OXFORD

THE GERONTOLOGICAL SOCIETY OF AMERICA®

Original Research Article

Older Adult Health-Related Support Networks: Implications for the Design of Digital Communication Tools

Miruna Petrescu-Prahova, PhD,[1,][*] Katie Osterhage, MMS,[2] Jean O. Taylor, PhD,[1] Ian Painter, PhD,[1] Yong Choi, PhD, MPH,[3] and Anne M. Turner, MD, MPH[1,4]

[1]Department of Health Services, School of Public Health, University of Washington, Seattle. [2]Department of Family Medicine, School of Medicine, University of Washington, Seattle. [3]Betty Irene Moore School of Nursing, University of California, Davis, Sacramento. [4]Department of Biomedical Informatics and Medical Education, School of Medicine, University of Washington, Seattle.

*Address correspondence to: Miruna Petrescu-Prahova, PhD, Department of Health Services, School of Public Health, University of Washington, 1107 NE 45th St, Seattle, Washington 98105. E-mail: mirunapp@uw.edu

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 was 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 semistructured 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 the involvement of friends and family regardless of their physical location, allow for the 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 which older adults are likely to use them and how they accommodate the different roles of network members.

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 (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 (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 (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, DeVito 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 & Spillman, 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), because 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, & Baecker, 2019; Mitzner et al.,

2010; Tsai, Shillair, Cotten, Winstead, & Yost, 2015). This is in part due to a 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 was 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 the 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 who 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 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 University of Washington Institutional Review Board approved this study.

We conducted in-person semistructured interviews in the participants' homes, lasting 90–120 min. 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 in the *Social network data* section).

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 comorbidity 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, posttraumatic stress disorder, or bipolar disorder. We used the Lubben Social Network Scale (LSNS-6; Lubben et al., 2006) to assess the size of the 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 a 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 the 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 article, 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 and colleagues (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, e.g., 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 (Seeman & Berkman, 1988; Wellman & Wortley, 1990).

We conducted the qualitative analysis of interview transcripts using the Dedoose web application (SocioCultural Research Consultants LLC, 2018). 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. Because 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 provides 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 LSNS, 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 LSNS 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 who 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 the 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 88 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 comorbidity index less than 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).

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 than 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, 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.

Relationship Between Alter Characteristics and Type of Support They Provide

As shown in Table 3, 16% of female alters provided *appraisal support*, compared with only 5% of male alters; 16% 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 aged 60 and older.

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

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 (years)	
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)
Postgraduate	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	39 (45)
I want	
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[a]	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)
Yes	20 (24)
Portal use	
No	58 (66)
Yes	30 (34)
	Mean (*SD*)
LSNS—friends subscale	9.2 (3.9)
LSNS—family subscale	8.1 (3.5)
API—decision-making scale (0–100)	44 (20)
API—information-seeking scale (0–100)	84 (12)

Note: AI/AN = American Indian/Alaska Native; LSNS = Lubben Social Network Scale; API = Autonomy Preference Index.
[a]Independent-shared dwellings had certain requirements based on age/disability, but no provision of meals or personal care services.

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)

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 who 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 who 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.

Table 3. Percentage of Alters Within Each Variable Category That Provide Each Type of Support (*n* = 304)[a]

	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)				
<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%

Note: 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.
[a]One alter can provide multiple types of support, so row totals do not equal 100%.

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								
<70	0.52	0.99	1.83	2.10	1.39	1.12	1.26	1.21
70–79	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
Postgraduate	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

Note: 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.

Participants with a postgraduate education identified more alters who provided *appraisal support* (i.e., decision making and feedback support) than participants with lower levels of education. Women and participants with higher LSNS—family subscale scores (i.e., the total size of family support network, including people who

provide nonhealth-related support) nominated a greater number of alters providing *emotional support*. Younger participants, those in independent living, those with postgraduate education, and those who used online patient portals had a greater number of alters providing *informational support*. Older participants and those with a

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—family	0.04	0.31	0.14	0.12
API—decision making	−0.29	−0.27	−0.14	0.17

Note: LSNS = Lubben Social Network Scale; 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.

college education nominated more alters providing *instrumental support*.

