Older adult health-related support networks: implications for the design of digital communication tools

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Abstract

Background and Objectives: Digital communication tools facilitate the provision of health-related social support to older adults. However, little is known about what design features make such tools most useful and feasible. The purpose of this study is to describe health-related social support networks of older adults and outline recommendations for the design of tools that facilitate the giving and receiving of support. Research Design and Methods: We collected data through validated instruments and semi-structured qualitative interviews with 88 older adults. We calculated descriptive statistics for the quantitative data, and analyzed qualitative data using directed content analysis. Results: Health-related support networks described by our sample of generally healthy older adults varied in size from 0 to 10 members. Some networks did not include any family members, and others did not include any friends. Seventy-four percent of network members lived in the same state as the older adult participant, but only 15% of them lived with the participant. Emotional support was the main type of health-related support provided, followed by instrumental, informational, and appraisal support. Discussion and Implications: Health-related support networks of older
adults are varied and complex. Our results suggest that digital communication tools to promote and leverage support from network members should facilitate involvement of friends and family regardless of their physical location; allow for transparent allocation of concrete tasks to prevent overburdening any one network member; and facilitate sharing of personal health information with family and friends while ensuring privacy and autonomy.

**Translational Significance:** To better serve older adults and their family and friends, we must design digital communication tools that allow existing support relationships to thrive in a digital environment, and take into account both which older adults are likely to use them, and how they accommodate the different roles of network members.

**Keywords:** social support, informal caregiving, care coordination
Background and Objectives

Social support from family, friends, and other caregivers, defined as the different types of assistance they provide, is associated with better health outcomes and lower morbidity and mortality for older adults (N. D. Berkman, Sheridan, Donahue, Halpern, & Crotty, 2011; Kim, Fredriksen-Goldsen, Bryan, & Muraco, 2017; White, Philogene, Fine, & Sinha, 2009). The availability of social support such as help with tasks (instrumental support) or love and understanding (emotional support) benefits older adult health either directly, through physiological stress responses or emotional regulation, or indirectly, through improved access to services and resources (L. F. Berkman, Glass, Brissette, & Seeman, 2000; Philipson, Bernard, Phillips, & Ogg, 2000; Thoits, 2011). Social support in the lives of older adults is a predictor of greater cognitive function (T. E. Seeman, Lusignolo, Albert, & Berkman, 2001), better self-reported health status (White et al., 2009), fewer cardiovascular events (Krumholz et al., 1998), better hypertension control (Cornwell & Waite, 2012), and increased medication adherence (DiMatteo, 2004). As personal communications and interactions have moved to the Internet, digital communication tools such as email and social networking sites have been shown to support social connectedness in later life (Cotten, Anderson, & McCullough, 2013; Findlay, 2003; Garattini, Wherton, & Prendergast, 2012; Khosravi, Rezvani, & Wiewiora, 2016; Masi, Chen, Hawkley, & Cacioppo, 2011). Older adults use social networking sites primarily to maintain and enhance existing relationships, especially with family, and to mobilize support (Jung, Walden, Johnson, & Sundar, 2017; Nowland, Necka, & Cacioppo, 2018; Quan-Haase, Mo, & Wellman, 2017). In addition, healthcare systems are increasingly moving to digital platforms with the expectation that patients will communicate with their providers through online patient portals (Goldzweig et al., 2013; Irizarry, De Vito Dabbs, & Curran, 2015).
Older adults are especially likely to have others involved in their health and healthcare activities and decisions (National Academies of Sciences Engineering and Medicine, 2016; Wolff & Spellman, 2014), due to the increased prevalence of chronic disease in later life, as well as age-related sensory, mobility, and cognitive impairments that affect the ability to perform certain tasks. Existing tools such as Tyze or CaringBridge allow individuals experiencing health issues and their caregivers to create secure, personalized web pages to provide status updates and share instrumental and emotional support needs with family and friends (Cammack & Byrne, 2012; Han & Wiley, 2013). However, researchers have been calling for more usability research to improve the reach and effectiveness of digital health tools for older adults (Levine, Lipsitz, & Linder, 2016), since little is known about what design features to prioritize in order to make such tools most useful and usable for older adults (Barbosa Neves, Franz, Judges, Beermann, & Baeccker, 2017; Mitzner et al., 2011; Tsai, Shillair, Cotten, Winstead, & Yost, 2015). This is in part due to lack of information about what types of health-related support older adults receive, and who provides it. Previous research into the types of support associated with different types of relationships did not focus specifically on older adults (Wellman & Wortley, 1990). More recent research on older adult health-communication support networks showed that such networks included a wide range of individuals (e.g., biological relatives, extended family, and friends), but did not discuss specific types of support they provided (Valdez & Brennan, 2015).

