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Social Relationships and Adaptation in Later Life

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Introduction

Social relations have been increasingly recognized as fundamentally important to the health and well-being of individuals in every part of the world and may be especially relevant in later life. Older adults may be more susceptible to the risks of social isolation due to age-related changes such as retirement, changes in health, and loss of network members (e.g., widowhood). Indeed, survey research conducted in the United States reports that American adults aged 60 years and older report spending over half their waking hours alone (Livingston, 2019). About 28%, estimated to be roughly 13.8 million individuals, of all non-institutionalized American older adults reported living alone in 2017 (Administration for Community Living & Administration on Aging, 2018). Although higher proportions of older adults living alone are seen in North American and Nordic countries (Reher and Requena, 2018), similar trends are emerging globally. For instance, in Singapore, the number of older Singaporeans (65 years and older) living alone is estimated to increase by 42% from 2012 (35,000) to 2030 (83,000) (Ministry of Health, 2016).

Further, the proportion of older adults world-wide is also increasing (i.e., population aging). As of 2015, an estimated 8.5% of the world's population was aged 65 and older. By 2030, this is projected to increase to 12%, and by 2050, 16.7% of the world's population will be 65 years or older (He et al., 2016). This increase in the older adult population is paired with the proportion of youth (under 20 years old) remaining flat over the same time period (He et al., 2016). A rapidly aging population will face several socioeconomic and health-related changes such as increased chronic disease burden, increased healthcare costs, and reduced labor supply (Bloom et al., 2015), this despite the fact that people are remaining healthier longer. As social relations are a modifiable factor that has been linked to a variety of health-related outcomes (Cacioppo and Cacioppo, 2004; Cornwell and Waite, 2009; Coyle and Dugan, 2012; Steptoe et al., 2013), coupled with increases in population aging, the need to understand the implications of social relations or lack thereof (i.e., social isolation) is becoming more relevant and more urgent.

In past decades, the field has made great progress in developing increasingly sophisticated evidence to document the who, what, why, and how of social relations. As the field moved forward, social relations was identified as an umbrella term that refers

to structural characteristics of the social network (e.g., age, gender, education of network members), social support (e.g., aid, affect or affirmation that is exchanged) and support adequacy or satisfaction (e.g., the evaluation of the support network and social support available to the individual). All of these aspects of social relations, in turn, affect the individual's health and well-being both contemporaneously and longitudinally. While empirical evidence has accumulated in support of positive effects of social relations on health and well-being, there has also been recognition that not all social relations are positive or have a positive effect on people. It is clear that some people are disadvantaged by negative or ambivalent relations which, in turn, have the potential to negatively influence health and well-being. This greater specificity has framed and advanced the scientific study of social relations.

In this chapter we begin with a consideration of several prominent *theories of social relations*, highlighting important characteristics of social relations as well as potential age-related changes in social relations. Next, we move to a summary of extant knowledge about how social relations are associated with health and quality of life by examining the hierarchical breakdown of social relations (see **Fig. 1**). To exemplify this, we can use contact frequency, one specific dimension of social relations, as an example. Contact frequency is one unique social resource stemming from social relations and can be viewed as distinct from other social resources (i.e., social support, social strain, etc.). This resource can further be broken down by examining the source of this social contact. Is the individual interacting with friends, family, children, their spouse, a neighbor, etc.? Even further, an examination of the strength of that specific relationship tie can also highlight the unique contributions to health. Is the individual interacting with a close or more casual friend? Or a combination of close family and casual friends? Finally, as technology is increasingly facilitating social interactions, we examine how individuals are in contact with their social ties. Is the individual interacting with a close friend in-person or simply calling a friend to chat? Each of these dimensions may have unique implications for how social relations influence health and quality of life.

In this chapter, in line with this breakdown of the complexities of social relations depicted in **Fig. 1**, we discuss the *different dimensions of social relations*, including positive and negative aspects of relations. Further, we will consider different *relationship types* from parents and peers in early life to family and friends in later life, noting the critical role of each. We also examine the interesting and evolving research recognizing the strength of weak ties. Finally, with recognition of the rapidly changing world and influence of technology, the *means of communication* are reviewed and discussed.

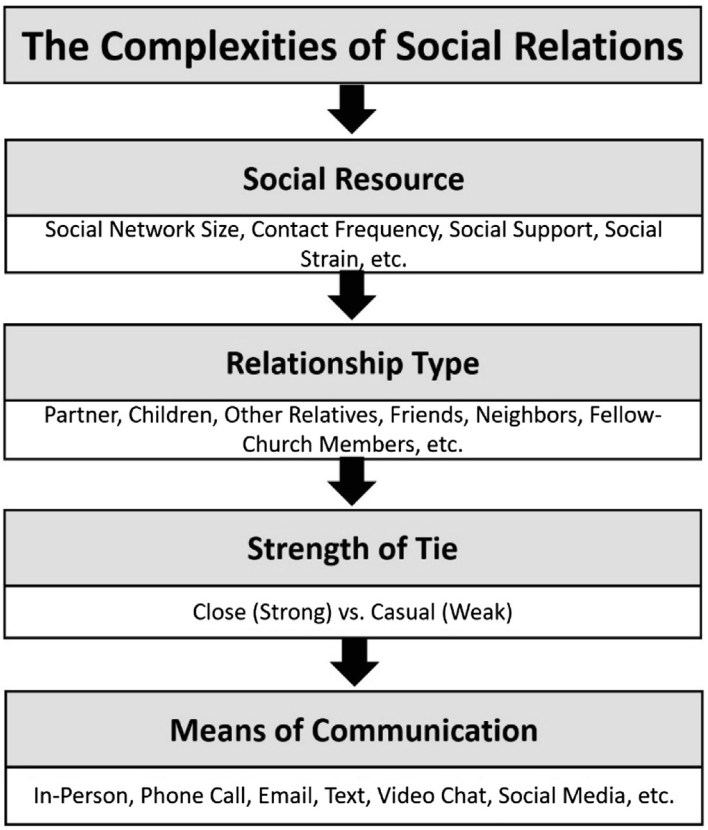

Figure 1 Conceptual Figure of the Complexities of Social Relations.

Social Relations Theories

Individuals engage in social relationships across the life course and it is important to note that age-related changes in the structure, function and quality of social relations occur in later life. Prior theoretical and empirical evidence has documented the structure of older adults' social networks as well as mechanisms that may explain shifts in social relations such as partner selection and how older adults deal with interpersonal conflict. The following section highlights three prominent theories commonly used in the aging literature that focus on social relations: (1) the Convoy Model of Social Relations, (2) Socioemotional Selectivity Theory, and (3) the Strength and Vulnerability Integration Model. We acknowledge that these are not the only theories regarding aging and social relations. Our discussion here is simply meant to be illustrative of prominent theories often cited in prior literature.

Convoy Model

The Convoy Model of Social Relations (Antonucci, 2001; Kahn and Antonucci, 1980) was designed to include the individual as part of a dynamic network across the lifespan and over the life course. This model is less culture laden and allows the individual to project their own convoy as they experience it without being driven by external norms or expectations. Under optimal conditions, the convoy surrounds and supports individuals throughout their life-time. Personal characteristics, such as age, gender, and personality, as well as situational characteristics, such as role expectations, resources, and demands, shape the individual's current and evolving convoy. Ideally, the people who form an individual's convoy provide a reassuring foundation that helps an individual grow, develop and cope with their life experiences. At the same time, situational factors provide the context within which these social relations evolve. Context is important because it situates the individual's expectations as well as the demand characteristics of organizations, roles, and/or norms. Both are critical in the development of social relations.

In 1987, Antonucci & Akiyama published one of the first empirical examinations of the convoy model using data from a national study of adults 50 years of age and older collected in 1980. They documented the structure and function of respondents' convoys and examined separately the influence of spouse, children, family and friends. In 2019, Antonucci, Ajrouch and Webster replicated that study with data collected in 2005 from a regionally representative sample and showed remarkable similarities in structure. Both cohorts had convoys of similar size, gender composition, years known and sources of support, suggesting that these characteristics are fairly consistent over time. Network size in both samples included approximately 7 people, included more women than men, and individuals knew their network members, on average, 38 years. There have also been changes in convoys over the 25 years and not always in the direction that might have been predicted. More recent cohorts were older, lived closer to and had more frequent contact with their network members than the earlier 1980 cohort. On the other hand, there was one notable difference in network composition. Proportion of family that composed a convoy was significantly smaller in 2005. Reports of emotional closeness were largely the same in the two cohorts, assessed as the number of people defined as closest (3–4), closer (2–3) and close (1–2). Composition of convoys were also fairly similar. Convoys consisted, in both samples, of spouse, children, siblings and other family and friends. Only the percentage of family decreased over the two samples. All others were substantially the same. The authors conclude not only that these are critical characteristics of a convoy but also that despite many demographic and social changes, these appear to be basic and critical elements of the convoy.

Empirical studies of the effect of social relations on health using the convoy model permit a detailed examination of these associations, often resulting in more nuanced findings or greater specificity with respect to long held or traditional findings. We provide three such examples with respect to mortality, socioeconomic status and network member education. A classic and very important finding in the literature indicates that people with more positive social relations live longer. This is a finding we do not mean to contest. However, Antonucci and colleagues (Antonucci et al., 2010) found that under conditions of serious or life-threatening illness, people with more negative relations live longer. They interpret the finding as indicating that under some situations negative relations may be experienced as negative but prolong life by encouraging life-saving behavior change such as diet, exercise or adherence to a medical regimen. Another classic finding is that people of lower socioeconomic status have poorer health than people of higher socioeconomic status. This, too, is generally true. Yet, in another study by Antonucci and colleagues (Antonucci et al., 2003), middle aged men of lower socioeconomic status with key support from their children were as healthy as men of higher socioeconomic status. And finally, Webster and colleagues (Webster et al., 2013) found that the education level of network members was significantly associated with an individual's self-rated health, above and beyond their own educational attainment and also controlling for that individual's age, gender, race, and marital status. While it is a long standing finding that higher education is associated with health, this finding indicates the importance of the education level of the people closest to you for your own health. In summary, these findings suggest that careful assessment of personal, situational and social relations characteristics can provide a more nuanced understanding of how social relations influence health and well-being of the individual in later life.