Discussion and Implications

In this article, we describe the size, composition, and support function of health-related support networks of older adults. We examine (1) whether network members with certain sociodemographic 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 the 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 because 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 nonkin 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 who provided emotional support than men, which is in line with previous findings about women's support networks (Antonucci & Akiyama, 1987). Although 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 the privacy of communication and usability (Mitzner et al., 2010).

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 younger than 60 years, 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 by friends and family as well (Barbosa Neves et al., 2019; Tsai, Shillair, & Cotten, 2017).

We found that our respondents had, on average, 0.5 alters who 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 following list highlights key considerations for the design of tools to promote and leverage support from network members:

- Facilitate the 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 to 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 the health outcomes of older adults.

Funding

Acknowledgments

Conflict of Interest

None reported.

References

Anderson, M., & Perrin, A. (2017). *Tech adoption climbs among older adults*. Washington, DC: Pew Research Center. https://www.pewresearch.org/internet/2017/05/17/tech-adoption-climbs-among-older-adults/

Andersson, M. A., & Monin, J. K. (2018). Informal care networks in the context of multimorbidity: Size, composition, and associations with recipient psychological well-being. *Journal of Aging and Health*, **30**, 641–664. doi:10.1177/0898264316687623

Antonucci, T. C., Ajrouch, K. J., & Birditt, K. S. (2014). The convoy model: Explaining social relations from a multidisciplinary perspective. *The Gerontologist*, **54**, 82–92. doi:10.1093/geront/gnt118

Antonucci, T. C., & Akiyama, H. (1987). An examination of sex differences in social support among older men and women. *Sex Roles*, **17**, 737–749. doi:10.1007/BF00287685

Ashida, S., & Heaney, C. A. (2008). Differential associations of social support and social connectedness with structural features of social networks and the health status of older adults. *Journal of Aging and Health*, **20**, 872–893. doi:10.1177/0898264308324626

Badawy, P. J., Schafer, M. H., & Sun, H. (2019). Relocation and network turnover in later life: How distance moved and functional health are linked to a changing social convoy. *Research on Aging*, **41**, 54–84. doi:10.1177/0164027518774805

Barbosa Neves, B., Franz, R., Judges, R., Beermann, C., & Baecker, R. (2019). Can digital technology enhance social connectedness among older adults? A feasibility study. *Journal of Applied Gerontology*, **38**, 49–72. doi:10.1177/0733464817741369

Berkman, L. F., Glass, T., Brissette, I., & Seeman, T. E. (2000). From social integration to health: Durkheim in the new millennium. *Social Science & Medicine (1982)*, **51**, 843–857. doi:10.1016/s0277-9536(00)00065-4

Berkman, N. D., Sheridan, S. L., Donahue, K. E., Halpern, D. J., & Crotty, K. (2011). Low health literacy and health outcomes: An updated systematic review. *Annals of Internal Medicine*, **155**, 97–107. doi:10.7326/0003-4819-155-2-201107190-00005

Bernard, H. R. (2017). *Research methods in anthropology: Qualitative and quantitative approaches*. Lanham, MD: Rowman & Littlefield.

Burt, R. S., Meltzer, D. O., Seid, M., Borgert, A., Chung, J. W., Colletti, R. B.,…Margolis, P. (2012). What's in a name generator? Choosing the right name generators for social network surveys in healthcare quality and safety research. *BMJ Quality & Safety*, **21**, 992–1000. doi:10.1136/bmjqs-2011-000521

Callahan, C. M., Unverzagt, F. W., Hui, S. L., Perkins, A. J., & Hendrie, H. C. (2002). Six-item screener to identify cognitive impairment among potential subjects for clinical research. *Medical Care*, **40**, 771–781. doi:10.1097/00005650-200209000-00007