Older adults have been relatively slower to access the Internet and adopt digital communication tools (Levine et al., 2016), although numbers are increasing: in 2017, 42% of older adults reported owning smartphones, and 67% reported using the Internet (Anderson & Perrin, 2017). As a consequence, these technologies are most often designed with younger adults in mind (Jung et al., 2017). However, as digital communication tools become more pervasive in our society it is imperative that we understand the nature of older adult
communication and support networks. This will inform the creation of tools that allow these relationships to thrive in a digital environment (Czaja, Boot, Charness, Rogers, & Sharit, 2018; Quan-Haase et al., 2017). The purpose of this study is to describe health-related social support networks of older adults and outline recommendations for the design of digital communication tools that facilitate the giving and receiving of support. The study is part of a larger research project that explored the personal health information needs and practices of primarily healthy older adults (https://www.soaringstudy.org). The goal of the project was to inform the design of effective personal health information management technologies that support older adults’ health and independence as they age. The present study is based on the Convoy Model of social relations (Antonucci, Ajrouch, & Birditt, 2014), which posits that individuals are surrounded by supportive others throughout the life course, and that the structure, function, and quality of these relationships vary based on personal characteristics and situational context. As a consequence, we examine 1) whether certain kinds of network members provide certain types of support, and 2) whether the characteristics of health-related support networks differ according to older adult characteristics such as age or living situation. Our findings may inform the design of tools that facilitate provision of social support in a manner consistent with older adult needs and current practices.
Research Design and Methods

The research reported here was informed by social network analysis, particularly the analysis of personal, or egocentric, networks (Wasserman & Faust, 1994). A personal network consists of a focal actor, called “ego” (which in this case is an older adult), and a set of actors called “alters” to whom the focal actor is tied through a particular relationship (in this case, the provision of health-related support). Personal networks are often used in the study of social support (Ashida & Heaney, 2008; Cornwell & Waite, 2012; Kim et al., 2017) because they allow researchers to map and characterize the immediate social environment of respondents, and then examine the relationships that exist between the characteristics of respondents and those of their networks (Andersson & Monin, 2018; Valente, 2010).

Participants and Procedures

We used purposive sampling to select participants with diverse living situations, income levels, and racial identities. This type of sampling allows researchers to identify participants that are knowledgeable about the phenomenon of interest and are available and willing to participate (Bernard, 2017). We recruited participants through direct contact, fliers placed at community centers, and agency contacts at assisted living and retirement communities. We included only older adults who were age 60 years or older, resided in [name of county – blinded for review] at the time of the interview (June 2014 to August 2015), were able to speak and read English, and had no significant cognitive impairment (i.e., a score of 4 or higher on the Six-Item Screener) (Callahan, Unverzagt, Hui, Perkins, & Hendrie, 2002). The [blinded for review] Institutional Review Board approved this study.

We conducted in-person semi-structured interviews in the participants’ homes, lasting 90-120 minutes. Participants received a $25 gift card for participation. Interviews were audio-recorded and transcribed verbatim by a professional transcriptionist.
Measures

During the in-person interviews we collected data on: 1) participant characteristics (via quantitative, validated instruments) and 2) health-related support networks (via name-generator and name-interpreter instruments, described below). Supplemental Table 1 describes the different data sources, analyses, and output used in this paper.