Socioemotional Selectivity Theory

Socioemotional selectivity theory (SST; Carstensen, 1995; Carstensen et al., 1999) is based on and derived from Baltes' Selection, Optimization and Compensation Model (SOC: Baltes, 1997; Baltes et al., 2006). According to SST, people make active choices about the number and closeness of relationships in which they would like to invest, and older adults become more selective in choosing their social network members due to shifts in motivation (English and Carstensen, 2014). These shifts in social relations are driven, in part, by perceptions of time rather than age per se. SST is fundamentally a lifespan theory which takes into account

different life goals at different points in the lifespan (Carstensen et al., 1999). Younger people are motivated to reach out and explore the world, in part, due to having more expansive time horizons (i.e., open-ended). Thus, younger adults strive for more knowledge-focused goals (i.e., achievement, accumulating information, etc.) to gain more independence from their family of origin and seek new connections as they seek to discover their place in the world. As individuals get older, SST argues people perceive their time left to live as more limited. With age, people become less interested in exploring new relationships but rather focus on relationships they already have that are more emotionally meaningful. With this goal dominating the basis of their social relationships, people begin to reduce the number of relationships in which they are invested in order to devote more of their remaining time to their close relationships, which become increasingly significant to them.

In an early empirical examination of SST, three cohorts of nationally representative samples were examined. Across all three cohorts, younger people reported wanting to increase the number of social relations (e.g., friends) while older people felt they had enough friends and were quite satisfied with the current size of their social networks (Lansford et al., 1998). Experimental data are also supportive. For example, in a cross-sectional study (Fredrickson and Carstensen, 1990) investigating social partner selection, individuals were asked who they would spend half an hour of free time with: a member of their immediate family (familiar social partner), a recent acquaintance they have a lot in common with (novel social partner) or an author of a book they read (novel social partner). When asked in the unspecified condition, older adults showed greater preference for familiar social partners compared with younger adults. In contrast, in a condition in which participants were told to imagine they were moving across the country by themselves (i.e., a salient ending condition), younger adults showed similar social preferences to older adults (Study 2; Fredrickson and Carstensen, 1990). In another study, using the same paradigm as the previous study (Fredrickson and Carstensen, 1990), researchers examined social partner selection in Hong Kong before, right after and 4 months after the September 11th terrorist attacks (Study 1; Fung and Carstensen, 2006). Before September 11th, younger people were less likely to select familiar social partners than older people. Right after 9/11, however, age differences were no longer present such that both younger and older individuals showed a preference towards familiar social partners. Four months after 9/11, age differences reemerged, showing a greater preference of familiar social partners at older ages (Study 1; Fung and Carstensen, 2006). Further, in a longitudinal study, social partner selection was examined in Hong Kong during the peak of the SARS epidemic and right after it subsided. During the SARS epidemic, no age differences in social partner selection emerged, however, after the SARS epidemic, younger ages were less likely to select familiar social partners compared with older ages (Study 2; Fung and Carstensen, 2006).

Overall, SST highlights the role of motivation, life goals, and context (i.e., perceptions of time left and/or the finitude of life) which influence social relationship preferences. That is, older individuals tend to be more likely to prefer familiar social partners, which may reflect a shift from knowledge-focused goals to emotion-focused goals due to changing perceptions of time horizons. Prior research has shown that age is a good predictor of time perception such that older adults show more limited future time perspectives than younger adults (Lang and Carstensen, 2002). However, life events and experimental manipulations can also reduce time horizons (e.g., Fredrickson and Carstensen, 1990; Fung and Carstensen, 2006) and thus, shifts in motivation and social preferences may occur at any life stage. Overall, SST argues that close social relationships become more, not less, important as people age, which may be driven by motivational changes in goals. At the same time and perhaps because of this, people become more selective about their relationships. They prefer to invest what they perceive to be their limited remaining time in relationships that are most important to them.

Strength and Vulnerability Integration Model

The strength and vulnerability integration (SAVI; Charles, 2010) model, building on the tenets of SST (Carstensen et al., 1999), describes age-related gains and losses that influence the process of emotion regulation in older adulthood. In particular, consistent with SST, the SAVI model addresses the frequent finding that older adults express higher levels of well-being than younger adults. This finding is somewhat counterintuitive in that older adults are known to experience increased susceptibility to the negative consequences of high emotional arousal, such as from conflict and misunderstandings stemming from social relations. To protect themselves from this vulnerability, older adults are theorized to use strategies that allow them to avoid and/or disengage from emotionally laden situations and do so to a much greater extent than younger adults. Indeed, prior research has shown that older adults tend to endorse more passive emotion regulation strategies compared with younger adults (Blanchard-Fields, 2007) which may have more benefits for health and well-being in later life. For example, in a daily diary study of U.S. adults, older age was associated with less affect reactivity to interpersonal stressors when individuals *avoided an argument* whereas older age was unrelated to affect reactivity when individuals engagement in arguments (Charles et al., 2009). This strategy, of avoiding negative social situations, serves to protect the older individual from their known heightened sensitivity to stress and may explain, at least in part, the observed age-related benefits in well-being achieved by avoiding negative social situations. This interpretation was further supported in a cross-sectional study in which younger and older adults were presented with audiotapes of two actors insulting another person in which they were instructed to imagine that the negative comments were directed at them (Charles and Carstensen, 2008). In response to these imagined insults, older adults made fewer cognitive appraisals about the speakers, expressed less negativity and less anger, but equivalent levels of sadness compared with younger adults in response to the overheard insults (Charles and Carstensen, 2008). These findings may indicate that older adults protect themselves by shifting attention away from and disengaging from averse social situations, thus dampening negative responses.

In another form of self protection from vulnerabilities and consistent with SST, SAVI theorizes that older adults maintain social relationships with close others while pruning more peripheral social partners (English and Carstensen, 2014). This occurs in order

to help maintain important, emotionally meaningful relationships and helps to maximize emotional well-being (see review, Rook and Charles, 2017). These changes in social partner selection are another form of self protection, driven not only by perceptions of time left (i.e., SST), but also by accrued knowledge and experience (Charles, 2010). The amount of time lived may be an important indicator of social expertise (Luong et al., 2011) such that older adults may have more experience dealing with everyday life which allows them to be selective and increase efficiency at dealing with and avoiding potential stressors (Charles, 2010).

SAVI further expands on SST by highlighting not only age-related gains (i.e., strengths), but also age-related losses (i.e., vulnerabilities). Specifically, older adults experience decreases in the body's ability to downregulate strong negative emotional responses that may have consequences for emotional and physical health outcomes (Charles, 2010). Increased difficulty at downregulating sustained emotional arousal and reactivity in older adulthood may, in turn, attenuate age-related improvements in emotion regulation when faced with unavoidable stressors (Charles, 2010). While many long-term social ties are positive, some are not. Negative close social relations often cannot be avoided and may be a source of strain and ambivalence. Thus, when older adults are unable to avoid situations that cause high levels of distress, such as conflicts or misunderstandings in social relationships, they are likely to experience arousal that may challenge their health and quality of life (Rook and Charles, 2017). For example, in a classic finding Rook (1984) found that negative relations had a more powerful effect on well-being than positive relations. In a related longitudinal study of British adults aged 40 to 77, negative social interactions were more strongly associated with physical health with older age (Hakulinen et al., 2016).

Overall, the SAVI model builds on the foundation of SST, further highlighting the age-related gains and losses associated with maintaining emotional well-being. Notably, the SAVI model posits that older adults actively down regulate emotional stress, avoid high arousal circumstances and/or limit their reaction to those circumstances whenever possible. This approach offsets the increased vulnerability of older people to stress and its negative effects on health and well-being. These strengths and vulnerabilities, in turn, may influence the selection of social network members (i.e., social pruning) as well as how individuals choose to interact during social contexts (i.e., avoiding interpersonal stressors/conflicts).

Summary: Integrating and Applying Social Relations Theories

Each of these theories are lifespan in nature and offer accumulating evidence concerning individual and specific important insights concerning the *who*, *what*, *why*, and *how* of social relations. The convoy model of social relations offers an overarching, inclusive theory meant to identify specific aspects of social relations (i.e., structure, support and satisfaction) while also detailing *what* and *how* personal and situational characteristics influence the individual's needs for specific aspects of social relations. All antecedent elements of the model influence consequences for the individual in terms of health and well-being outcomes. On the other hand, socioemotional selectivity theory focuses on *what* motivates individuals to seek and invest in relationships, and specifically what influences exactly the types of relationships in which people will invest (e.g., new vs. old, close vs. distant). SST argues that people are motivated by goals which are affected by circumstances (e.g., time, place and context). This, in turn, influences the choices people make about with whom they choose to spend their time. Finally, the strength and vulnerability integration model drills down even further the *how* and *why* of social relationships. Specifically, SAVI examines the strategies people, especially older adults, use to avoid extremes of emotions and maintain emotional regulation. This is accomplished by maximizing the positive and minimizing the negative in their relationships (i.e., *how*) thus avoiding emotion regulation problems often caused by and associated with the stress and strain of difficult relationships and/or circumstances (i.e., *why*).

