

# **Aging in Place in Los Angeles: Recognizing Challenges to Social Connectedness**

---

Leonard Davis School of Gerontology | University of Southern California



**Kate Wilber, E-mail: [wilber@usc.edu](mailto:wilber@usc.edu)**

**Haley Gallo, Hyunju Shim, Stephen Frochen, Kelly Ford**

December 2018

## EXECUTIVE SUMMARY

In our review of the literature and focus groups with older adults, we found that older adults have a wide range of technology use patterns and diverse characteristics that influence their likelihood of feeling lonely. While some older adults do not have the resources or the desire to use technology, others use mobile phones, smart phones, tablets, and computers – either in combination or alone – for purposes such as contacting their family and friends, accessing health care information, getting the news, shopping, and watching television. In Part I we describe existing policies and programs that offer technology and Internet resources for older adults, and in Part II we present findings from focus groups about technology use and social connectedness among older Angelenos. In line with this theme, in Part III we highlight students' ideas for applications that alleviate social isolation and loneliness among older adults. Though some studies suggest that technology is associated with reduced feelings of loneliness among older adults, there is a dearth of research that examines how technology-based communication is associated with feelings of loneliness compared to in-person contact. To build on our findings from the first two phases, in Part IV we used data from the Health and Retirement Study (HRS) to examine whether frequency or mode of contact (technology-based versus in-person) influenced the likelihood that older adults felt lonely.

This report summarizes our review of the literature regarding technology use and isolation among older adults and focuses on the findings from our focus groups with English, Spanish, and Korean-speaking older adults at St. Barnabas Senior Services (SBSS). We also present the winning submissions from the contest in which students pitched their ideas regarding applications that can alleviate social isolation and loneliness among older adults, and our results from the secondary data analysis. Finally, we make preliminary recommendations for future policies, programs, and research that AARP, in collaboration with Purposeful Aging Los Angeles (PALA) as well as other public and private partners, should consider regarding the intersection of technology and intergenerational community engagement to reduce social isolation and loneliness among older Angelenos.

## PART I: SURVEY OF POLICIES AND INTERVENTIONS

The 21st century has been shaped by the influence of unprecedented longevity and advanced digital technology. As a result, understanding the use of technology and its effect on older adults has become increasingly important. The concept of promoting the use of technology for older populations – or gerontechnology – began in 1980s with an open question about how to design new technology to better assist older people to cope with aging processes and maintain functional ability in their chosen environments (Czaja & Barr, 1989; Charness & Jastrzembski, 2009; Schulz, Wahl, Matthews, Dabbs, Beach & Czaja, 2014). The earliest definition of gerontechnology was “the study of technology and aging for the improvement of the daily functioning of the elderly” (Bouma, 1992, p. 1).

Technology can be an effective tool to help older adults age in place, as it can assist with instrumental activities of daily living including communications, shopping, health management, banking, and transportation. Even food preparation can be arranged and carried out online. Innovative technological approaches present government, service providers, friends, and families with new ways to meet the needs of older people from the convenience of their homes (Goodwin, 2013). The connection to community and services, which the Internet affords, has the potential to mitigate the geographical challenges posed to older adults, particularly those in remote and unsafe neighborhoods, supporting aging in place efforts and helping them avoid institutional care for as long as possible (Kim & Gray, 2016; Kim, 2008). See ([Appendix A](#)) for examples of existing programs and interventions that use technology to promote social connectedness among older adults.

A review of the literature ([Appendix B](#)) revealed a wide range of technology uses among older adults, including for purposes of preventing social isolation, connecting to family and friends, accessing health care, online dating, getting the news, shopping, and searching for information. The access to and adoption of technology is just as diverse as the people who use (or don't use) it. For this Report we use the following definitions by Perlman & Peplau (1998, pp. 571):

**Loneliness:** “The subjective psychological discomfort people experience when their network of social relationships is significantly deficient in either quality or quantity.”

**Social Isolation:** “The objective situation of being alone or lacking social relationships.”

Additionally, we use the World Health Organization's definition of **social connectivity** (WHOQOL Group, 1995, pp. 1405):

“Individuals' perception of the interpersonal relationships and social roles in their life.”

## PART II: FOCUS GROUPS

The perception often exists that older adults are out-of-touch with technology, yet in reality, growing numbers of older adults use technology for daily activities. In 2000, only 14% of older Americans used the Internet; in 2016, however, 67% of people aged 65 years and older reported going online (Anderson & Perrin, 2017). Older adults who are White, younger, more educated, and who have higher income are more likely to have smartphones and use the Internet (Anderson & Perrin, 2017), yet Los Angeles is home to older adults with diverse backgrounds that are not necessarily reflective of these demographics.

To explore and understand technology adoption and social connectivity among low-income older adults, we organized six sessions of focus groups with older adults who used St. Barnabas Senior Services (SBSS) during October 2017. SBSS is located in the Westlake neighborhood, just west of downtown Los Angeles. Reflecting the demographic characteristics of the neighborhoods around SBSS, the majority of focus group participants were Latino or Korean, and the average age for all participants was 73.8 years old. For more information on the composition of the focus groups, see [Appendix C](#). Participants were recruited in their primary language.

To understand technology use patterns from multiple cultures, two focus groups were conducted in Spanish, two in Korean, and two in English. Though we do not make systematic comparisons between the responses in each of these languages, we present a few observations regarding differences between language groups that arose during analysis. Spanish- and Korean-speaking focus groups were transcribed and translated to English by the facilitator and then coded and analyzed by English-speaking researchers.

A major goal of the focus groups was to determine how older adults use technology and how technology relates to their social health. We explored how focus group participants used technology to participate in social and civic life, who they connected with, whether they were satisfied with their online interactions, and the patterns, issues, and barriers to Internet use.