Participant characteristics. We asked older adult participants to provide data on standard demographic items (age, gender, race, etc.), as well as their living situation (independently, in a retirement community, in an assisted living facility, or other). We used the Charlson Co-Morbidity Index (Chaudry, Jin, & Meltzer, 2005) to assess the number of chronic diseases each participant had and asked an additional question allowing the participants to self-report whether they experienced any mental health conditions such as depression, anxiety, PTSD, or bipolar disorder. We used the Lubben Social Network Scale (LSNS-6) (Lubben et al., 2006) to assess the size of family (LSNS-family) and friend (LSNS-friend) networks. We used the Autonomy Preference Index (API) instrument to assess decision-making and information-seeking preferences (Ende, Kazis, Ash, & Moskowitz, 1989). The API takes values between 0 and 100; a higher score indicates greater preference for being informed and for higher levels of physician involvement in decision-making. Finally, we asked participants whether they currently use or had ever used online patient portals to manage their health information. In the analyses presented below, we use a binary version of this variable (i.e., any portal use vs. no portal use) for ease of interpretation.
Social network data. We collected data on the size and composition of health-related support networks. During the interviews, we collected network data through a *name generator*, a question that asks respondents to enumerate individuals with whom they share a particular type of relationship (Burt et al., 2012). The interviewer asked older adult participants to nominate friends and family members who were involved with their health (hereafter referred to as “alters”); the participants could name as many as they wanted in each category. We generated a health-related support network for each participant composed of alters nominated in this process.

We collected additional information about each alter using *name interpreters* – follow-up questions on the demographic characteristics of each alter and the relationship between participant and alter (Marin & Hampton, 2007). We asked participants to provide the following information about alters: their relationship with the participant (i.e., family or friend), gender, age (in years), place of residence (city), frequency of contact (less than monthly, monthly, few times a month, weekly, few times a week, daily), and the role they played in the participant’s health (through the open-ended question “what is this person’s role in your health?”). In the remainder of the paper, we refer to these data as “alter characteristics.”

*Qualitative Data Analysis*

We analyzed the open-ended portion of the name interpreter instrument, which provided descriptions of each alter’s role in the participant’s health, using a directed content analysis approach (Hsieh & Shannon, 2005). We coded these descriptions into one or more of the four categories of social support identified by Berkman et al (2000): *appraisal* (help in decision-making and giving feedback); *emotional* (love, caring, sympathy and understanding available from others); *informational* (provision of information in the service of particular
needs, for example about a new diagnosis or a treatment); or *instrumental* (assistance with tangible needs such as getting groceries, driving to appointments). As a result, each alter was assigned one or more social support roles, which is in line with previous research showing that network members may provide multiple types of social support (Teresa E. Seeman & Berkman, 1988; Wellman & Wortley, 1990).

We conducted the qualitative analysis of interview transcripts using the Dedoose web application (SocioCultural Research Consultants LLC, 2016). Two team members double-coded a subset of randomly chosen transcripts (10%) and met weekly to discuss and reconcile differences in coding until agreement across double-coded transcripts reached 90%. The remaining transcripts were coded independently.

**Quantitative Data Analysis**

We conducted an exploratory data analysis of the relationships between (1) alter characteristics and alter support roles, and (2) between older adult characteristics and the size, composition, and function of health-related support networks. These analyses allow us to make design recommendations that take into account which alters provide which type of support, and the variability that exists among older adults in terms of who is part of their support networks and what type of support they receive. Since this was an exploratory study, no hypothesis tests are reported. Instead, we provide descriptive statistics for the outcomes of interest.
Relationship between alter characteristics and alter support roles. Using the unit of analysis of alters, we focused this analysis on the entire group of alters nominated by all older adults. This type of analysis examines whether, for instance, family members provide certain types of support but not others. We report the percentage of alters in each category that provide each type of support (Table 3).