Each theory offers guidance about specific aspects of social relations. Some theories motivate specific research questions whereas others guide the interpretation of research findings. While the convoy model provides a heuristic framework within which to understand the causes and consequences of social relations over the life course, SST focuses on the individual's time perspective and what motivates social interactions while the SAVI model specifies a common strategy among older adults used to maintain high levels of well-being through emotion regulation and avoidance of conflict. In the paragraphs below we use these theories to interpret findings that address common dimensions of social relations, relationship types, and means of communication. Finally, we end with a consideration of clinical applications and future recommendations.

Differing Dimensions Based on Social Relations

The extent to which people engage with, and receive benefits from, their social relations is influenced by structural, functional, and qualitative aspects of their relationships (Holt-Lundstad, 2018). Structural aspects refer to the objective components of the network that are directly observable, such as total network size, age of, gender, relationship to and frequency of contact with network members. Supportive or functional aspects of social relations refer to the exchange of aid (e.g., tangible goods, instrumental support), affect (e.g., emotional support, affection), and affirmation (e.g., confirmation of values; informational support). On a more evaluative level, qualitative aspects of social relations are those pertaining to one's subjective experiences of interactions with others in their social networks such as satisfaction, enjoyment, strain or conflict with their relationships. One example of the distinction between structural and qualitative aspects of social relations can be found in the growing literature on social isolation versus loneliness (Cacioppo and Hawkley, 2009). Social isolation refers to the lack of network members and the lack of support exchanges and corresponds to the objective, structural and functional aspects of not receiving support. In contrast, loneliness refers to the distress experienced or the individual's personal assessment that they are not sufficiently supported by others. That evaluation

of a lack of support results in low levels of satisfaction which corresponds to a low evaluation of the quality of their relationships. It should be noted that quality of relationship is a subjective evaluation in that two people with the same support exchanges might evaluate those support exchanges differently, which would then have different effects on health outcomes (van Tilburg et al., 1998).

Greater specificity of structural, functional, and qualitative aspects of social relations has significantly contributed to a better understanding of how social relations influence health in older adulthood. The following sections explicates specific ways in which structural, functional, and qualitative aspects of social relations distinctly contribute to health-related outcomes. In this section, we frequently highlight cognitive health as illustrative both because of its overall importance and link to Alzheimer's disease and because significant advances have recently been made demonstrating the association between social relations and cognitive functioning in numerous populations around the world.

Structural Aspects of Social Relations

Social network size is a commonly used indicator of network structure which has been shown to be related to physical (i.e., mortality; Berkman and Syme, 1979; Kauppi et al., 2018) and cognitive health (Barnes et al., 2004; Bennett et al., 2006) outcomes in older adulthood. For instance, in a clinicopathologic study examining social network size, cognitive functioning and brain pathology at autopsy, individuals with a larger social network showed attenuated associations between brain pathology and cognitive functioning. In other words, even when individuals had more severe levels of brain pathology, cognitive function remained high for participants with larger social networks whereas individuals with a smaller social network showed lower cognitive function at higher levels of brain pathology (Bennett et al., 2006). These findings suggest that social network size may be a source of cognitive reserve and may contribute to the maintenance of cognition, in spite of neuropathology.

Additionally, a cross-sectional investigation of the role of network size on cognition using a cohort of U.S. older adults by Katz and colleagues (Katz et al., 2020) found that social network size was significantly related to executive functioning but this association varied by race and ethnicity. They reported that the strongest associations existed between executive functioning and quadratic estimates of the number of close children of non-Hispanic Black participants, and number of close family members for Hispanic participants. On the other hand, among Black participants, a curvilinear relationship indicated that less than or more than two close children was associated with lower executive functioning. This was not the case for Hispanic participants, among whom higher executive functioning was associated with fewer (0–1) and greater (4–5+) numbers of family member contacts.

Prior research has also shown the potential benefits of contact frequency for health and quality of life. A recent study by Grant and colleagues (Grant et al., 2009) who followed a sample of middle aged adults in Britain, showed that people reporting less contact with network members had higher salivary cortisol upon waking and throughout the day, compared with those in more frequent contact with their network members. These findings suggest that less frequent contact with network members, which could be an indication of social isolation, negatively affects the stress response of the body. As is perhaps evident, this has important implications for other health outcomes. Indeed, less contact frequency has been associated with higher mortality (Berkman and Syme, 1979). As reviewed in more detail later, this biochemical response to social isolation may be one way by which contact frequency contributes to physical health. In a related longitudinal study of American adults by Seeman and colleagues, higher frequency of contact was associated with better executive functioning and better memory while decreases in contact frequency over two time points was associated with worse memory (Seeman et al., 2011). This study was unique in that it began to specify exactly what dimensions of cognitive functioning are influenced by contact frequency. Similarly, Zahodne and colleagues (Zahodne et al., 2019a), using longitudinal data from a U.S. nationally representative sample of older adults, found that more contact was associated with better memory at baseline and slower memory decline over 6 years. On the other hand, social network size was not associated with memory trajectories (Zahodne et al., 2019a). These findings suggest that it is the stimulation of social contact rather than the number of social ties which positively affects cognitive functioning among older people. These authors also examined the reverse, to see whether memory was associated with changes in social contact over the same span of time. It is noteworthy that they report no association between memory and change in contact frequency (Zahodne et al., 2019a), indicating that it is the loss of social relations that is detrimental to cognitive health, rather than declines in cognitive health leading to more isolation.

Another important structural characteristic of social relations can be measured by the number of social activities in which an individual engages. Number of social activities and/or groups represent a form of structural ties. These appear to be beneficial to cognitive health as they help increase the number of weak ties (i.e., peripheral social ties such as neighbors, acquaintances, etc.) in the social network. These activities seem to promote health through the requirement of active contingent interaction and allocation of resources through the exchange of support (i.e., see in-depth discussion regarding the strength of weak ties in the next section). Social activities are those that involve actively interacting with others, such as playing cards, going to church, or playing a competitive sport, and these activities may have implications for health in older age. Prior research has found that social activity was associated with less disability at baseline and slower decline in function over 9 years (Mendes de Leon et al., 2003). Similarly, in another study, Barnes and colleagues (Barnes et al., 2004) reported that more frequent social activity was associated with baseline global cognitive function and slower decline in global cognition over time, independent of network size. Furthermore, the number of different types of social groups with which one engages may also be beneficial for health given that number of social groups is associated with increased network size (Hawkley et al., 2008).

The above examples and prior research have shown promising links between structural aspects of social relations and health outcomes. It is important to note, however, that these various structural aspects of social relations work in tandem with other aspects of social relations. Just as there are structural aspects of social relations, functional support or the exchange of support as well as

qualitative aspects of social relations are important components of social relations that merit further discussion. These functional and qualitative aspects of support may also be independently associated with health.

Functional Aspects of Social Relations

Functional or social support refers to the actual support that is exchanged and can be subcategorized by whether the support provided included practical aid (e.g., instrumental/tangible support), affect (e.g., emotional/affectional needs) and/or affirmation (e.g., verification of values) (Kahn and Antonucci, 1980; Krause, 1987). Social support has been shown to be associated with a wide variety of physical and mental health outcomes. For example, an Irish longitudinal study of older adults found a negative association between social support and depressive symptoms. Of note, this pattern of findings varied across men and women, with higher levels of spousal support and less strain from one's spouse as well as better social network integration being protective against depressive symptoms only in men (Santini et al., 2016). Further, there were no associations between support and anxiety for either men or women, suggesting that functional aspects are more impactful for mood compared to anxiety (Santini et al., 2016). Another longitudinal study similarly found that baseline social support and change in social support over 3 years were both related to depressive symptoms in that more support was related to fewer depressive symptoms, but loss of support was related to more depressive symptoms (Oxman et al., 1992). In regards to cognitive health, in a longitudinal study of American older adults, no associations between baseline social support and change in cognitive function was found; however, the authors did find an association between satisfaction with social support (i.e., quality) and global cognitive function and processing speed/attention at baseline (Hughes et al., 2008).

Social support may also facilitate increased physical activity in older adults, which may be another way of promoting health and well-being over time. For instance, in a study of South Korean older adults, social support was related to increased physical activity (Kang et al., 2018). This increase may be due to the increased accountability and companionship that comes with joint physical activity, which can help older adults be more motivated to adhere to fitness regimens and other healthy behaviors to promote overall quality of life. Examining an outcome such as physical activity engagement may be an area where the type of support given and received can be further disentangled as the reciprocal benefits of support given and support received may have mutually beneficial health outcomes.

It is important to note, however, that individuals can both *receive and provide* social support to network members and these may have distinct effects on health in later life. For example, in a study by Thomas (2010), when simultaneously modeling support received, support given, and other aspects of social relations, the authors found that psychological well-being was positively associated with support given, while support received was not associated with psychological well-being. These findings suggest that when considering indicators of psychological health, it may be more important to consider the effects of support, both given and received, in order to identify more salient effects of social relations on mental health outcomes. To this point, a study by LaFleur and Salthouse (2017) found that *providing* both informational and emotional support were beneficial for memory. A similar pattern of findings has also been demonstrated internationally. Specifically, in a longitudinal study examining older adults in southwestern France, independent of other indicators of social relations such as network size, receiving more support than giving support was associated with lower odds of dementia incidence (Amieva et al., 2010). Of note, another longitudinal study of American older adults found that emotional support received was independently associated with change in overall, better cognitive performance after accounting for other indicators of social relations, including perceptions of support *given* by the participant (Seeman et al., 2001). In this same study, authors found that the effect of support *given* as indicated by a measure asking about frequency of instrumental and emotional support given, was not associated with cognition at baseline or change in cognition over two times points. Combined, these studies highlight the importance of the type of functional support exchange to improve health, and that the effect of giving support may not be equally associated with positive health outcomes as support received in similar types of support exchanges.