Participants used a wide range of technological devices and had varying levels of comfort and satisfaction with technology. Not only were there some differences in technology adoption between focus groups, but also different degrees of technology adoption occurred within each group. Across the English, Spanish, and Korean-speaking focus groups, the participants used various modes of technology – including cell phones and computers – to keep in contact with friends and family. They also reported learning how to use technology in a variety of ways. Some were comfortable using smartphones, computers, and tablets, while others said that this technology was too complicated and expensive.

### TECHNOLOGY USES

Consistent with the technology uses identified in the literature review ([Appendix B](#)), participants from the focus groups used a wide range of devices (Figure 1) including computers (some in their own homes, and some at the senior center), tablets, and cell phones (basic cell phones and smartphones). Some felt comfortable using the computer multiple times per day to check the news, while others had no interest in buying a computer. Some said they do not use the computer because they preferred to watch television. Those who used computers used them to search for information, look up bus schedules, plan for international travel, and some even used them

to learn English. Many of these uses reflected those identified in the literature review as well (Bolle et al., 2015; Olson, O'Brien, Rogers, & Charness, 2011; AARP, 2015).

Almost 25% of focus group participants own a computer, either with (20.0%) or without (4.4%) Internet access. This is similar to national estimates from 2010 which demonstrated that a third of older adults in the U.S. owned a computer (U.S. Census Bureau, 2010). This lags behind more recent estimates, however, which demonstrate that approximately two-thirds of older adults own a computer (U.S. Census Bureau, 2016). Interestingly, a fifth of the focus group participants did not report using any computing devices.

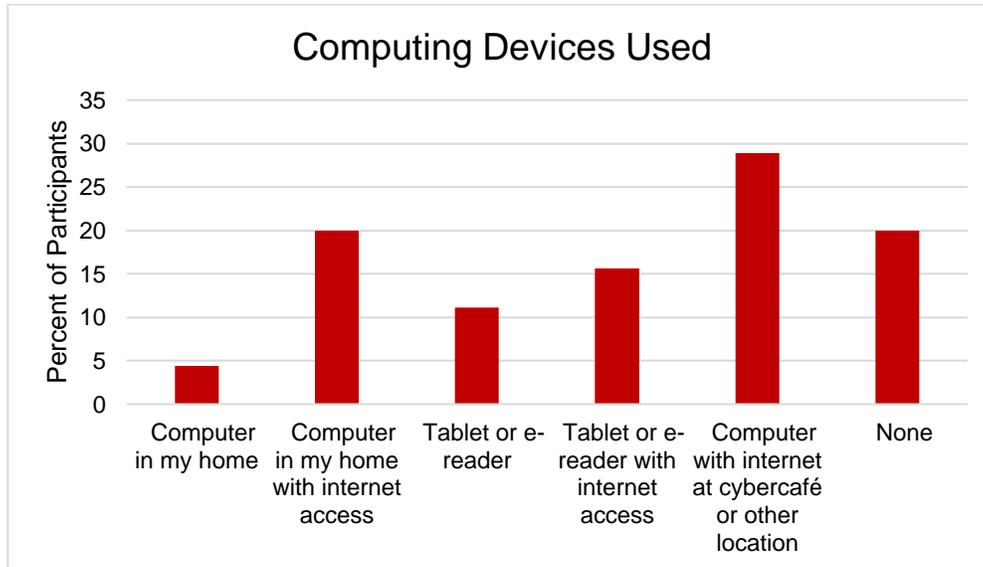


Figure 1. Computing devices used by focus group participants (N = 45).

Focus group participants demonstrated a range of technology preferences; some preferred to use tablets because, as one participant from a Korean focus group explained, notification functions on cell phones are “too noisy...and fonts are small and will hurt my eyes.” Studies examining older adults aged 65 and over who own tablets found that most older adults felt that tablets were intuitively easier than laptops or other computers to use, and 90% of these adults cited benefits such as feeling connected to their families and communities (Tsai, Shillair, Cotten, Winstead & Yost, 2015). Additionally, social support both in technical (e.g., how much help older adults can get from their family in learning to use the device) and emotional (e.g., how much interaction they have by using tablets) were important determinants of tablet use (Barnard, Bradley, Hodgson & Lloyd, 2013; Tsai, Shillair & Cotten, 2014).

While some focus group participants used computers and did not feel the need to go online with a smartphone, others said they have stopped using computers in the senior center Cyber Café because they now have smartphones. For some, particularly for African American and Hispanic populations and lower income households, smartphones provide a means to access Internet services that are otherwise inaccessible (Prieger, 2013; Smith, 2015a).

---

## CELL PHONE USES

Cell phone use and access varied across focus group participants (Figure 2). Almost 11% of participants did not have cell phones, 39.1% had basic cell phones, and half had smartphones. Some used many features of their smartphones, some had smartphones but did not know how to use them, and some did not want a smartphone. Rather, they used cell phones to call and text their family and friends, check the time, and call someone in case they have an emergency. Those who used smartphones used them for checking the news in other countries, checking the weather, watching Netflix and YouTube, playing games, and video chatting with their family and friends. Among those who had smartphones, almost no one used them to order ride hailing services (e.g., Uber, Lyft).