Health-related support network characteristics. We used the following measures to characterize each individual support network: number of family members, number of friends, and number of alters (i.e., family and friends) providing each type of social support. These measures differ from the Lubben scale, which only provides a range for the size of the family or friend network, not the exact size, and does not offer any information about the role of network members. The Lubben scale is also not specific to health.

Relationship between older adult characteristics and support network characteristics. Here the unit of analysis is the older adult participant; this type of analysis examines whether, for instance, female participants have more alters that provide instrumental support. Because we specifically asked older adults to provide names of alters in each relationship category (i.e., family and friends), our analyses use number of alters in each of these categories rather than percentage in the network.

We conducted descriptive bivariate analyses of the relationship between older adult covariates and the number of alters stratified by category. We calculated correlation coefficients for continuous covariates (LSNS - family and friend subscales, API – decision-making subscale and API – information seeking subscale) and means and standard deviations for categorical covariates. We conducted all analyses using the R statistical software (R Core Team, 2016).
Results

Participant characteristics

We recruited 90 older adults into the study. The eighty-eight participants who completed the study were 77.7 years old on average, predominantly female (69%), white (70%), and college-educated (62%). Forty-one percent of respondents reported a Charlson co-morbidity index below 2, and 24% reported having a mental health issue. On average, API scores indicated a strong preference for being informed, but a more neutral response to physician involvement in decision making (Table 1).

[Table 1 about here]

Alter characteristics

Table 2 summarizes alter characteristics as provided by the older adult participants. Eighty-eight participants identified 302 alters. The average number of alters reported by older adults was 3.4 (SD 2.3, range 0 – 10). Just over two thirds of alters were family members; two thirds were female; and the majority lived in the same state as the older adult (74%). One in seven alters lived in the same residence as the older adult. For 21% of alters the contact with older adult participants was less than once a week. Sixty-five percent of alters provided emotional support, 34% provided instrumental support, 20% provided informational support, and only 12% provided appraisal support. Thirty-eight percent of alters provided more than one type of support.

[Table 2 about here]
Relationship between alter characteristics and type of support they provide

As shown in Table 3, sixteen percent of female alters provided appraisal support, compared with only 5% of male alters; sixteen percent of in-state alters provided informational support, compared with 31% of out-of-state alters; and a little more than 40% of family, in-state, and under 60 year-old alters provided instrumental support (i.e., assistance with specific tasks), compared with 18% of friends, 11% of out-of-state alters, and 23% of alters 60 and older.

[Table 3 about here]

Health-related support network characteristics

On average, two thirds of alters named in a health-related support network were family members. However, the composition of older adult support networks varied: 13 participants (15%) had no family members in their networks, while 42 (48%) did not list any friends in their network.

In general, we found that these health-related support networks consisted of more alters who provided emotional support (2.4 network members on average), followed by instrumental (1.3 members on average), informational (0.5 members), and appraisal support (0.2 members). Twenty-two (25%) older adults did not identify any alters as providing emotional support, 27 (31%) did not identify any alters as providing instrumental support, 55 (63%) did not identify any alters as providing informational support and 59 (67%) did not identify any alters as providing appraisal support.
Relationship between participant characteristics and health-related support network characteristics

Number of alters that provide each type of support. In Tables 4 and 5 we present results from analyses of the relationship between older adult participant characteristics and the number of alters that provide each type of support. We summarize below the analyses for which the Cohen’s effect size was medium or large (i.e., a difference of 0.5 or more standard deviations) for at least one comparison between two levels of the variable (Kelley & Preacher, 2012), or for which the Pearson’s $r$ was greater than or equal to +/-0.3.

Participants with a post-graduate education identified more alters that provided appraisal support (i.e., decision-making and feedback support) than participants with lower levels of education. Females and participants with higher LSNS-family subscale scores (i.e., total size of family support network, including people who provide non-health related support) nominated a greater number of alters providing emotional support. Younger participants, those in independent living, those with a post-graduate education, and those who used online patient portals had a greater number of alters providing informational support. Older participants and those with a college education nominated more alters providing instrumental support.