Qualitative Aspects of Social Relations

The quality of one's social relations may have a unique effect on later life health outcomes. Social strain, a distinct *negative* qualitative aspect of social relations, can be described as the degree of interpersonal conflict and/or obligatory interactions (i.e., family obligations), that results in the person perceiving increased dissatisfaction and distress from these interactions (Yang et al., 2014). Prior research has linked social strain in older adulthood to health-related outcomes. For example, in the study mentioned above by Antonucci and colleagues (Antonucci et al., 2010) investigating the links between social strain and health, under conditions of serious illness, the strength of positive and negative interactions with network members was associated with mortality in a somewhat counterintuitive manner. Stronger negative interactions were related to lower mortality as were weaker positive interactions. On the other hand, a study of Danish middle aged adults, always or often experiencing social strain had higher risk of mortality compared with those who reported seldom experiencing these strains (Lund et al., 2014). In a longitudinal study, Seeman and colleagues (Seeman et al., 2011) investigated a cohort of American older adults and found that more social strain was independently associated with worse executive function while accounting for other social relations. Of note, these authors did not find measures of quality of social relations to be related to change in cognitive function over time (Seeman et al., 2011). Recall that in the longitudinal study of Irish older adults mentioned above examining associations of social strain with depressive and anxiety symptoms, a positive association between social strain and depressive symptoms but no association between strain and anxiety was

found (Santini et al., 2016). Together these studies suggest that while strain may have overtly negative health consequences, there may be aspects of interacting with others that may be protective, indicating that further study into the mechanisms underlying the association between social strain and health is warranted.

Because of the ways that social strain affects mental health, physical health, and cognitive health, studies have also found that qualitative aspects of social relations are associated with increases in similar biochemical processes in the body. In a study examining social strain and risk of elevated inflammation using a composite of five indicators of inflammation (C-reactive protein, fibrinogen, interleukin-6, E-selectin, intracellular adhesion molecule 1), social strain was independently associated with increased risk for elevated inflammation (Yang et al., 2014). Further, the effect of social strain was stronger than the effect of social support, confirming Rook's (1984) finding and suggesting that the presence of social strain may be more detrimental to health than the absence of social support (Yang et al., 2014). These findings provide some insight by which social strain can affect physical and mental health outcomes.

As the convoy model suggests, both personal and situational characteristics influence the structure, function and quality of life. One manifestation of the situation is culture, which can fundamentally influence expectations and evaluations of social relations. What may be seen as social support in some cultures, may be perceived as social strain or conflict in others. Their detrimental effects may then depend on the cultural norms as well as how closely individuals identify with a particular culture and adhere to its norms. As an example, collectivistic cultures may view responsibility of family members, particularly responsibility to older adults, to be important in family relations. A qualitative study by Willis (2012) explored this topic in a study on caregiving of older adults in Britain around ethnic identity and duty to elders in examining the effects of collectivistic cultures. Those who identified with their ethnic group membership, and whose ethnic group valued service and support of elders as one behavioral indicator of collectivistic culture, were more likely to indicate agreement that younger generations should take care of their elders. In this study of largely ethnic minorities, minorities of south Asian descent and white Irish immigrants endorsed beliefs consistent with collectivistic ideals of taking care of elders, while white British older adults did not endorse these beliefs (Willis, 2012). An international comparison of perceived filial piety (i.e., responsibility for elders) in five European countries, Germany, Israel, Norway, Spain, the United Kingdom and the United States similarly found that sense of filial piety depended on the collectivist versus individualist orientation of the European country and, in the case of the United States, the ethnic/racial background of the respondents (Jackson et al., 2008). Although perception of obligation regarding elder care may be either individually or culturally based, an elder who perceives a younger person as not adhering to those elder care norms may experience their relationship as strained when these expectations are not met.

Loneliness as an Illustrative Example of Quality

Quality of relationship, as noted above, refers to the individual's evaluation of their social relationships. Thus, people with the exact same amount of exchanges (functional support) and number of relationships (structure of social network) can feel differently about the quality of their relationships. One might feel their relationships are perfectly adequate, another might feel dissatisfied with the same relations and, instead of being content with them, feel quite lonely. Thus, loneliness is differentiated from structural network characteristics, such as social isolation, and functional characteristics such as support received, in that it is the individual's evaluation of satisfaction with their social relations that affects health and emphasizes the person's negative emotional reaction to their dissatisfaction with the quality of their social relations.

Loneliness, in particular, may be a salient example of the importance of investigating quality of social relations. Increased loneliness in older age has been linked to a number of mental health, physical health, and cognitive outcomes. For example, more loneliness is associated with increased depressive symptoms over time (Cacioppo et al., 2010). Loneliness has also been associated with poorer physical health, as indicated by increased physical disability (Shankar et al., 2017), hypertension (Hawkley et al., 2010), and increased mortality (Patterson and Veenstra, 2010). Furthermore, individuals who reported often feeling lonely had a higher risk of mortality due to non-ischemic cardiovascular diseases, compared with those who reported never feeling lonely, when accounting for other aspects of social relations (Patterson and Veenstra, 2010). The odds of non-ischemic cardiovascular mortality were higher than all-cause mortality, suggesting that loneliness's impact on cardiovascular health may be a leading cause of death (Patterson and Veenstra, 2010). Indeed, other studies have examined loneliness and cardiometabolic disease and demonstrated that increased risk of metabolic syndrome (e.g., waist circumference, triglycerides, high density lipoprotein cholesterol, blood pressure, and fasting glucose; Whisman, 2010) is associated with higher amounts of loneliness.

Loneliness may also impact cognitive health in older adulthood. While one cross-sectional study with an American sample of racially and ethnically diverse older adults did not find an association between a comprehensive measure of loneliness and episodic memory when accounting for structural aspects of social relations and other psychosocial factors (Sol et al. under revision), another cross-sectional study with an Irish sample did find an independent association between loneliness and global cognition, processing speed, and visual memory when accounting for social network integration (O'Luanaigh et al., 2012). In a recent longitudinal study of social activities among Chinese older adults, an independent association emerged between loneliness and global cognitive decline over 9 years, among those engaging in more frequent social activities (Zhong et al., 2017). Loneliness has also been associated with increased inflammation, important as inflammation is often associated with all of the aforementioned health outcomes (Kiecolt-Glaser et al., 2010), including cognitive function (Zahodne et al., 2019b). Increased inflammation is one of the mechanisms proposed by Hawkley and Capitanio (2015), as to how loneliness affects health. Thus, further study of the biochemical mechanisms between loneliness and various health outcomes may also provide insight into ways to reduce its detrimental effects in older age. Additional specification is suggested in a recent study by Kang and colleagues (Kang et al., 2018) who found that while physical

activity did not mediate the relationship between social support and quality of life, the positive relationship between social support and quality of life was mediated through a negative relationship with loneliness. These findings show how other aspects of social relations (i.e., functional exchanges/ support) can affect health outcomes through qualitative factors (i.e., loneliness). Furthermore, when modeling both social isolation and loneliness concurrently, their relative impact may depend on the outcome studied, as social isolation may be related to increased likelihood of poorer self reported health, while increased loneliness may be related to increased likelihood of poorer mental health (Coyle and Dugan, 2012). Taken together, these studies highlight the complexity of various aspects of social relations and loneliness and how they each contribute to overall health.

As loneliness may be a potential risk factor for health and quality of life in older adulthood, understanding the antecedents of loneliness may be an important area for future intervention. Several factors may contribute to the experience of loneliness. Previous experiences of loneliness may be one predictor which leads to a cyclical pattern of behaviors which results in additional feelings of loneliness over time (Cacioppo and Hawkley, 2009). Personality influences social relationships and these relatively fixed characteristics may contribute to the cycle of loneliness, particularly characteristics indicating neuroticism (Buecker et al., 2020). Nonetheless, other research has found that levels of neuroticism decrease over the life course (Ormel et al., 2012), which is promising as older adults who experience elevated levels of neuroticism earlier in the life course may be able to seek and maintain the relationships they desire in order to reduce loneliness.

Summary: Support Structure, Function and Quality

Taken together, these concepts and the related studies show the importance of examining not only the structural aspects of social relations but also the exchange of support and the subjective or evaluative aspects of social relations. Consistent with the tenets of the social convoy model, this evidence helps identify why structural aspects of social relations are important given its emphasis on the observable aspects of social networks and the ways in which these observable aspects influence health over the life course. In addition, this evidence helps identify why structural characteristics such as network size and frequency of contact contribute to health because the presence of others and contact with them is essential to developing the relationships critical to health. Further, an examination of the distinct dimensions of social relations helps identify ways in which the qualitative aspects of relationships helps to motivate reasons for maintaining contact in older age in order to better invest limited time with more meaningful relationships, as proposed by and consistent with socioemotional selectivity theory. Similarly, the links between higher quality social relations and health outcomes supports the tenets proposed by the SAVI model, which suggest that maintaining contact with desired others and pruning unwanted relationships reinforce positive emotional experiences with desired others. These motivations to protect limited time (i.e., SST) and to increase positive emotional experiences (i.e., SAVI) can be in the form of both support/functional exchanges as well as perceived relationship quality.

Given that none of these aspects of social relations exists in isolation nor are easily separable, future work can further refine understanding on the ways in which structural, functional, and evaluative aspects of social support may improve overall health. Understanding the nuances underlying social relations may also help improve interventions that target improving structural, functional support exchanges, and qualitative aspects of social relations in order to better meet and resolve older adults' specific needs in social relations. Further, structural and functional aspects of social relations such as social isolation and support exchanges, as well as qualitative aspects such as loneliness, are specific ways in which social relations affect health. Examining these various components of social relations together may help improve future study into ways to increase the beneficial aspects of social relations while reducing those characteristics of social relations that negatively affect health in older adulthood.