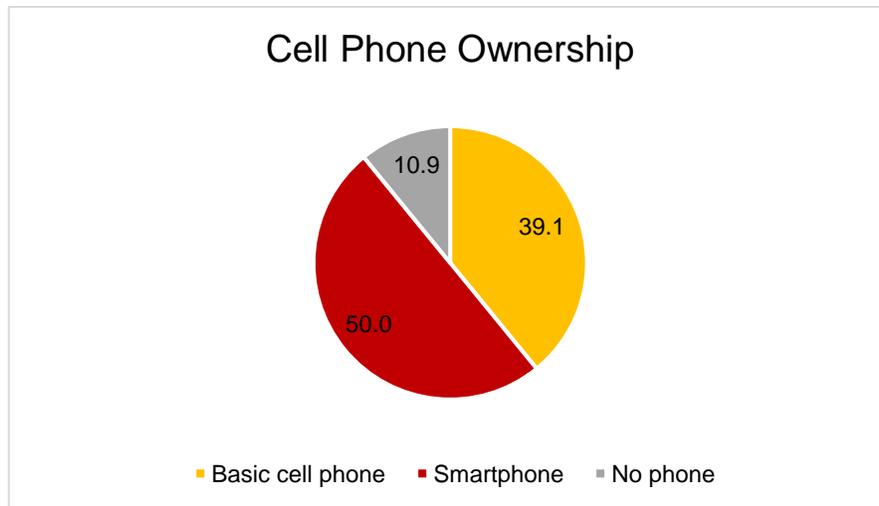


Figure 2. Cell phone ownership among focus group participants (N = 46).

In addition to the range of uses within each group, some differences emerged in the patterns of cell phone use between the language groups. In one of the Spanish groups, for instance, only one participant had a smartphone, while the majority of participants had smartphones in the second Spanish group. Participants in the Korean focus groups mentioned using their smartphones for watching dramas and documentaries.

The roughly four in ten participants with basic cell services indicated that they were content and did not feel the need for a smartphone. One participant from an English focus group remarked that his basic cell phone “is a camera, it’s got music, games. It’s got anything, just about anything else that I need.” Another participant from a Spanish focus group said,

*“I have had many opportunities to get a smartphone, but every time I reject it. I am good with the cheap one.”*

## KEEPING IN CONTACT

Social support augmented by online interaction among older adults is thought to be an intermediary explanatory factor of wellbeing (Heo, Chun, Lee, Lee, & Kim, 2015). Internet use among older people varies directly with explanatory factors such as support from the community, personal fulfillment, and confidence in oneself (Erickson & Johnson, 2011; Sum, Matthews, & Hughes, 2009; Chang, McAllister, & McCaslin, 2015). Gatto and

Tak (2008) show that older people in America can gain long term connection and personal fulfillment through use of the Internet to keep in touch with friends and family and for recreational purposes. Beyond mere communication with others, online interaction is related to increased participation in community organizations, including churches, clubs, and senior centers (Hogeboom, McDermott, Perrin, Osman, & Bell-Ellison, 2010), as well as increased leisure and the quality of relationships (Heo, Kim, & Won, 2011).

Although focus group participants reported using cell phones (for both texting and calling), email, video chat, and language-specific apps to keep in contact with family and friends, many used more than one mode of communication to stay in contact. One participant from an English group, for instance, said,

*“Yeah, I write, I write letters. I like to write. I call, I use my cell phone, computer. All of the above.”*

Many participants said they would like more contact with their family and friends (especially for those that live far away), while others expressed satisfaction with the frequency of contact that they have. Many preferred communicating in-person when possible, but they enjoyed video chat technology that allowed them to see their family and friends’ faces.

Participants used apps like Facebook Messenger, Viber, WhatsApp, and KakaoTalk to contact family in other countries for free. One participant in a Korean focus group said,

*“So, I do mostly KakaoTalk, especially face time talk feature. I really like it when I can talk with my granddaughter face-to-face like that.”*

Some participants reported using different modes of technology depending on what language they need to communicate in. One participant noted,

*“Well, I think using English 100% for contact is difficult. So, in my opinion, using cell phone is usually good for keeping in contact in Korean. For emails, using English is okay.”*

---

## “TECHNO KIDS”

Since its inception in the late 20th century, the Internet has grown in use and functionality, becoming a part of everyday American life. This is true for older Americans as well as their younger counterparts even though older people have historically been considered digitally deprived. The ‘digital divide’ seems to be narrowing, with computer and Internet usage up more than two-fold among older adults in the U.S. following the turn of the century (Hong & Cho, 2016). Nevertheless, focus group participants expressed their dissatisfaction at younger peoples’ reliance on technology.

In one of the English-speaking groups, a long discussion revealed a concern about the generational gap in peoples’ ability to communicate in-person. Many older adults blame technology for the growing number of young people who don’t know how to interact with people without using a cell phone. One participant explained:

*“The techno kids of today...just use symbols and don’t have any personal relationships with anything...”*

Though the participants liked the convenience and entertainment that comes with technology, they still valued face-to-face communication and in-person interactions.

## ABILITY TO USE TECHNOLOGY

Discussions suggested a wide range in the participants' abilities to use technology. Some felt very comfortable using smartphones and computers, while others liked using basic cell phones because they are easy to use. Others did not want to learn to use technology or at least did not prioritize it. SBSS offers computer classes and music classes, and one of the participants from an English focus group said that she wanted to focus her time on learning music before she took computer classes.

We did not find much difference in ability to use technology between language groups. In each group, some people felt comfortable using technology, and others did not. In one of the Spanish groups, for instance, when asked if they liked using a smartphone the most, one participant said, "Yes," another said, "Very easy," and yet another said, "For me it is not easy."