[Table 4 about here]
Discussion and Implications

In this paper we describe the size, composition, and support function of health-related support networks of older adults. We examine 1) whether network members with certain socio-demographic characteristics provide certain types of support, and 2) whether the size, composition, and support function of health-related support networks differ according to older adult characteristics such as age or living situation. In the remainder of this section we review our main findings and outline implications for the design of digital communication tools to facilitate provision of health-related support to older adults.

We found that health-related support networks described by our sample of generally healthy older adults varied in size from 0 to 10 alters. Some networks did not include any family members, and others did not include any friends. Seventy-four percent of alters lived in the same state as the older adult participant, but only 15% of alters lived with the participant. Given this range and complexity of network compositions, future digital communication tools could serve the needs of older adults better by facilitating the supportive role of family and friends regardless of their geographical location. This is particularly important since previous research has shown that long-distance moves, which are common for older adults, lead to changes in the structure of their core social networks: they tend to add more family members and lose non-kin members (Badawy, Schafer, & Sun, 2019).

Our results show that emotional support was the main type of health-related support provided by family and friend alters, consistent with previous research on the types of support received by older adults through digital media (Czaja et al., 2018; Quan-Haase et al., 2017) and on the importance of different types of support for older adults (Hagan, Manktelow, Taylor, & Mallett, 2014). On average, female participants identified a larger number of alters in their networks that provided emotional support than men, which is in line with previous findings about women’s support networks (Antonucci & Akiyama, 1987).
While older adults often use social networking sites such as Facebook to maintain ties with family and friends, they are often frustrated with the lack of transparency regarding privacy settings and with the complexity of site features (Jung et al., 2017). Consequently, digital communication tools that encourage the provision of emotional support for health-related issues should allow alters to interact with older adults often and from any distance, and for older adults to actively participate as well, but ensure privacy of communication and usability (Mitzner et al., 2011).

The second largest category of support provided was instrumental support. This type of support was provided to a greater extent by family members, alters (friends or family) who were under 60 years old, and alters who lived in-state. These results are consistent with the nature of instrumental support, which comprises hands-on help with tangible, more immediate needs, and with previous research showing that older adults use digital media to mobilize support in the form of small and large services, and financial aid (Quan-Haase et al., 2017). A useful tool for both older adults and their network members might be one that allows the older adult to specify the tasks they need help with, and allows alters to sign up for the tasks. Such a tool would not only facilitate better coordination of support, but also give alters a better sense of how much each is contributing. This could help prevent any one alter from being overburdened and create a support structure for the alters themselves (Smyth, Rose, McClendon, & Lambrix, 2007). Similar tools have been developed and tested for cancer patients (Hartzler et al., 2011; Skeels, Unruh, Powell, & Pratt, 2010). Such tools should take into account best practices for designing information technology for older adults, including the oldest old demographic, such as providing a consistent interface throughout the application and allowing for easy resizing of text and graphics which support age-associated changes in cognition, vision, and physical dexterity (Reeder, Zaslavksy, Wilamowska, Demiris, & Thompson, 2011). To encourage accessibility for older adults and others in their
health network digital communication tools should be available on a variety of platforms, particularly tablets (Tsai et al., 2015). Furthermore, the success of a given technology depends not only on the acceptability and usability as perceived by older adults but the adoption of friends and family as well (Barbosa Neves et al., 2017; Tsai, Shillair, & Cotten, 2017).

We found that our respondents had, on average, 0.5 alters that provided informational support, which is almost 5 times lower than the average number of alters providing emotional support (2.4). This finding is consistent with previously reported findings that older adults prefer getting health information from providers and family members with a health background over family and friends in general (Turner, Osterhage, Taylor, Hartzler, & Demiris, 2018; Volkman et al., 2014). However, older adults who used online patient portals reported more alters providing informational support than those who did not use portals. These results suggest that future digital communication tools facilitating the provision of informational support may need to be integrated with health information management systems in order to allow older adults who are more involved in managing their health information through electronic systems to share their personal health information with their alters. These findings align with calls from researchers for a more patient-centered approach to the design of mobile health tools and online patient portals (Irizarry et al., 2015; Matthew-Maich et al., 2016).