Cammack, V., & Byrne, K. (2012). Accelerating a network model of care: Taking a social innovation to scale. *Technology Innovation Management Review*, **2**, 26–30. doi:10.22215/timreview/578

Chaudhry, S., Jin, L., & Meltzer, D. (2005). Use of a self-report-generated Charlson Comorbidity Index for predicting mortality. *Medical Care*, **43**, 607–615. doi:10.1097/01.mlr.0000163658.65008.ec

Cornwell, E. Y., & Waite, L. J. (2012). Social network resources and management of hypertension. *Journal of Health and Social Behavior*, **53**, 215–231. doi:10.1177/0022146512446832

Cotten, S. R., Anderson, W. A., & McCullough, B. M. (2013). Impact of internet use on loneliness and contact with others among older adults: Cross-sectional analysis. *Journal of Medical Internet Research*, **15**, e39. doi:10.2196/jmir.2306

Czaja, S. J., Boot, W. R., Charness, N., Rogers, W. A., & Sharit, J. (2018). Improving social support for older adults through technology: Findings from the PRISM randomized controlled trial. *The Gerontologist*, **58**(3), 467–477. doi:10.1093/geront/gnw249

DiMatteo, M. R. (2004). Social support and patient adherence to medical treatment: A meta-analysis. *Health Psychology*, **23**, 207–218. doi:10.1037/0278-6133.23.2.207

Ende, J., Kazis, L., Ash, A., & Moskowitz, M. A. (1989). Measuring patients' desire for autonomy: Decision making and information-seeking preferences among medical patients. *Journal of General Internal Medicine*, **4**, 23–30. doi:10.1007/BF02596485

Findlay, R. A. (2003). Interventions to reduce social isolation amongst older people: Where is the evidence? *Ageing and Society*, **23**, 647–658. doi:10.1017/S0144686X03001296

Garattini, C., Wherton, J., & Prendergast, D. (2012). Linking the lonely: An exploration of a communication technology designed to support social interaction among older adults. *Universal Access in the Information Society*, **11**, 211–222. doi:10.1007/s10209-011-0235-y

Goldzweig, C. L., Orshansky, G., Paige, N. M., Towfigh, A. A., Haggstrom, D. A., Miake-Lye, I.,…Shekelle, P. G. (2013). Electronic patient portals: Evidence on health outcomes, satisfaction, efficiency, and attitudes: A systematic review. *Annals of Internal Medicine*, **159**, 677–687. doi:10.7326/0003-4819-159-10-201311190-00006

Hagan, R., Manktelow, R., Taylor, B. J., & Mallett, J. (2014). Reducing loneliness amongst older people: A systematic search and narrative review. *Aging & Mental Health*, **18**, 683–693. doi:10.1080/13607863.2013.875122

Han, J., & Wiley, J. (2013). Digital illness narratives: A new form of health communication. Transactions of the International Conference on Health Information Technology Advancement 2013. https://scholarworks.wmich.edu/ichita_transactions/18

Hartzler, A., Skeels, M. M., Mukai, M., Powell, C., Klasnja, P., & Pratt, W. (2011). Sharing is caring, but not error free: Transparency of granular controls for sharing personal health information in social networks. *AMIA. Annual Symposium Proceedings. AMIA Symposium*, **2011**, 559–568.

Hsieh, H. F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research*, **15**, 1277–1288. doi:10.1177/1049732305276687

Irizarry, T., DeVito Dabbs, A., & Curran, C. R. (2015). Patient portals and patient engagement: A state of the science review. *Journal of Medical Internet Research*, **17**, e148. doi:10.2196/jmir.4255

Jung, E. H., Walden, J., Johnson, A. C., & Sundar, S. S. (2017). Social networking in the aging context: Why older adults use or avoid Facebook. *Telematics and Informatic*, **34**, 1071–1080. doi:10.1016/j.tele.2017.04.015

Kelley, K., & Preacher, K. J. (2012). On effect size. *Psychological Methods*, **17**, 137–152. doi:10.1037/a0028086