One participant from a Korean focus group accurately summarized the varying levels of ability to use technology by saying:

*"I teach other seniors how to use computers at the center, but those who come to the center, they are selective samples. They're very smart and up-to-date. But you should remember there's many people who are not like that. There's so many seniors who can't use Internet although they have smartphone. They can't read emails, too."*

---

## LEARNING HOW TO USE TECHNOLOGY

Not unlike younger adults, older adults report that learning how to use devices and communication applications is typically a process of trial and error, one that involves "playing around" with the technology (Tsai, Shillair, & Cotton, 2017, p. 29). Focus group participants said that it takes them time to learn how to use new technology, and they forget how to use it if they do not frequently make use of what they learned. Some of them said that their children help them use technology; one even pointed out that it is hard to learn how to use the computer when you do not have children to help you. Many of them took computer classes at SBSS. One participant from a Spanish focus group who took these classes said:

*"At the beginning, for me [learning to use the computer] was very difficult but for me it is better now...because of practice."*

## PERCEIVED QUALITY OF TECHNOLOGY

Some of the participants liked the convenience and the information that comes from having more technology. Some reported liking technology because of a variety of direct benefits: children can easily transfer funds to them, international travel can be more convenient, they can find bus schedules and directions, and email allows them to contact family and friends in different time zones and contact potential employers. One participant from an English focus group said:

*“I think by using the social media that we have through our electronic devices and computers we are able to reach out and touch more people so that they are more aware of us and our abilities if we want to work or be employed or whatever that we would not have if we didn’t have this technology.”*

Some were pleased that they qualified for “the Obama phone” (as they described it) through General Assistance, Supplemental Security Income, or Section 8.

---

## BARRIERS TO ADOPTION

While adoption of technology and social media have the potential to promote social connectivity, there are many factors that hinder older adults’ adoption including cost, disinterest, and a lack of the skills needed to use various devices. Several participants noted that they could not rely on children to teach them to use technology. One participant explained that learning to use technology is difficult,

*“...because I don’t have children. For those with children, they can see how their children use them. But I can’t learn that way, and gotta do it on my own.”*

A few participants mentioned that they did not trust certain aspects of technology, particularly when it comes to transferring funds and using their credit cards. The two main barriers to technology adoption that participants endorsed were that it is “too complicated” or too expensive.

Many of the participants commented that too much information exists on the Internet and there is too much to learn in order to use different types of technology. Participants preferred only using technology that felt easy to use, and when asked what makes it difficult to learn how to use other devices, participants from the Korean focus groups explained their hesitations:

*“It’s too complicated. I don’t want to learn”* and

*“I, until recently, used a regular phone and had to change because my children insisted on it. But a regular cell phone is much more convenient. Smartphone is too complicated. It’s good because it has many features. But I can’t use even 5% of its capacity.”*

In addition to challenges in learning new technology, many participants talked about technology and Internet prices preventing them from using certain devices:

*You know why I don’t have a computer? It is because then I have to pay the Internet bill. One can’t afford to pay all those things.*

The participants in the Korean groups did not explicitly mention any financial barriers to their technology use. They did report, however, using certain apps that allowed them to call family and friends in other countries at low rates. In addition to using KakaoTalk to contact family and friends, one participant explained,

*“For family members in Korea, if I try to call them it takes lots of time and is also costly. With emails, I don’t have to worry about those and they can also read my message when it’s convenient for them.”*

## CONCLUSION

For many older people, the use of social media and communication technology is a means to a very specific end: keeping in touch with friends and family – particularly children and grandchildren – which motivates them to apply themselves to the learning curve (Chiu, Hu, Lin, Chang, Chang, & Lai, 2016). Studies show that even moderate amounts of time improve older adults' attitudes about using the Internet, communication technology, and social media, reducing distrust and increasing comfort and ease of use (Xie, Watkins, Golbeck, & Huang, 2012). Although older people have concerns about privacy and the risks of exposing their personal and private information on social media, (Lehtinen, Nasanen, & Sarvas, 2009), they also recognize its value in maintaining a sense of control, garnering social support, strengthening relationships, and reducing stress (Shapira, Barak, & Gal, 2007; Gatto & Tak, 2008; Leist, 2013; Wright, 2000). Additionally, social networking tools and websites provide older adults with opportunities to solve both social and practical problems, such as social inclusion and assistance with instrumental activities of daily living (IADLs), through the wide array of social supports and services available at one's fingertips via online networking (Sum, Mathews, Pourghasem, & Ian, 2008).

The patterns of technology use as described by the older adults from these focus groups provide an insight into the wide range of technology adoption among low-income older adults in the metropolitan Los Angeles area. We found that there was a relatively high use of some technology among this engaged group. Yet the older adult population in Los Angeles is increasingly diverse, with varieties in older adults' abilities and desires to use technology. Among a relatively engaged group of older adults who are connected through a comprehensive senior center, many indicated a reluctance to adopt newer technology because they preferred to communicate in-person and they expressed concerns that technology is too complicated or too expensive; others used it for entertainment, to plan local and long-distance travels, and to communicate with their loved ones. These insights can be applied to developing programs and opportunities for older adults to grow more comfortable using technology and to help them navigate the barriers that prevent them from technology adoption.

## PART III: STUDENT CONTEST

USC's Gerontechnology master class, as well as students from other graduate and undergraduate classes, submitted proposals for technological solutions to social isolation for the residents of Los Angeles County. On Wednesday, April 4, the five finalists were asked to "pitch" their proposals to a distinguished panel of judges, including:

- Dean Pinchas Cohen, M.D., Professor of Gerontology, Medicine and Biological Sciences; USC Leonard Davis School of Gerontology; William and Sylvia Kugel Dean's Chair in Gerontology
- Laura Trejo, General Manager, City of Los Angeles Dept. on Aging
- Professor Aaron Hagedorn, Associate Professor, USC Leonard Davis School of Gerontology

Students were asked to respond to the following questions:

1. What does the proposed technology do?
2. How does it improve social connectivity and reduce loneliness/isolation among older adults?
3. Why is it needed?

4. Who are the targeted users?
5. What are potential barriers to the adoption of this technology? How will you address those barriers?