Differentiation Based on Relationship Type

As we seek to understand the association between social relations and health, it has become clear that specific social relationships may provide unique forms of interaction and support. In the following sections, we highlight the characteristics and importance of several types of social relations and their unique impact on later life health. We highlight (1) the importance of early-life social relationships with parents and peers, (2) the importance and distinctions between friends and family, and (3) the role of weaker social ties such as fellow church members and neighbors in older adulthood.

The Importance of Early Life Social Relationships for Later Life Health Outcomes

Prior research focusing on social relationships in later life as well as a majority of the research covered in this chapter predominantly focus on the associations between current social relationships and health outcomes in older adulthood. It should be acknowledged, however, that social relationships grow and develop across the lifespan. Specifically, social relationships in childhood play a critical role in developmental processes that have been shown to have far reaching effects on social, mental, physical and cognitive health in adulthood. As theorized in attachment theory and the social convoy model, social relationships build from previous social experiences (Antonucci et al., 2014; Bowlby, 1980). Specifically, attachment theory argues that children develop internal working models of attachment (i.e., a representation of one's self and of relationships in general) that will guide expectations and behaviors exhibited in future social relationships (see chapter, Siegler et al., 2011). Indeed, prior research examining attachment of white middle-class infants at 12 months old showed that a majority of the infants (72%) received the same secure/insecure attachment

classification in early adulthood (Waters et al., 2000). Therefore, early life relationships with parents and important others may have far reaching effects on health and quality of life through late life current social relationships. Further, prior research also suggests that early life social relationships may influence health more directly through the development of physiological stress response (Luecken and Lemery, 2004). That is, children who have poorer quality relationships with parents may be hypervigilant to threat cues in their environments, may exhibit poor self-regulatory responses (i.e., maladaptive coping strategies) and elevated physiological stress responses (see reviews; Luecken et al., 2006; Luecken and Lemery, 2004).

In line with this notion, prior research has linked parental social relationships to a variety of health outcomes later in life. For example, in a cross-sectional study of U.S. adults examining the associations between retrospective childhood social support and allostatic load measured by a sum of risk scores across 7 physiological systems, higher social support in childhood (emotional and instrumental) was associated with less biological dysregulation in midlife (Slopen et al., 2016). Consistent with these cross-sectional findings, a longitudinal study of Harvard undergraduate men found that lower ratings of parental caring in young adulthood was associated with greater risk of illnesses such as coronary artery disease, hypertension, duodenal ulcer, and alcoholism 35 years later (Russek and Schwartz, 1997). An examination of the influence of early parental relationship quality on cognitive health outcomes by Sharifian and colleagues (Sharifian et al., 2019) revealed that respondents from a nationally representative U.S. sample of older adults who reported higher retrospective maternal relationship quality showed less decline in episodic memory over time through reduced loneliness and depressive symptoms. Similarly, in a population-based longitudinal study of non-Hispanic African American and White adults, greater retrospective childhood social support was associated with better initial memory through educational attainment and mental (stress) and physical (BMI) health pathways (Zahodne et al., 2019c). These findings highlight the enduring effects of early life social relationships on health-related outcomes directly and indirectly through multiple bio-psychosocial pathways.

In addition to parental relationships, peer relationships in childhood and adolescence may also have long-term implications for health. Peer relationships become especially salient as individuals begin to spend more time with age peers in adolescence and begin to value expectations of peers more highly (see chapter, Brown and Larson, 2009). Social acceptance by peers has previously been identified as a reliable indicator of socioemotional and behavior adjustment outcomes and are thought to have long-term ramifications for developmental processes over the life course. For example, in a 27-year prospective Swedish cohort study, peer problems at age 16, defined by perceived degree of unpopularity and social isolation at school, were linked to greater risk of metabolic syndrome at age 43 (Gustafsson et al., 2012). This finding was robust after accounting for health behaviors, school adjustment and family circumstances in adolescence as well as psychological distress, health behaviors and social circumstances in adulthood (Gustafsson et al., 2012). Peer bullying specifically has also been associated with a variety of health-related later outcomes. For example, in a longitudinal study following American children into young adulthood, being a victim of bullying as well as being a bully-victim (i.e., someone who is bullied and is also a bully) was associated with increased risk of poorer health, socioeconomic and social-relationship outcomes in adulthood (Wolke et al., 2013). Consistent with the previous study, in a 50-year prospective follow-up of a British birth cohort, bullying victimization in childhood (ages 7 and 11) was associated with worse mental, physical, and cognitive health outcomes in midlife (Takizawa et al., 2014). Findings specific to adult social relationships indicate that bullying in childhood was associated with weaker social relationships in adulthood (Takizawa et al., 2014) and support the hypothesis that later-life social relationships are based on and develop from earlier relationships such as interactions with adolescent peers.

These findings are consistent with the social convoy model and attachment theory, suggesting that parental relationships in childhood and peer relationships in adolescence may act as building blocks for developmental processes in later life. Specifically, early life social relationships may influence current and later life health outcomes (i.e., mental, physical, cognitive) through the early development of internal working models of attachment. These early life social relationships may also influence health outcomes through their impact on threat appraisal, self-regulatory and physiological responses to stress (Luecken et al., 2006; Luecken and Lemery, 2004). Additionally, although not discussed in detail in the current chapter, early life social relationships with parents have been linked to self-regulatory behaviors in childhood (Eisenberg et al., 1999) and in early adulthood (Baker and Hoerger, 2012). Thus, children and adolescents who develop appropriate self-regulatory skills in childhood are likely to show better regulation skills later on in life. This may be an important individual difference that influences emotion regulation strategy selection and efficiency in order to avoid age-related vulnerabilities to high arousal situations (i.e., conflicts, misunderstanding) as conceptualized within the SAVI model. In light of the above summarized findings, we conclude that it is important to consider not only current characteristics of social relations in older adulthood, but also significant social relationships at pivotal developmental periods.

Distinctions Between Family and Friendships in Later Life

An ongoing issue in the field of social relations is the relative importance of family and friends as well as their association with health and well-being, especially in later life. When prior research has compared the distinct effect of friends and family, friendships are often shown to more strongly benefit later life health and quality of life. For example, in a cross-sectional study across 97 countries, valuing both family and friendship relationships was associated with better health and higher happiness, however, valuing friends became a stronger predictor of health and happiness at older ages (Study 1, Chopik, 2017). In a longitudinal follow-up study of U.S. older adults, friendship strain was associated with more chronic illness over time. At the same time, support and strain from spouse, children and friends predicted subjective well-being whereas other family relationships (i.e., relatives other than spouse and children) were not associated with health or well-being (Study 2, Chopik, 2017). Similar patterns were also evidenced in studies

examining cognitive health outcomes. For example, in a cross-sectional study of Chinese nonagenarians and centenarians, the number of friends and being married, but not the number of children or ties with neighbors, were associated with better cognitive health (Wang et al., 2015). Finally, in a recent longitudinal nationally representative study of U.S. older adults, more frequent contact with friends, but not family, was associated with less decline in memory over time (Zahodne et al., 2019a).

These converging findings may reflect the distinct features of friendships versus familial ties. Friendships can be seen as more voluntary in nature. As individuals actively select their friends, friendships may provide different resources compared with family ties that help to promote health and quality of life. For instance, friendships are often reported as a greater source of companionship in later life, especially in comparison to family ties (Crohan and Antonucci, 1989; Quan-Haase et al., 2017). They may, therefore, influence later life health through shared activities and mutual interests. Indeed, prior empirical research has shown activity engagement to mediate the association between friendships and health. For example, in a cross-sectional study of Swiss older adults, higher engagement in leisure activities mediated the association between a higher number of close friends and higher cognitive functioning (Ihle et al., 2018). Similarly, evidence from a longitudinal study of U.S. adults showed that higher contact frequency with friends, but not family, was associated with higher engagement in cognitive and physical activities, both of which were associated with higher episodic memory and executive functioning (Sharifian et al., 2020). This pattern of findings has also been demonstrated when examining socioemotional outcomes. For example, in a nationally representative longitudinal study of Germans, informal social activities with friends were associated with better subjective well-being (i.e., higher positive affect, lower negative affect, and higher life satisfaction) in older adults. In contrast, informal social activities with family were only associated with an increase in positive affect and an *increase* in negative affect in older adults (Huxhold et al., 2014). Using experience sampling, a study of older Canadian adults found that when older adults reported being in the company of friends, they also reported more positive subjective well-being compared with when they were with family (Larson et al., 1986). This finding may be partly attributable to the types of activities individuals engage in with friends versus family. Specifically, when with family members, older adults reported higher engagement in maintenance activities (i.e., housework) and passive leisure activities (i.e., watching television). In contrast, when with friends, older adults reported higher engagement in more active leisure activities such as hobbies, religious/cultural engagement, and sports (Larson et al., 1986). These findings are also consistent with the notion that friendships bolster activity engagement.