Only a small number of alters provided appraisal support (i.e., help in decision-making and giving feedback). Because we were studying support within a group of relatively healthy older adults, it is possible that participants were not, at the time, dealing with significant health-related decisions, and therefore did not require this type of support. In other situations, it is likely that alters would provide more appraisal support, as found in a previous study of medication management (Mickelson, Unertl, & Holden, 2016). Further research is
needed to investigate the need for appraisal support tools in older adults with a greater disease burden.

**Limitations**

Although we conducted a large number of in-depth interviews, our sample was from the same geographic region, and despite efforts to gain a diverse sample in terms of race and education, our participants were primarily white and well educated. As a result, it is possible that our results did not capture network characteristics that would be observed in a more diverse sample. Our exploratory study engaged a population of generally healthy older adults, and our already lengthy interview process precluded us from gathering in-depth information about the kinds of support that respondents needed for specific medical conditions, or whether they were satisfied with the quantity and type of support they received from family and friends. To further reduce respondent burden, we used self-report of physical and mental health conditions, which may lead to inaccurate representation of the prevalence of various conditions among our respondents. The assignment of support type was based on researcher analysis of interview transcripts and not by the individual participant themselves. It is possible that coder bias may have influenced the results. To minimize individual researcher bias we had two researchers code separately and discuss differences. Finally, our descriptive study does not allow us to examine the effect that the different types of support have on the health outcomes of our participants.
Implications

Our findings suggest that relatively healthy older adults have support networks that are varied and complex. To better serve older adults and their family and friends, we must design digital communication tools that do not prioritize one type of support at the expense of others, and facilitate the strengthening of existing networks (Quan-Haase et al., 2017). Such tools also need to take into account which older adults are likely to use them, and which network members would find them most useful (Matthew-Maich et al., 2016). In particular, designers of digital communication tools should take into consideration the primary types of support provided by network alters: emotional support and instrumental support. The list below highlights key considerations for the design of tools to promote and leverage support from network members:

- Facilitate involvement of friends and family regardless of their physical location and technological expertise.
- Seek input and feedback through usability testing from diverse older adults including the oldest old, individuals with low digital literacy, and key members of health-related support networks.
- Facilitate sharing of tangible tasks such as transportation to provider visits and medication pick-ups. Allow for transparent allocation of tasks to prevent overburdening any one network member.

- Allow for older adults to easily and flexibly control access of health information by family and friends to facilitate frequent interactions but ensure privacy and autonomy.

- Allow for flexible and easy sharing of health information resources in a variety of formats and platforms.

Future studies employing user-centered and participatory approaches are needed to explore these design implications and assess the impact of the use of such tools on health outcomes of older adults.
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Table 1. Characteristics of participants (n=88)