Proposals were evaluated on:

1. Innovation: uniqueness of concept, creativity, and ability to address the problem
2. Feasibility: technological capability to implement, ease of implementation
3. Significance: ability to improve social connectivity/reduce loneliness through technology
4. Originality: technology should not duplicate what already exists
5. Marketability: Extent of need in population (how many people need/would be interested in this?)

## RESULTS

Winner	Description
1 <sup>st</sup> Place, \$500 - Jennifer Lee, <b>CoLab</b>	<p><b>CoLab</b> envisions a collaborative learning platform between older adults and USC students.</p> <p>The incentive of the application is to connect with the impetus of sharing knowledge through continued learning opportunities, as taught by the students.</p> <p><b>CoLab</b> mitigates social isolation through intergenerational socialization.</p>
2 <sup>nd</sup> Place, \$300 - Kelly Ann Ford, Adam Baker, Tung-Ying Lu, <b>CATCH!</b> (“Community+Match”)	<p><b>CATCH!</b> employs the neighborhood principles of the app “NextDoor” with the companionship principles of the social site, Stitch.net.</p> <p>NextDoor is the <i>private</i> social network for people, their neighbors, and their community.</p> <p>Stitch.net is a dating and companionship site which helps anyone over 50 find the companionship they need.</p> <p><b>CATCH!</b> is a <i>social village</i> that combines these two concepts, encouraging a mini “village” model to emerge in the community.</p>

<p>3<sup>rd</sup> Place, \$200 - Jean Galiana,  <b>“Better Together”</b></p>	<p><b>“Better Together”</b> is an app that enables older adults to post a need and be connected to registered volunteers who live in their community.</p> <p>“Better Together” relies on the growing sharing economy to improve the lives of older adults.</p>
----------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Final feedback from the judges to all participants highlighted the students’ excellent understanding and appreciation of the problem of social isolation. The students were lauded for the creativity and ingenuity of their ideas and were strongly encouraged to continue to develop them. Professor Hagedorn encouraged the students to consider the practicality and marketability of their ideas.

Ms. Trejo agreed, and emphasized that students should also continue to think in day-to-day terms when it comes to executing any new program within an older adult community. She encouraged students to be mindful of administrative concerns and incorporate marketing plans, an important element of executing successful programs.

Dean Cohen, who is a strong champion of the use of technology to enhance the lives of older adults, encouraged the students to send him summaries of their ideas as he continues to reach out to other schools at USC, such as the Viterbi School of Engineering and the Annenberg School of Communications, to discuss potential collaborations.

**PART IV: EXAMINING DATA RELATED TO SOCIAL CONNECTIVITY AND TECHNOLOGY**

Exploring available data sets suggested that the Health and Retirement Study (HRS), a nationally representative longitudinal sample of adults aged 50 and older, offered the most useful data set to address core questions related to connectedness and technology. The HRS, which was first fielded in 1992, is conducted every two years surveying a representative sample of people aged 50 and older (N=26,000). We selected the HRS for several reasons, including the focus on middle-aged as well as older adults, its in-depth interviews using a representative sample of people in the United States, and the specific data it offers on loneliness through an additional Leave Behind Questionnaire that is not available in other studies. In addition, two researchers at USC with extensive experience on the HRS were available to assist with the secondary analysis.

To augment our HRS analyses, we included the California Health Interview Survey (CHIS), which is the country’s largest state health survey. The CHIS offers key information on Californians of all ages and allows for a closer examination of demographic characteristics including age, race and ethnicity.

Secondary data analysis was conducted using the 2014 Leave Behind Questionnaire of the HRS. In addition, we examined the 2016 wave of the California Health Interview Survey (CHIS). It should be noted that while the HRS includes measures of loneliness, the CHIS does not. Therefore, based on sociodemographic characteristics and place-based factors of the CHIS sample, we extrapolate our findings from the national HRS dataset to discuss implications for older adults in California.

---

## SAMPLE CHARACTERISTICS

The CHIS sample is somewhat older with 65% of respondents in our analysis aged 65 and older compared to 51.9% of HRS respondents. A majority of both the HRS (54.1%) and the CHIS (57.2%) sample are female. Additionally, the CHIS sample has proportionally fewer White and Black respondents, and more Hispanic and Other Race respondents than the national HRS sample (Table 1).

Though both samples are highly educated, a larger proportion of the CHIS sample completed at least some college (almost 70%) compared to the HRS sample (54.5%). More than a third of the CHIS sample lives alone (37.7%), compared to about a quarter of the HRS sample (24.2%).

On average, HRS respondents report living in neighborhoods high in neighborhood social cohesion (assessed by questions about how people in the neighborhood interact) ( $M = 5.4$ ,  $SD = 1.3$ ; scale ranges from 1 to 7). The CHIS measure of neighborhood social cohesion differs slightly from that in HRS. The CHIS sample, however, reports living in neighborhoods high in social cohesion ( $M = 3.2$ ,  $SD = 0.5$ ; scale ranges from 1 to 4). Questions that assess neighborhood social cohesion can be found in [Appendix D](#).