Family ties, in contrast to friendships, may be viewed as more obligatory in nature. Family ties are more permanent relationships with less autonomy at selection (Dono et al., 1979) and are sometimes seen as a burden (Crohan and Antonucci, 1989; Quan-Haase et al., 2017). Despite friendships often being viewed as a better source of companionship, family ties may be a better source of long-term social support which is critical to maintaining one's quality of life in older adulthood. Illustratively, a cross-sectional study of older adults found that family members were identified as greater sources of social support (instrumental and emotional) and social control (i.e., efforts to promote healthy and deter risky health behaviors), whereas friends were identified as greater sources of companionship (Rook and Ituarte, 1999). In another cross-sectional study, older adults' expectations for assistance (i.e., services and resources) from family exceed expectations from both close and casual friends. Older adults were more likely to endorse expectations that family should help with tasks such as providing shelter, money, unsolicited advice or put themselves at risk for the older adult (Mancini and Simon, 1984). Of note, reported expectations of family and close friends for intimacy (i.e., feelings and emotions) and social integration (i.e., shared experiences, companionship) were similar (Mancini and Simon, 1984). Examining a group of older women hospitalized for congestive heart failure in the past year, Friedman (1993) found that women who reported emotional support from family and women who reported emotional support from both family and nonfamily (i.e., friends/neighbors) had higher positive affect than those who reported support only from nonfamily (Friedman, 1993). Similarly, women who reported tangible support from family and women who reported tangible support from both family and nonfamily had greater life satisfaction than those who reported only tangible support from nonfamily (Friedman, 1993). Consistent with Cantor's (1979) hierarchy of support, Friedman suggested that older women who are ill may feel more satisfied with tangible assistance that comes from family, as it aligns with their expectations and norms (i.e., more appropriate to receive this type of help from family rather than nonfamily). Family ties may provide more long-term assistance and support to help older adults that may not be seen as appropriate for non-family ties to provide. Antonucci (2001) suggested that people develop a support bank, an informal accounting of what is given and what is received over time from individuals specifically and more generally. It may be that the long-term nature of family relationships means that older people feel that they are more entitled to support from family members as they are more likely to have provided support to these same or related individuals in the past. This is consistent with findings indicating that older adults report that major support services such as caretaking are more commonly expected of family relationships relative to other types of social relationships (Quan-Haase et al., 2017), and family members represent more appropriate social ties to help with more long-term issues (Cantor, 1979).

In sum, the importance of both family and friends relationships across the lifespan for health and quality of life is clear. Less clear, however, is the *relative* importance of friends versus family (i.e., which is more important?). From a developmental and clinical scientist perspective, it seems most likely that both are important and play different roles, especially in late life. Much as mother-infant attachment provides the secure base from which infants discover and explore the world, it appears that close family relations provide a secure base for adults as indicated by the fact that they are known to be a comforting source of instrumental as well as emotional support. With regard to peer relations, it appears that older people are more likely to turn to friends for companionship and leisure activities.

Both types of relationships contribute in important and significant ways to health and quality of life. With age and a more limited future time perspective, SST would predict that people spend more time with close family and begin to limit interactions

with friends. The nature of families and the availability of friendships are idiosyncratic and thus likely to vary depending on specific circumstances. Overall, family relationships and friendships occur in very different contexts (i.e., friends outside the home, family within the home, etc.) and situations (i.e., for leisure, during health crises, etc.) and may therefore influence later life health through different pathways.

The Strength of Weak Ties

Although close social relationships with friends and family are important for successful aging, other more peripheral social ties, such as those with fellow church members, neighbors and acquaintances, may also provide beneficial resources in later life. The strength of weak ties as proposed by Granovetter (1973) posits that weak ties may provide unique forms of support in times of need. Specifically, weak ties can link individuals to resources to which they might not normally have access and may also provide contrasting views and information not available from strong ties (Granovetter, 1983). Weak ties may also provide unique types of support that only geographic proximity and shared communities can, such as a neighbor having a spare set of house keys (Dono et al., 1979). Indeed, in a longitudinal study following U.S. adults over a 23-year period, although close and weaker ties were both associated with a reduction in depressed affect, the number of weaker social ties was more strongly associated with maintaining a low level of depressed affect over time than the number of close social ties. Weaker ties were also more strongly associated with maintaining positive affect over time compared with close ties (Huxhold et al., 2020). Although prior research suggests that older adults reduce the number of peripheral social ties (SST & SAVI), the convoy model outlines different personal and situational characteristics predicting the types of social ties an individual needs. Weak ties are likely useful under those personal and situational circumstances that indicate needs not readily met by stronger social ties. While other forms of weak-ties exist, we specifically highlight two that may be particularly relevant for older adults as illustrative examples: church-related ties and neighbors.

Church-Related Ties

Religious involvement may be an avenue by which the strength of weak ties has a powerful impact on the individual. Prior research has linked religious attendance to physical (Ferraro and Kim, 2014; Krause, 2002) and cognitive health outcomes (Hill et al., 2006; Kraal et al., 2019). For example, in a longitudinal study investigating religious involvement and C-reactive protein (a biomarker for cardiovascular disease risk and progression), higher religious attendance was associated with less increase in C-reactive protein in Black, but not White, older adults (Ferraro and Kim, 2014). Similarly, in a cross-sectional study of White and Black American older adults, individuals who received more church-based social support also reported better health, and these associations were stronger in Black older adult participants (Krause, 2002). An investigation of a third US minority group, Mexican American older adults, found that those who attended church monthly, weekly and more than weekly showed slower rates of global cognitive decline (MMSE) than those who did not attend church (Hill et al., 2006). Similarly, Kraal et al. (2019) found in another longitudinal study of American older adults that higher religious attendance and more private prayer were associated with better concurrent memory functioning, even after accounting for nonreligious social participation. Further, higher religious attendance and private prayer among Black and Hispanic older adults partially reduced the magnitude of racial and ethnic inequalities in memory, which suggests that religious involvement may be an important protective resource for racial and ethnic minorities (Kraal et al., 2019).

Overall, individuals who are part of a church community may reap health benefits through feelings of belongingness or social support from these community members. Further, church members may benefit health outcomes through social control, such that church members encourage healthy behaviors and discourage risky health behaviors. For example, in a cross-sectional study examining older Samoan women who attended churches in Los Angeles county, informal, church-based ties increased the likelihood of utilizing preventive health services, including having a recent mammogram and planning to have a future mammogram (Levy-Storms and Wallace, 2003). Consistently, in a study of Malawi congregations, unmarried adolescents who were frequently exposed to messages about HIV/AIDs prevention within their congregations had higher odds of abstinence (Trinitapoli, 2009). Additionally, married individuals were more likely to be faithful in congregations in which leaders monitored sexual behaviors, and individuals were more likely to use a condom in congregations where leaders privately advised members to do so (Trinitapoli, 2009). In summary, fellow-church members and congregational leaders in one's network may be a distinct source of support and increase feelings of community and may, in turn, influence health-related behaviors that have a beneficial effect on health and quality of life.

Neighbors

Neighborhoods, specifically social relationships with neighbors, may be especially important in later life as older adults spend more time within their homes and communities (Horgas et al., 1998; Spalt et al., 2016) due to social role shifts (i.e., retirement) and changes in health and mobility. Neighborhood social cohesion is often defined as feelings of mutual trust and solidarity among neighbors and the perception that neighbors are willing to do the right thing. Prior research has indeed shown that in a nationally representative sample of American older adults, higher perceived social cohesion was linked to better physical health outcomes (i.e., stroke; Kim et al., 2013), and better cognitive outcomes (i.e., verbal fluency; Zaheed et al., 2019). These findings have been replicated in other populations, including among racial and ethnic minorities. For instance, in a cross-sectional study of South Asian (India, Pakistan, Bangladesh, Nepal, Sri Lanka) adults living in the United States, higher social cohesion was associated with lower prevalence of hypertension in women, but not men (Lagisetty et al., 2016). In another cross-sectional investigation, higher

perceived social cohesion was associated with better global cognition, better episodic memory, and better executive functioning in Chinese older adults living in the United States (Zhang et al., 2019).

Neighbors may be a unique source of informal support that helps to facilitate aging in place and the maintenance of life quality due to their close physical proximity. It has been argued that neighbors may help with short-term instrumental tasks particularly in times of emergency or as health and safety monitors (i.e., signs of an intruder or accident; Dono et al., 1979). Illustratively, older residents of New York City identified neighbors as potential sources of informal social support when family was not available. A majority of the sample reported knowing one or more neighbors well and that these individuals would help each other out for specific tasks. Neighbors tend to help out with short-term and/or emergency related tasks such as assistance with shopping when ill or in inclement weather and are readily available to sit or chat, whereas other more long-term tasks were often left up to family (Cantor, 1979). Similarly, in a qualitative study examining older adults living in a naturally-occurring retirement community (NORC), neighbors were described as being helpful for particular types of tasks, such as cooking, shopping, or transportation, but were thought of as inappropriate for other tasks like financial or personal issues (Greenfield, 2016). Overall, neighbors, although often viewed as weak social ties, provide immediate help and compensate for non-available family members. In addition to providing small, short-term instrumental assistance for older adults they may also provide the opportunity for older adults to reciprocate, thus contributing to a feeling of community belongingness.

Summary: Relationship Types

Available evidence indicates that different relationship types offer distinct benefits for health and quality of life and, as shown in Fig. 2, may operate through several distinct pathways. Specifically, social relations in general may influence health and quality of life by promoting healthy behaviors (i.e., exercise, going to a doctor, etc.), increasing engagement in stimulating activities (i.e., leisure activities, hobbies, etc.), helping to alleviate stress (i.e., emotional and tangible social support), and providing access to novel information and resources. When examining which pathways each relationship type might operate through, prior research suggests that friends may be a greater source of companionship whereas family may be a greater source of long-term social support and care. Further, more peripheral network members also bring about health benefits, for example when neighbors and fellow-church members provide short-term support or access to diverse informational resources. Early-life social relationships, such as those with parents and peers, may influence emotional, physical, and cognitive health outcomes through social functioning. That is, consistent with attachment theory and the convoy model, early-life social relationships may be foundational and influence the development of subsequent social relationships in adulthood (i.e., romantic relationships, friendships, etc.) but may also directly impact health and quality of life through the development of physiological stress response patterns. Still, despite prior research examining the complexities of social relationships and their implications for health and quality of life, further investigation is necessary to fully disentangle these unique associations of each relationship type.