| Variable                        | N (%)   |
|---------------------------------|---------|
| **Race**                        |         |
| White                           | 62 (70%)|
| Asian                           | 8 (9%)  |
| AI/AN                           | 6 (7%)  |
| Black / African American        | 6 (7%)  |
| Other                           | 5 (6%)  |
| **Gender**                      |         |
| Female                          | 61 (69%)|
| Age                             |         |
| 60-69                           | 23 (26) |
| 70-79                           | 32 (36) |
| 80+                             | 33 (38%)|
| **Marital Status**              |         |
| Divorced/separated              | 27 (31%)|
| Widowed                         | 27 (31%)|
| Married/partnered               | 23 (26%)|
| Single, never married/partnered | 11 (12%)|
| **Education**                   |         |
| Some high school OR high school graduate | 10 (11%) |
| Some college                    | 23 (26%)|
| College graduate                | 28 (32%)|
| Post-graduate                   | 26 (30%)|
| **Income**                      |         |
| Not at all adequate OR Can meet necessities only | 15 (17%) |
| Can afford some of the things I want but not all I want | 39 (45%) |
| Can afford about everything I want | 26 (30%) |
| Can afford about everything I want and still have money leftover | 7 (8%) |
| **Living situation**            |         |
| Assisted Living                 | 17 (19%)|
| Independent shared dwelling     | 24 (27%)|
| Retirement Community            | 24 (27%)|
| Independent                     | 22 (25%)|
| Homeless                        | 1 (1%)  |
| **Charlson Comorbidity Index**  |         |
| Mean (sd)                       | 2.0 (1.3)|
| 0-1                             | 36 (41%) |
| 2 or more                       | 52 (59%) |
| **Mental Health Issues**        |         |
| No                              | 62 (76%) |
| Portal Use |   |
|-----------|---|
| No        | 58 (66%) |
| Yes       | 30 (34%) |

| Mean (SD) |
|-----------|
| LSNS² – friends subscale | 9.2 (3.9) |
| LSNS² – family subscale | 8.1 (3.5) |
| API³ – decision-making scale (0-100) | 44 (20) |
| API³ – information-seeking scale (0-100) | 84 (12) |

¹Independent shared dwellings had certain requirements based on age/disability, but no provision of meals or personal care services. ²LSNS = Lubben Social Network Scale; ³API = Autonomy Preference Index.
Table 2. Characteristics of alters (i.e., network members) (n=302)

| Variable                                      | N (%)  |
|-----------------------------------------------|--------|
| **Relationship with older adult**             |        |
| Family member                                 | 205 (68) |
| Friend                                        | 97 (32) |
| **Gender**                                    |        |
| Female                                        | 195 (66) |
| Male                                          | 101 (34) |
| Not reported                                  | 2 (0.7) |
| **Age range**                                 |        |
| < 60                                          | 172 (57) |
| >= 60                                         | 132 (43) |
| **Lives in the same house as older adult**    |        |
| Yes                                           | 45 (15) |
| No                                            | 249 (85) |
| Not reported                                  | 10 (3) |
| **Lives in the same state as older adult**    |        |
| Yes                                           | 215 (74) |
| No                                            | 76 (26) |
| Not reported                                  | 13 (4) |
| **Frequency of contact**                      |        |
| Weekly or more frequently                     | 212 (70) |
| Less than weekly                              | 64 (21) |
| Not reported                                  | 28 (9) |
Table 3 – Percentage of alters within each variable category that provide each type of support (n=304)*

|                      | Appraisal Support** | Emotional Support | Informational Support | Instrumental Support |
|----------------------|---------------------|-------------------|-----------------------|---------------------|
| **Relationship**     |                     |                   |                       |                     |
| Friends              | 13%                 | 72%               | 25%                   | 18%                 |
| Family               | 11%                 | 61%               | 18%                   | 42%                 |
| **Location**         |                     |                   |                       |                     |
| In-state             | 13%                 | 62%               | 16%                   | 41%                 |
| Out-of-state         | 9%                  | 77%               | 31%                   | 11%                 |
| **Age (years)**      |                     |                   |                       |                     |
| Under 60             | 10%                 | 59%               | 20%                   | 41%                 |
| 60 or older          | 16%                 | 75%               | 21%                   | 23%                 |
| **Gender**           |                     |                   |                       |                     |
| Female               | 16%                 | 61%               | 22%                   | 34%                 |
| Male                 | 5%                  | 69%               | 17%                   | 27%                 |
| **Frequency of contact** |                 |                   |                       |                     |
| Less than weekly     | 11%                 | 57%               | 30%                   | 22%                 |
| Weekly or more frequent | 13%              | 68%               | 16%                   | 37%                 |

*One alter can provide multiple types of support, so row totals do not equal 100%.