**Table 1. Sample Characteristics in HRS and CHIS**

	HRS (N=6,800)		CHIS (N=11,795)	
	N	% or M(SD)	N	% or M(SD)
<b>Sociodemographic Factors</b>				
<b>Age</b>				
54-64	2,634	48.1	4,133	35.0
65-79	3,018	39.4	5,661	48.0
80+	1,148	12.5	2,001	17.0
<b>Gender</b>				
Female	4,008	54.1	6,750	57.2
Male	2,791	46.0	5,045	42.8
<b>Race</b>				
White	4,722	78.1	7,551	64.0
Black	1,127	9.9	516	4.4
Hispanic	751	8.7	1,771	15.0
Other	192	3.2	1,957	16.6
<b>Education</b>				
Less than high school	1,043	12.7	1,194	10.1
High school grad or GED	2,368	32.8	2,354	20.0
At least some college	3,388	54.5	8,247	69.9
<b>Income</b>				
<\$30K	2,431	30.4	6,770	32.2
\$30K - \$70K	2,272	31.1	6,032	28.7
\$70K - \$150K	1,489	26.4	5,503	26.1
\$150K +	608	12.2	2,750	13.1
<b>Marital Status</b>				
Married or partnered	4,232	65.1	6,100	51.7
Separated	956	14.6	2,302	19.5
Widowed	1,291	14.2	2,365	20.1
Never married	321	6.1	1,028	8.7
<b>Place-Based Factors</b>				
<b>Rurality</b>				
Urban or suburban	4,976	72.7	8,979	76.1
Rural	1,824	27.3	2,816	23.9
<b>Living Arrangement</b>				
Lives alone	1,657	23.4	4,452	37.7
Lives with one other person	3,514	52.4	5,113	43.4
Lives with 2+ people	1,629	24.2	2,230	18.9
Neighborhood social cohesion	6,673	5.4 (1.3)	11,790	3.2 (0.5)
<b>Mobility</b>				
Trouble walking one block	1,047	14.0		
Trouble walking across the room	432	5.9		
Trouble climbing one flight of stairs	1,233	16.3		
Trouble walking, climbing stairs, reaching, etc.			3,723	31.6
Trouble going outside home alone			1,182	10.0

<sup>a</sup> Neighborhood social cohesion is measured on a scale from 1 (low) to 7 (high) in HRS, and on a scale from 1 (low) to 4 (high) in CHIS

---

## FINDINGS ON ISOLATION/LONELINESS

Over a quarter (26.4%) of the HRS sample reported feeling lonely at least some of the time (Table 2). The CHIS does not collect information about feelings of loneliness.

Compared to males (46.0%), a higher proportion of females were lonely (54.1%). Loneliness also varied by race, ranging from 20.6% among Hispanics to 30.7% among Blacks. The proportion of people who felt lonely decreased as education and income increased. Loneliness also varied by marital status and living arrangement: 20.7% of married participants were lonely, compared to 42.7% of those who never married. 36.8% of those who lived alone were lonely compared to 22.1% of those who lived with one other person and 25.8% of those who lived with two or more people. Additionally, people who lived in rural regions (31.4%) were more likely to be lonely than those who live in urban or suburban regions (24.6%), and people who had trouble walking one block, walking across the room, or climbing a flight of stairs were more likely to be lonely than their more mobile peers. People who were lonely reported living in neighborhoods lower in social cohesion ( $M=4.9$ ,  $SD=1.4$ ) than people who were not lonely ( $M=5.6$ ,  $SD = 1.3$ ).

**Table 2. Characteristics of HRS Sample by Loneliness Status<sup>a</sup>**

	N	% or M(SD)	Lonely (%) <sup>b</sup>	Not Lonely (%) <sup>b</sup>
	6,800		26.4	73.6
<b>Sociodemographic Factors</b>				
<b>Age*</b>				
54-64	2,634	48.1	29.2	70.8
65-79	3,018	39.4	22.7	77.3
80+	1,148	12.5	27.6	72.4
<b>Gender*</b>				
Female	4,008	54.1	27.1	72.9
Male	2,791	46.0	25.7	74.3
<b>Race*</b>				
White	4,722	78.1	26.5	73.5
Black	1,127	9.9	30.7	69.3
Hispanic	751	8.7	20.6	79.4
Other	192	3.2	29.0	71.0
<b>Education*</b>				
Less than high school	1,043	12.7	31.4	68.6
High school grad or GED	2,368	32.8	28.3	71.7
At least some college	3,388	54.5	24.2	75.8
<b>Income*</b>				
<\$30K	2,431	30.4	35.7	64.3
\$30K - \$70K	2,272	31.1	25.8	74.2
\$70K - \$150K	1,489	26.4	21.4	78.6
\$150K +	608	12.2	16.2	83.8
<b>Marital Status*</b>				
Married or partnered	4,232	65.1	20.7	79.3
Separated	956	14.6	38.4	61.6
Widowed	1,291	14.2	33.5	66.5
Never married	321	6.1	42.7	57.3
<b>Place-Based Factors</b>				
<b>Rurality*</b>				
Urban or suburban	4,976	72.7	24.6	75.4
Rural	1,824	27.3	31.4	68.6
<b>Living Arrangement*</b>				
Lives alone	1,657	23.4	36.8	63.2
Lives with one other person	3,514	52.4	22.1	77.9
Lives with two or more people	1,629	24.2	25.8	74.2
Neighborhood social cohesion <sup>*,c</sup>	6,673	5.4 (1.3)	4.9 (1.4)	5.6 (1.3)
<b>Mobility</b>				
<b>Trouble walking one block*</b>				
Yes	1,047	14.0	43.2	56.8
No	5,732	86.0	23.6	76.4
<b>Trouble walking across the room*</b>				
Yes	432	5.9	46.5	53.5
No	6,364	94.1	25.1	74.9
<b>Trouble climbing one flight of stairs*</b>				
Yes	1,233	16.3	39.4	60.6
No	5,485	83.7	23.7	76.3

\* All tests of statistical significance are two-tailed; significant Chi square test for differences in proportion of participants who are lonely versus not lonely

<sup>a</sup> Percentages are calculated based on person weights for HRS participants

<sup>b</sup> Row percentages

<sup>c</sup> Range from 1 (low) to 7 (high)

## FREQUENCY OF CONTACT BY MODE AND LONELINESS STATUS

The most common mode of contact among HRS participants was using phone calls (M=4.5), followed by in-person meetings (M=3.7), writing letters/emails (M=2.8), and using social media (M=2.2), respectively (Figure 3). Participants who were not lonely reported using each mode more frequently than those who were lonely ( $p < .05$ ).