Khosravi, P., Rezvani, A., & Wiewiora, A. (2016). The impact of technology on older adults' social isolation. *Computers in Human Behavior*, **63**, 594–603. doi:10.1016/j.chb.2016.05.092

Kim, H.-J., Fredriksen-Goldsen, K. I., Bryan, A. E. B., & Muraco, A. (2017). Social network types and mental health among LGBT older adults. *The Gerontologist*, **57**(Suppl 1), S84–S94. doi:10.1093/geront/gnw169

Krumholz, H. M., Butler, J., Miller, J., Vaccarino, V., Williams, C. S., Mendes de Leon, C. F., . . . Berkman, L. F. (1998). Prognostic importance of emotional support for elderly patients hospitalized with heart failure. *Circulation*, **97**, 958–964. doi:10.1161/01.cir.97.10.958

Levine, D. M., Lipsitz, S. R., & Linder, J. A. (2016). Trends in seniors' use of digital health technology in the United States, 2011–2014. *JAMA*, **316**, 538–540. doi:10.1001/jama.2016.9124

Lubben, J., Blozik, E., Gillmann, G., Iliffe, S., von Renteln Kruse, W., Beck, J. C., & Stuck, A. E. (2006). Performance of an abbreviated version of the Lubben Social Network Scale among three European community-dwelling older adult populations. *The Gerontologist*, **46**, 503–513. doi:10.1093/geront/46.4.503

Marin, A., & Hampton, K. N. (2007). Simplifying the personal network name generator: Alternatives to traditional multiple and single name generators. *Field Methods*, **19**, 163–193. doi:10.1177/1525822X06298588

Masi, C. M., Chen, H. Y., Hawkley, L. C., & Cacioppo, J. T. (2011). A meta-analysis of interventions to reduce loneliness. *Personality and Social Psychology Review*, **15**, 219–266. doi:10.1177/1088868310377394

Matthew-Maich, N., Harris, L., Ploeg, J., Markle-Reid, M., Valaitis, R., Ibrahim, S., Isaacs, S. (2016). Designing, implementing, and evaluating mobile health technologies for managing chronic conditions in older adults: A scoping review. *JMIR MHealth and UHealth*, **9**(4), e29. doi:10.2196/mhealth.5127

Mickelson, R. S., Unertl, K. M., & Holden, R. J. (2016). Medication management: The macrocognitive workflow of older adults with heart failure. *JMIR Human Factors*, **3**, e27. doi:10.2196/humanfactors.6338

Mitzner, T. L., Boron, J. B., Fausset, C. B., Adams, A. E., Charness, N., Czaja, S. J., Sharit, J. (2010). Older adults talk technology: Technology usage and attitudes. *Computers in Human Behavior*, **26**, 1710–1721. doi:10.1016/j.chb.2010.06.020

National Academies of Sciences, Engineering, and Medicine. (2016). *Families caring for an aging America*. Washington, DC: The National Academies Press. doi:10.17226/23606

Nowland, R., Necka, E. A., & Cacioppo, J. T. (2018). Loneliness and social internet use: Pathways to reconnection in a digital world? *Perspectives on Psychological Science*, **13**, 70–87. doi:10.1177/1745691617713052

Philipson, C., Bernard, M., Phillips, J., & Ogg, J. (2000). *The family and community life of older people: Social networks and social support in three urban areas*. London, UK: Routledge. doi:10.1097/00019442-200207000-00017

Quan-Haase, A., Mo, G. Y., & Wellman, B. (2017). Connected seniors: How older adults in East York exchange social support online and offline. *Information Communication and Society*, **20**, 967–983. doi:10.1080/1369118X.2017.1305428

R Core Team. (2016). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. Http://Www.R-Project.Org/

Reeder, B., Zaslavksy, O., Wilamowska, K. M., Demiris, G., & Thompson, H. J. (2011). Modeling the oldest old: Personas to design technology-based solutions for older adults. *AMIA. Annual Symposium Proceedings. AMIA Symposium*, **2011**, 1166–1175.