**Appraisal support = help in decision-making and giving feedback; emotional support = love, caring, sympathy and understanding available from others; informational support = provision of information in the service of particular needs; instrumental support = assistance with tangible tasks
Table 4 – Number of alters providing each type of support, averaged over older adult participant characteristics

| Participant-level Categorical variables | Appraisal Support* | Emotional Support | Informational Support | Instrumental Support |
|----------------------------------------|--------------------|-------------------|-----------------------|---------------------|
|                                        | Mean   | SD    | Mean   | SD    | Mean   | SD    | Mean   | SD    |
| Gender                                 |        |       |        |       |        |       |        |       |
| Female                                 | 0.54   | 0.99  | 2.59   | 2.31  | 1.03   | 1.41  | 1.34   | 1.24  |
| Male                                   | 0.26   | 0.45  | 1.44   | 1.5   | 1.41   | 1.99  | 1.07   | 1.27  |
| Age Group                              |        |       |        |       |        |       |        |       |
| Under 70                               | 0.52   | 0.99  | 1.83   | 2.10  | 1.39   | 1.12  | 1.26   | 1.21  |
| 70 to 79                               | 0.59   | 1.04  | 2.75   | 2.21  | 1.69   | 2.25  | 0.84   | 1.17  |
| 80 and older                           | 0.27   | 0.52  | 2.03   | 2.10  | 0.45   | 0.67  | 1.67   | 1.24  |
| Education                              |        |       |        |       |        |       |        |       |
| High school or less                    | 0.00   | 0.00  | 1.90   | 1.79  | 1.00   | 1.25  | 0.8    | 0.92  |
| Some college                           | 0.48   | 0.95  | 2.39   | 1.34  | 0.96   | 1.02  | 1.35   | 1.15  |
| College                                | 0.36   | 0.68  | 2.21   | 2.90  | 0.68   | 1.16  | 1.61   | 1.29  |
| Post-graduate                          | 0.73   | 1.08  | 2.31   | 2.05  | 1.92   | 2.26  | 0.96   | 1.34  |
| Living Situation                       |        |       |        |       |        |       |        |       |
| Assisted living                        | 0.29   | 0.59  | 2.06   | 1.64  | 0.47   | 0.8   | 1.76   | 1.09  |
| Independent                            | 0.59   | 1.01  | 2.27   | 2.29  | 2.09   | 2.33  | 1.18   | 1.40  |
| Independent -shared                    | 0.54   | 1.06  | 2.21   | 2.00  | 1.25   | 1.54  | 1.00   | 1.06  |
| Retirement community                   | 0.38   | 0.71  | 2.33   | 2.62  | 0.67   | 0.76  | 1.29   | 1.33  |
| Any Portal Use                         |        |       |        |       |        |       |        |       |
| No                                     | 0.47   | 0.91  | 2.03   | 2.05  | 0.79   | 1.20  | 1.4    | 1.21  |
| Yes                                    | 0.44   | 0.85  | 2.63   | 2.33  | 1.83   | 2.05  | 1.0    | 1.29  |

*Appraisal support = help in decision-making and giving feedback; emotional support = love, caring, sympathy and understanding available from others; informational support = provision of information in the service of particular needs; instrumental support = assistance with tangible tasks
Table 5 – Pearson’s $r$ values for the correlation between older adult characteristics and number of alters providing each type of support

| Participant-level Continuous Variables | Appraisal Support* | Emotional Support | Informational Support | Instrumental Support |
|----------------------------------------|--------------------|-------------------|-----------------------|---------------------|
| LSNS$^1$ - family                       | 0.04               | 0.31              | 0.14                  | 0.12                |
| API$^2$ – decision-making              | -0.29              | -0.27             | -0.14                 | 0.17                |

$^1$LSNS = Lubben Social Network Scale; $^2$API = Autonomy Preference Index

*Appraisal support = help in decision-making and giving feedback; emotional support = love, caring, sympathy and understanding available from others; informational support = provision of information in the service of particular needs; instrumental support = assistance with tangible tasks.