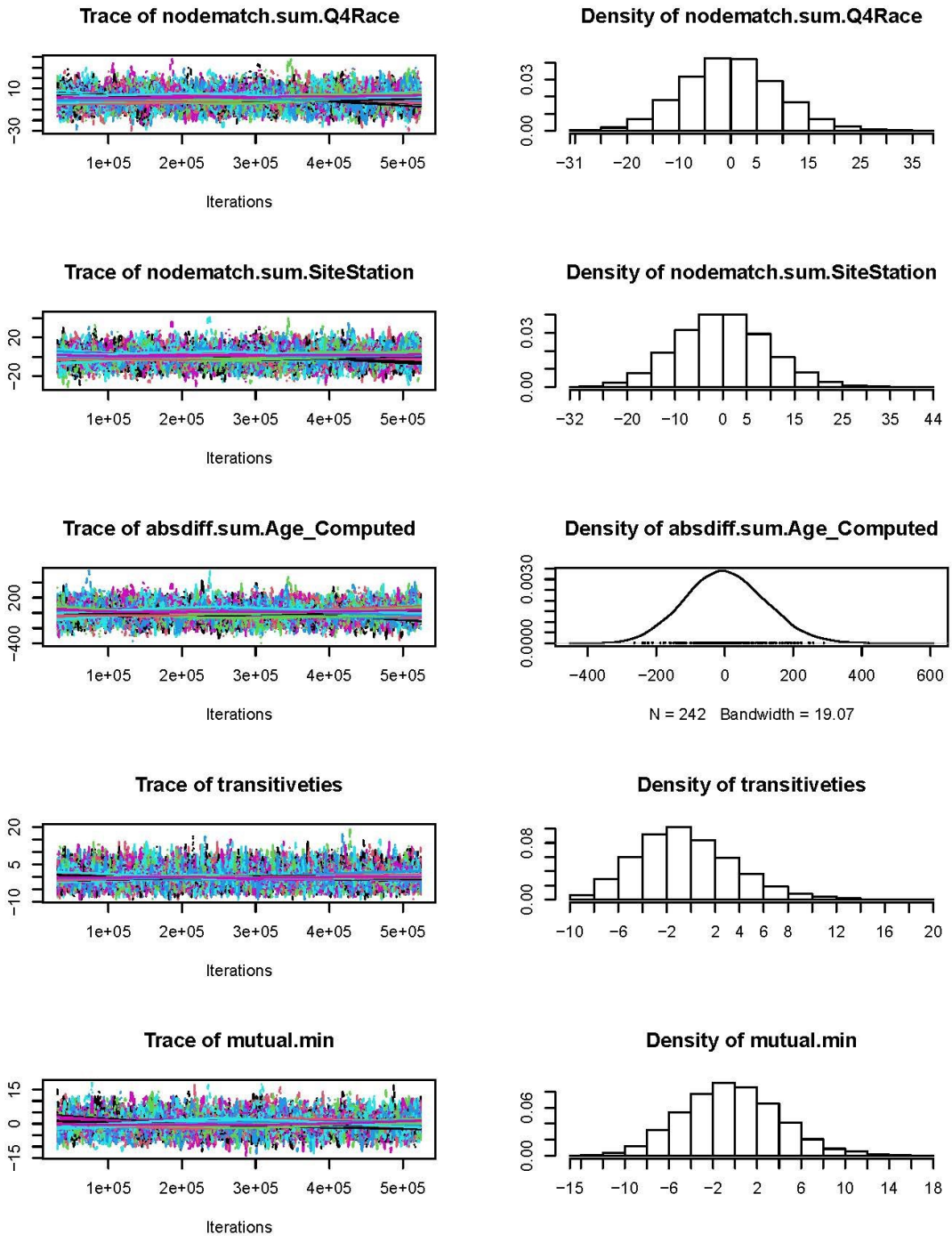











Trace of nodematch.sum.Q4Race
Density of nodematch.sum.Q4Race
Trace of nodematch.sum.SiteStation
Density of nodematch.sum.SiteStation
Trace of absdiff.sum.Age_Computed
Density of absdiff.sum.Age_Computed
N = 242 Bandwidth = 19.07
Trace of transitiveties
Density of transitiveties
Trace of mutual.min
Density of mutual.min
Iterations

Appendix M. Linear Network Autocorrelation Model (All Variables)

	Estimate	Std. Error	Z value	Pr(>|z|)	
Age	0.061	0.012	4.77	1.87E-06	***
Gender	1.26	0.51	2.46	0.014	*
USA	-0.26	0.78	-0.33	0.74	
Education	-0.27	0.13	-2.01	0.044	*
Perceived Neighborhood Livability	-0.081	0.27	-0.3	0.76	
Married	-0.13	0.76	-0.17	0.86	
Self-Rated Health	-0.24	0.32	-0.77	0.44	
Number of Family and Friends Interacted with in a Month	-0.077	0.02	-3.83	0.00013	***
Frequency of Volunteering	0.017	0.018	0.93	0.35	
ρ	-0.053	0.029	-1.85	0.064	.

Note. For gender, male=0 and female =1. The dichotomous USA variable was constructed from the Country of Origin variable (USA=1, non-USA=0) because of the scarcity of cases in each non-USA country. Because Education has more than five ordered categories (no high school degree, high school degree or equivalent, some college, no degree, Associate degree, Bachelor's degree, and graduate or professional degree), it was treated as a continuous variable (H. Wu & Leung, 2017). Similarly, perceived neighborhood livability (very good, good, fair, bad, very bad) and self-rated health (very good, good, moderate, bad, very bad) were also treated as continuous. p***<0.0001***; p**<0.001, p*<0.05, p·<0.1. AIC: 94.77 BIC: 108.2; Multiple R^2: 0.61, Adjusted R^2: 0.36.