Seeman, T. E., & Berkman, L. F. (1988). Structural characteristics of social networks and their relationship with social support in the elderly: Who provides support. *Social Science & Medicine (1982)*, **26**, 737–749. doi:10.1016/0277-9536(88)90065-2

Seeman, T. E., Lusignolo, T. M., Albert, M., & Berkman, L. (2001). Social relationships, social support, and patterns of cognitive aging in healthy, high-functioning older adults: MacArthur studies of successful aging. *Health Psychology*, **20**, 243–255. doi:10.1037//0278-6133.20.4.243

Skeels, M. M., Unruh, K. T., Powell, C., & Pratt, W. (2010). Catalyzing social support for breast cancer patients. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. CHI Conference*, **2010**, 173–182. doi:10.1145/1753326.1753353

Smyth, K. A., Rose, J. H., McClendon, M. J., & Lambrix, M. A. (2007). Relationships among caregivers' demographic characteristics, social support ratings, and expectations of computer-mediated support groups. *Journal of Applied Gerontology*, **26**(10), 58–77. doi:10.1177/0733464806296144

SocioCultural Research Consultants LLC. (2018). *Dedoose version 8.0.35, web application for managing, analyzing, and presenting qualitative and mixed method research data*. Los Angeles, CA: SocioCultural Research Consultants, LLC.

Thoits, P. A. (2011). Mechanisms linking social ties and support to physical and mental health. *Journal of Health and Social Behavior*, **52**, 145–161. doi:10.1177/0022146510395592

Tsai, H. S., Shillair, R., & Cotten, S. R. (2017). Social support and "Playing Around": An examination of how older adults acquire digital literacy with tablet computers. *Journal of Applied Gerontology*, **36**, 29–55. doi:10.1177/0733464815609440

Tsai, H. S., Shillair, R., Cotten, S. R., Winstead, V., & Yost, E. (2015). Getting grandma online: Are tablets the answer for increasing digital inclusion for older adults in the U.S.? *Educational Gerontology*, **41**, 695–709. doi:10.1080/03601277.2015.1048165

Turner, A. M., Osterhage, K. P., Taylor, J. O., Hartzler, A. L., & Demiris, G. (2018). A closer look at health information seeking by older adults and involved family and friends: Design considerations for health information technologies. *AMIA. Annual Symposium Proceedings. AMIA Symposium*, **2018**, 1036–1045.

Valdez, R. S., & Brennan, P. F. (2015). Exploring patients' health information communication practices with social network members as a foundation for consumer health IT design. *International Journal of Medical Informatics*, **84**, 363–374. doi:10.1016/j.ijmedinf.2015.01.014

Valente, T. W. (2010). *Social networks and health: Models, methods, and applications*. Cary, NC: Oxford University Press.

Volkman, J. E., Luger, T. M., Harvey, K. L., Hogan, T. P., Shimada, S. L., Amante, D., Houston, T. K. (2014). The National Cancer Institute's Health Information National Trends Survey [HINTS]: A national cross-sectional analysis of talking to your doctor and other healthcare providers for health information. *BMC Family Practice*, **15**, 111. doi:10.1186/1471-2296-15-111

Wasserman, S., & Faust, K. (1994). *Social network analysis: Methods and applications*. Cambridge, MA: Cambridge University Press.

Wellman, B., & Wortley, S. (1990). Different strokes from different folks: Community ties and social support. *American Journal of Sociology*, **96**, 558–588. doi:10.1086/229572

White, A. M., Philogene, G. S., Fine, L., & Sinha, S. (2009). Social support and self-reported health status of older adults in the United States. *American Journal of Public Health*, **99**, 1872–1878. doi:10.2105/AJPH.2008.146894

Wolff, J. L., & Spillman, B. (2014). Older adults receiving assistance with physician visits and prescribed medications and their family caregivers: Prevalence, characteristics, and hours of care. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, **69**(Suppl 1), S65–S72. doi:10.1093/geronb/gbu119