First, future research would benefit from greater attention to life course processes. Informed by the convoy model, social relationships occur across the lifespan, and early life relationships may be foundational for the development of future social relationships. Although retrospective data regarding early life social relationships have been linked to later life outcomes, scarce prospective research has utilized observed mother-child or peer interactions to alleviate concerns about recall bias. Second, future research should focus on the underlying pathways in which social relationships may confer health benefits, specifically with regard to distinctions between friends versus family, in order to clarify intervention targets. Finally, given differences found in specific ethnic and racial minority groups, the need for more representative samples is necessary to assess whether the same pattern of findings is consistently found across sociodemographic groups and cultural contexts. The structure of families and the expectations of friends versus family may differ depending on cultural norms. The distinct pathways that explain the link between relationship type and health outcomes may, therefore, not be universal.

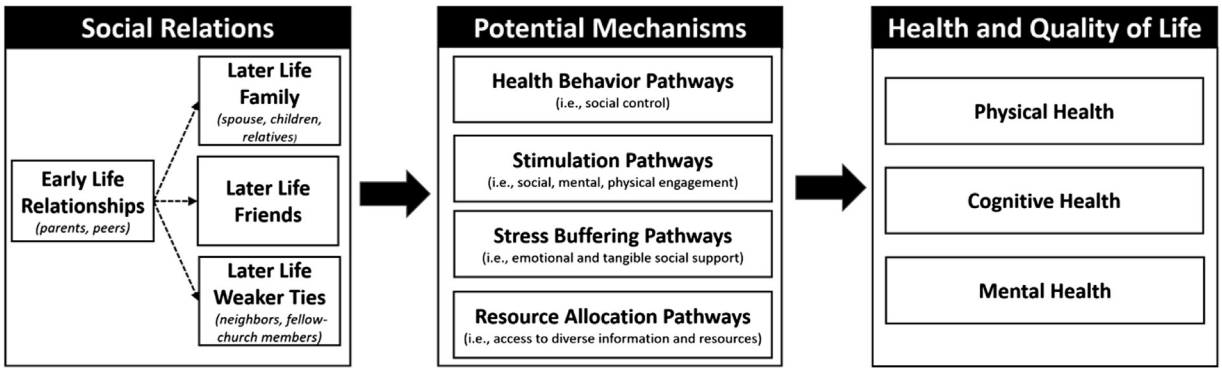

Figure 2 Conceptual Figure of Potential Mechanisms linking Social Relations to Health and Quality of Life.

Means of Communication – Changing Methods of Contact

The role that technology plays in facilitating and shaping social relationships has been steadily increasing. Technologies, such as emailing, texting and social media, are being used to a greater extent to connect with others and seem to be fundamentally changing how we interact. Consistent with this notion, in a U.S. sample of young adults, 3-in-4 individuals reported that mobile devices were either greatly or moderately altering the way they were conducting interpersonal communication with their friends, and a vast majority of the sample reported almost constantly having their devices with them (Pettegrew and Day, 2015). Further, some evidence suggests that younger individuals may prefer to use technology-mediated communication over in-person social interactions (Chung, 2013; Pinchot et al., 2011).

Although studies examining shifts in the ways in which individuals prefer to communicate have been conducted in predominantly younger adult populations, evidence suggests that older generations are increasingly engaging with these technologies as well. Survey research conducted in the United States has shown that the rates of smartphone, internet and social media adoption steadily increased in older adult populations between 2013 and 2017 (Duggan et al., 2015; Pew Research Center, 2017). The Pew Research Center (2017) reported that around 4-in-10 adults aged 65 and older had a smartphone in 2017, which is more than double that of older adults who reported owning a smartphone in 2013. In a qualitative study of older adults in the Toronto (Canada) locality of East York, a majority of participants owned a smartphone, and over half reported engaging with digital media to connect with friends and family. Further, once older adults began using digital media, it became a part of their routine to promote pre-existing relationships, foster companionship, and receive social support (Quan-Haase et al., 2017).

Overall, technology-mediated communication is not only being used by younger generations, but also being adopted by older generations as well. As the impact of offline social relationships on health-related outcomes in later life may vary depending on multiple factors (i.e., relationships source, type of resource, etc.), it is also essential to understand how these shifts in means of communication may influence health and quality of life as individuals age.

The Potential Benefits and Costs of Social Technology Use in Older Adulthood

Research examining social technology in older adult populations is still in its infancy, with scarce research examining its impact on health-related outcomes (Antonucci et al., 2017). Further, evidence regarding the effects of social technology use are mixed, with some studies showing health benefits (Chopik, 2016; Dodge et al., 2015; Myhre et al., 2017; Quinn, 2018) whereas other studies show costs (Frein et al., 2013; Meshi et al., 2020; Sharifian and Zahodne, 2020; Soares and Storms, 2018). As several intervention studies have focused on social technology and cognition, we highlight cognition as our illustrative health example in the subsequent sections to discuss the distinct bodies of research that have found cognitive benefits and cognitive costs of engaging with social technology.

Cognitive Benefits

Offline social relationships and interactions have been consistently linked to better cognitive functioning (e.g., Cacioppo and Cacioppo, 2004; Seeman et al., 2011; Zahodne et al., 2019), however, less is known regarding whether social resources facilitated through technology confer the same benefits. Some evidence suggests that social technologies may provide a unique resource for older adults to connect with others and remain socially active and cognitively stimulated. Although research is limited, some intervention research has indicated that engaging with social technology may be associated with improvements in cognitive functioning (Dodge et al., 2015; Myhre et al., 2017; Quinn, 2018). For example, in a 4-week randomized control trial examining social media use and executive functioning, social media novice older adults received instructional sessions about social media use (i.e., setting up accounts, privacy, etiquette, posting, etc.) and were compared with a wait-list control group (Quinn, 2018). The results revealed that instruction in social media use was associated with improvements in inhibitory control (i.e., ability to ignore irrelevant information) after the 4-week period and 4-months later (Quinn, 2018). In another intervention study examining the cognitive effects of learning how to use Facebook, older adults received 1 week of instructional classes on how to use Facebook and were instructed to subsequently post/comment daily for 7 weeks (Myhre et al., 2017). Results revealed that older adults who learned how to use Facebook showed significant improvements in updating, a component of executive functioning, compared with wait-list controls and those who were trained to use a private blog as an online diary (Myhre et al., 2017). Finally, in a 6-week randomized controlled trial, older adults received daily 30 min face-to-face online communication, relative to the control group that received a weekly telephone interview. Results demonstrated that cognitively-intact older adults who received the intervention showed improvements in semantic fluency immediately after the intervention and improvements in phonemic fluency at an 18-week follow-up assessment, relative to the control group (Dodge et al., 2015).

These intervention studies indicate that learning how to use social media or engaging in frequent online communication in later life may help to improve some domains of cognitive functioning, such as executive functioning. That is, it may be that engaging in social media is cognitively stimulating in and of itself. It may also be that social media and online communication bolsters social stimulation, which has been linked to better cognitive outcomes. Indeed, prior cross-sectional research in a nationally representative sample of American older adults has shown that the use of social technologies in later life was associated with better psychological and physical health outcomes, and these associations were mediated by lower levels of loneliness (Chopik, 2016). In the same cohort of U.S. older adults, internet use has been linked to lower levels of depressive symptoms in older adults (Cotten et al., 2012). Of note, an Australian study of older adults' internet use hints at the complicated associations between socioemotional

outcomes and technology use. In this study, although time spent on the internet was associated with more social loneliness, using the internet as a communication tool was associated with less social loneliness (Sum et al., 2008). Additionally, in the same study, internet use to identify new social ties was associated with *higher* levels of family loneliness, highlighting the complexities of researching social technology and the implications of how individuals use these tools (Sum et al., 2008).

Cognitive Costs

Although some intervention research suggests there are cognitive benefits to social technology use in older adulthood, other evidence suggests that there may also be negative consequences for cognitive health. For example, in a cross-sectional study of college-aged adults, individuals who were classified as high Facebook users (engaging with Facebook more than 1 h per day) scored worse on a memory recall task compared with individuals classified as low Facebook users (Frein et al., 2013). In an experimental study, college-aged adults were assigned to either passively view a series of paintings, take photographs of the paintings, or use Snapchat (a photo-sharing based social media platform) to document their experience of the paintings. Individuals who used Snapchat during the experiment had lower recall for the visual details of the paintings than those who simply observed or used a camera to take pictures (Experiment 1; Soares and Storm, 2018). In another experimental study, college-aged adults were instructed to place their silenced smartphones either in another room, their pocket/bag, or on the desk where subsequent tests of cognitive capacity (working memory, fluid intelligence) were administered. The more salient the individual's smartphone (i.e., the closer it was), the more their cognitive capacity was impaired (Ward et al., 2017). Further, in another experiment, these same researchers report that whether the phone was silenced or completely powered down did not alter this effect (Ward et al., 2017). Much less observational or experimental research has examined the links between social technology and cognition in older adulthood. However, a daily diary study of U.S. adults aged 25 to 75, found that on days when social media use was high, individuals also reported more memory failures that same day and the subsequent day. These findings were not moderated by age, which suggests that social media use was associated with more memory failures regardless of the age of the user (Sharifian and Zahodne, 2020).

The negative consequences of engaging with social technologies for cognitive functioning may operate through attentional and/or cognitive offloading pathways. That is, individuals who are using social technologies may have reduced attentional capacity for other stimuli in their environment (Soares and Storm, 2018). Individuals may also use these technologies to offload information onto external memory sources (Risko and Gilbert, 2016) such that individuals are relying more on technology to store information that was once previously remembered (i.e., phone numbers, birthdays, etc.). Finally, some evidence also suggests that the use of these tools may alter how we process and store information. For instance, in a series of experiments, individuals who believed they would have access to saved information for a recall task tended to have greater memory for where to find the information needed (i.e., the saved folder names) than for the content of the information itself (Sparrow et al., 2011).