The proportion of people who were lonely at least some of the time decreased as frequency of contact increased for both in-person meetings and phone calls. Greater frequency of contact with writing/emailing and using social media, on the other hand, was not associated with a smaller proportion of lonely people (Figure 4).

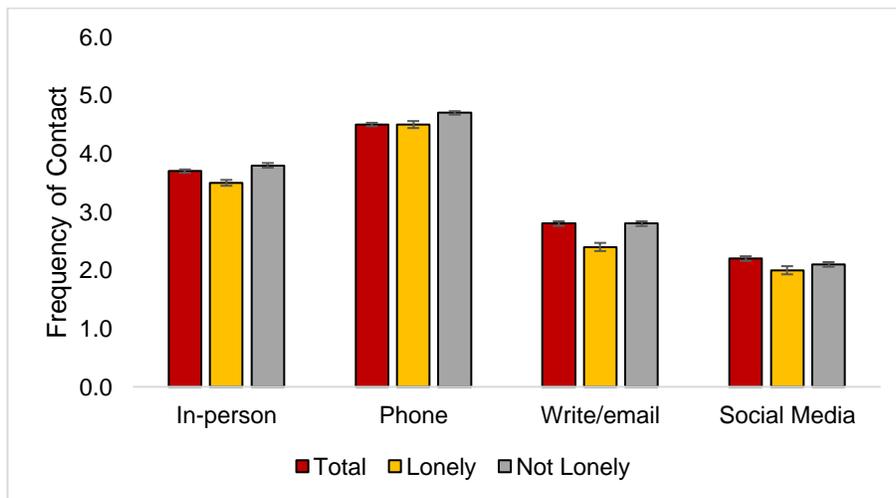


Figure 3. Average frequency of contact for each mode among the total sample and by loneliness status. Error bars are 95% confidence intervals. 1=Less than once a year or never; 6=Three or more times per week.

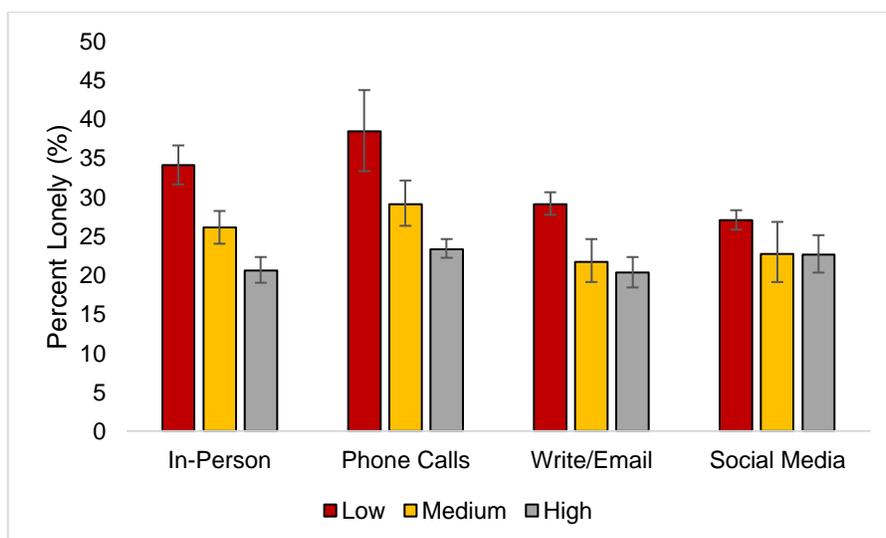


Figure 4. Percent lonely by frequency of contact. Error bars are 95% Confidence Intervals. Low frequency = less than once a year or never or once or twice a year; medium frequency = every few months or once or twice a month; high frequency = once or twice a week or three or more times a week.

## CALIFORNIA ESTIMATES OF LONELINESS

Based on the bivariate associations between loneliness and respondent characteristics in the HRS, we can use the CHIS to extrapolate the number of Californians who are lonely based on these characteristics. There are approximately 10.2 million Californians aged 54 years and older (U.S. Census Bureau, 2017), of whom we estimate about 2.7 million are lonely at least of the time (assuming an equal portion are lonely compared to the HRS national estimate). In the HRS sample, loneliness varied across factors such as income, marital status, geography, and living arrangement. For example, 20.7% of the married HRS sample were lonely at least some of the time, compared to 42.7% of those who were never married. About half of the CHIS sample were married, while less than 9% were never married. We estimate that approximately 1.1 million married Californians aged 55 and older are lonely, while about 379,000 never married Californians are lonely. Although the never-married group makes up a smaller proportion of the population, they are disproportionately affected by loneliness. Additionally, about a quarter of HRS respondents who live in urban or suburban regions are lonely, compared to almost a third of those who live in rural regions. About a quarter of middle-aged and older Californians live in rural regions, which places approximately 765,000 at increased risk of loneliness.

Although we cannot directly compare factors such as neighborhood social cohesion and mobility limitations between the national and the California datasets, we predict that safer, more inclusive neighborhoods and increased ability to physically access them are associated with lower rates of loneliness in the CHIS, just as in the HRS.

## DISCUSSION

These findings are consistent with others that report that older adults who live in rural regions are more likely to be lonely (Savikko et al., 2005; Drennan et al, 2008). Additionally, those who live alone (Savikko et al., 2005; Theeke, 2009), and those who have mobility limitations (Perissinotto et al., 2012) are more likely to report feeling lonely than are their more connected peers. Neighborhoods that are higher in social cohesion may encourage more social interaction and companionship, especially for older adults who live alone (Brommell & Cagney, 2014). Feeling that one lives in a safe and welcoming neighborhood may then encourage community engagement and reduce feelings of loneliness.