Overall, some evidence suggests that engaging with social technology, such as social media or smartphones in general, can impair cognitive functioning, at least in younger adulthood. Less is known regarding whether these same consequences extend into older adulthood, as prior intervention research has found beneficial effects. An important consideration regarding these mixed findings is how older adults are engaging with social technology in intervention studies. Specifically, older adults who are novices (i.e., little to no previous experience) are recruited and subsequently instructed to actively use social media over an extended period of time (Myhre et al., 2017; Quinn, 2018). Prior research has suggested that more active use of social media (i.e., direct messaging, commenting, etc.) is associated with more beneficial outcomes, whereas passive use (i.e., lurking, mostly browsing, etc.) is associated with more detrimental outcomes, at least in regards to socioemotional health (Escobar-Viera et al., 2018; Thorisdottir et al., 2019). When measuring the ways in which older adults engage with social technologies such as social media, it is important to note that older adults tend to use these resources more passively in everyday life to keep in touch with family and close friends. For example, older adults tend to engage in more family activities, such as viewing relatives' photos (McAndrew and Jeong, 2012), and view these activities as an effective tool for keeping up with the lives of family and friends (i.e., social surveillance; Jung et al., 2017) rather than as a platform to post photos and status updates. In a qualitative study, older adults who used social media tended to report being "lurkers" to keep watch over what their friends and family members posted online (Yuan et al., 2016). Older adults report privacy concerns as a major issue when using these technologies (Jung et al., 2017; Xie et al., 2012), which may impact how actively they use social media. In addition, the costs and/or benefits of social technology use for cognition may be domain-specific, which could help to explain some contrasting findings. For example, prior intervention research has shown stronger positive associations between social technology and executive functioning (e.g., Dodge et al., 2015; Myhre et al., 2017; Quinn, 2018), whereas other research has shown costs for memory functioning (e.g., Frein et al., 2013; Sharifian and Zahodne, 2020; Soares and Storm, 2018).

Summary: Means of Communication

In summary, evidence regarding whether the use of social technology affects health outcomes in later life is mixed. Further investigation is necessary to understand the potential impact of online social interactions for health and quality of life in older adulthood. In particular, future research should first investigate when, why and how older adults engage with these technologies as their preferred means of communication. In line with the social convoy model, personal and situational characteristics of the individual are likely to influence what means of communication are most likely to be used. Additionally, an individual's goals and motivation for contact, such as future time perspective, influence the preferred means of communication as may be predicted by socioemotional selectivity theory while the SAVI model would argue that the goal of regulating emotions and avoiding conflict

might predict one means of contact (e.g., distal versus proximal, virtual versus in-person). Future research is necessary to understand not only the implications of social technology on health and quality of life in older adulthood, but also how age-related changes in social relations and socioemotional goals may impact the selection and use of these same technologies. How an individual uses social technology may, in turn, have implications for health and quality of life. In line with this notion, whether an older adult uses technology actively versus passively or to facilitate pre-existing offline relationships versus develop new social connections appears to influence the effects of using social technology.

Another important consideration is that these technologies have only recently become more prevalent in older adult populations, and therefore, current research can only examine short-term implications of social technology use in later life. It is necessary to recognize and understand the long-term implications of use. For instance, it is important to disentangle the effects of growing up technologically embedded on younger generations' socioemotional and cognitive outcomes over the lifespan as well as long-term use of social technologies in older adults after adoption. Further, it is important to understand the historical and contextual contexts that may further influence these associations, such as the greater prevalence of using social technology to interact with friends and family in daily life among younger generations. Historical events, such as the experience of a pandemic that encourages physical distancing and self-isolation (e.g., COVID-19 pandemic), may shift the relative importance of online social interactions. During such periods, online social interactions may thus have a more prominent role in health and quality of life as they become one of the limited ways in which individuals are allowed to interact and communicate with others.

Additionally, technology is rapidly changing as researchers try to understand the implications of these tools and therefore, the effects of these technologies for health may also change in tandem. Technologies such as virtual and augmented reality technologies are becoming commercially available and these tools may have implications for health as well. For instance, in a recent study in which adults 50 and older played an exergame (i.e., physical activity using video games) in an immersive virtual environment (IVE) over the course of 4-weeks, the IVE group showed better executive functioning compared with the control group (i.e., non-immersive game) (Huang, 2020). Thus, it is essential to continually assess whether changes in these technologies influence their effects on health and quality of life. Finally, future research should clarify the potential domain-specific pathways that may explain the mixed findings regarding the costs or benefits of social technology in later life. It may be that gains are seen in one domain (i.e., executive functioning) but costs are seen in another (i.e., memory).

Clinical Applications and Recommendations

The literature reviewed above reveals the powerful influences social relations can have on the physical, mental, and cognitive health of older adults. Our increasing understanding of the complexities and nuances of social relations and their health impacts have important implications for multiple aspects of clinical practice. These specific insights may be harnessed to improve the clinical assessment and treatment of older adults.

With regard to clinical assessment, the growing literature on social relations highlights the value of considering not only individual factors (e.g., age, educational attainment, comorbid health conditions), but also contextual factors, including characteristics of the social network(s) in which an individual is embedded, when assessing risk of mental and cognitive disorders. Collecting more detailed information on the structure, function and the quality of an individual's social network can improve clinicians' understanding of risk and resilience. For example, characterizing objective social isolation without also querying the subjective experience of loneliness could result in an over- or under-identification of risk. Similarly, cataloging an individual's social ties without also assessing the frequency and quality of interactions is likely to yield an incomplete picture of social resources that can be considered as promising intervention targets. Thus, a comprehensive assessment of contextual factors can improve the development of clinical recommendations and treatment planning.

With regard to clinical intervention, a more detailed understanding of links between social relations and health can help to reveal the "active ingredients" of social relations, allowing for more targeted interventions. For example, a recent longitudinal study that considered multiple structural aspects of social relations as predictors of cognitive aging found that contact frequency, but not social network size, was associated with slower declines in episodic memory (Zahodne et al., 2019a,b,c). Findings such as these may be used to guide the development of interventions by suggesting that increasing the frequency of interaction with existing social network members may be more effective than introducing new network members, especially if contact with those new network members will be limited. Similarly, seminal studies on older adults' physical and mental health (Antonucci, 2001) and more recent studies on cognitive aging have drawn attention to the unique value of diverse social networks containing not only close family members but also more peripheral family members and friends (see review; Fingerman, 2009; Zahodne et al., 2019a,b,c; Ying et al., in press). As another example, a more nuanced understanding of the costs *and benefits* of social strain within particularly salient relationships (e.g., the spousal relationship; Birditt and Antonucci, 2008) may help clinicians working with individuals and couples modify behaviors and/or interpretations to optimize the emotional and instrumental support derived from a key relationship. Additionally, understanding the unique pathways in which different social relationships benefit health may help to clarify intervention targets. For instance, an understanding that friends may promote health through increased shared activities may inform future interventions to bolster friendships through activity/shared interest groups (i.e., art, bird watching, etc.).

In line with a changing technological landscape, rapidly evolving research on the mode(s) by which individuals interact with social network members is also highly relevant to the design and implementation of interventions targeting social relations. The benefits of social interaction may differ when it occurs in-person, over the phone, or online. In particular, the role that newer social

technologies (e.g., texting, video chats, social media) can play in shaping health outcomes is an active area of research. For example, research on younger adults suggests that active social media use (e.g., posting, commenting) is associated with better mental health, whereas passive social media use (e.g., scrolling, lurking) is associated with worse mental health (Escobar-Viera et al., 2018). If findings such as these are extended to older adults, then interventions involving social media should focus on promoting active use rather than just getting older adults online. Importantly, reducing the digital divide is necessary to ensure that *efficacious* interventions involving social technologies are also *effective* and that all older adults who would benefit from online social interaction have access. Indeed, a recent systematic review concluded that various technologies have the potential to reduce social isolation in older adults, but more systematic trials are needed (Khosravi et al., 2016).

Conclusions

In conclusion, the examination of social relations and health has made significant advances from early, small, qualitative studies to large quantitative studies. Social relations encompass a complex and dynamic set of characteristics that may have distinct effects on health and quality of life in older adulthood. Informed by the social convoy model, identifying the specific aspects of social relations (i.e., structure, function, quality) as well as detailing personal and situational characteristics (i.e., age, race, ethnicity, gender, etc.) may help to clarify how social relations specifically influence the individual. Further, taking a life course perspective, it is important to understand the role of age-related gains and losses that may influence changes in social relationships in later life. Socioemotional selectivity theory highlights the importance of motivational goals on social partner selection such that perceptions of time left may influence changes in social network size and composition. The strength and vulnerability integration model further exemplifies these points by highlighting that age-related vulnerabilities may impact social partner selection as well as how older adults cope with potential social stressors (i.e., avoidance or disengagement from negative social interactions). An understanding of the who, what, why and how of social relations helps to clarify the potential protective and/or harmful effects of each dimension of social relations on later life outcomes. Specific social resources (i.e., social network size vs. loneliness), relationship types (i.e., friends vs. family), and means of communication (i.e., online vs. offline) may uniquely inform future clinical research, and these specific insights into social relations may be harnessed to improve the clinical assessment and treatment of older adults. Methodological advances in measurement have made it possible to identify these social relations-health associations from the cellular to societal levels. These new methodological approaches have opened new avenues of knowledge and are forging the way for future research to identify, specify and design both prevention and intervention strategies to incorporate the natural and universal resource of social relations to maximize health and quality of life in later life.

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