Though previous literature has mixed results regarding the relationship between technology use and feelings of loneliness, our findings suggest that technology-based contact is not associated with feelings of loneliness. Social media was the least frequently used mode of contact among HRS participants, and more frequent use was not associated with a lower proportion of people who were lonely.

Just as the demographic characteristics of older Californians differ slightly from older Americans in general, it is important to note that these characteristics also differ not only between, but also within diverse communities

across the state. Though the HRS sample reported low neighborhood physical disorder, participants in the focus groups at SBSS reported feeling unsafe as they walked in the community. Many reported fear of theft, as well as difficulty navigating uneven pavements and vendors who block the sidewalks. It is important to remember that if these participants – who had the physical and cognitive capacity to travel to SBSS – did not always feel that their neighborhoods were safe and accessible, community engagement and access to resources must seem impossible to older adults who have more severe mobility limitations. The proportion of lonely participants also increased as income decreased. Low-income older adults in Los Angeles may be disproportionately affected by isolation and loneliness compared to their wealthier fellow Angelenos with access to resources such as private transportation and membership-based Villages.

Just as respondents from HRS reported varying frequency and modes of communication with their networks, the participants in the focus groups also reported a wide range of methods to contact their children, family, and friends. The participants prefer communicating in-person when possible, but they enjoy video chat technology that allows them to see their family and friends' faces, especially when they live far away. While Skyping with loved ones who live far away or connecting with friends on Facebook may not be a good replacement for in-person contact, it may reduce feelings of loneliness among people who have trouble visiting their networks in-person as often as they would like. Identifying potential risk factors for loneliness (i.e., living alone, living in a rural region) can help target policies and interventions that promote social connectivity. While technology may serve as a useful tool to reduce loneliness among some older adults, the nature of these interventions must be tailored to fit the needs and circumstances of each person.

## RECOMMENDATIONS

Designs for both policies and products should place more emphasis on place-based factors such as living arrangement, neighborhood social cohesion and inclusion, and improving accessibility and opportunities to interact for people with mobility limitations.

Loneliness interventions should target people who live alone, who have trouble leaving their homes, and who do not feel connected to friends/families or their neighborhoods. Local organizations, including those with religious affiliations, should advertise opportunities for support and reduce the stigma that surrounds feelings of loneliness.

Local governments should prioritize transportation assistance and promote community engagement for older residents to combat isolation, loneliness, and the negative health outcomes that result. Rather than viewing technology as a potential panacea for loneliness, policy makers and product designers must consider how technology use intersects with the built environment to promote more inclusive communities for people of all ages.

To learn more about promising practices, with funding from the Leonard Davis School, Professor Wilber and doctoral student Haley Gallo met with age-friendly experts in five countries: The Republic of Ireland, The U.K. (England and Wales), Belgium, The Netherlands, and Denmark. The trip culminated in a presentation to the WHO Healthy Cities Task Force on Healthy Ageing. The WHO's Global Network of Age-Friendly Cities and Communities (2007) provides a framework that guides over 700 communities throughout the world in localized efforts to make communities accessible for people of all ages. This framework focuses on eight domains of livability: Outdoor

Spaces and Buildings, Transportation, Housing, Social Participation, Respect and Social Inclusion, Civic Participation and Employment, Communication and Information, and Community Support and Health Services. Based on these meetings we identified seven general areas to consider regarding lessons learned and next steps to make communities more age-friendly:

1. Individual well-being plans: preference-based, person-centered care offered in each of the domains of livability. This model avoids a “one-size-fits-all” approach to improving the community and recognizes that there are a wide range of older residents with different needs and priorities.
2. Designate an Age-Friendly Champion to ensure that plans are implemented: hire someone who is knowledgeable about community culture, policies, and infrastructure that can translate research into age-friendly policies and programs.
3. Utilize co-production models (Buffel, 2018): Phase 1: Take steps to ensure that older adults from diverse backgrounds are not only consulted but are also included in the design of research methodology, data collection and interpretation, and implementation of policies that are inspired by the findings. Phase 2: Consider developing this into a peer-to-peer program, with those who start in phase 1 moving to a helping role in phase 2, in which they gather input from others who are less likely to reach out or to be included.
  - a. Improve efforts to address loneliness and engagement by creating an advisory board of older adults who would not normally have the opportunity to participate in designing and developing an initiative. In addition to the peers described above, work with frontline providers, physicians, and Meals on Wheels to identify isolated older adults who would most benefit by serving in this role. Also consider using public schools and ask students to take information to older adult relatives. Measure the outcome of inclusion on feelings of loneliness, well-being, generativity, and engagement.
4. Assess and improve the physical environment at the neighborhood level (Burholt, Roberts, & Musselwhite, 2016): focus not only on making public spaces more accessible, but also on helping older adults improve what is right outside their front doors. This includes quality of the pavement, litter on the ground, and improving the aesthetics of the neighborhood (i.e., planting flowers) to encourage people to spend more time outdoors and interacting with others. Seek to engage people of all ages in this effort.
  - a. Identify priorities from the planning phase to improve sidewalks, increase the number of low-cost or free public transportation options and ride-share services, and increase security in high-crime neighborhoods. Identify one or two priority areas to pursue and to evaluate. By addressing the livability domains of Outdoor Spaces and Buildings and Transportation, we will also improve Social Participation, Respect and Social Inclusion, and Civic Participation and Employment, as these steps will help older adults feel safe in the community and reduce social isolation.
5. Consider approaches and ask for input on best practices to promote awareness and accommodate diversity: this includes young and old residents, urban and rural regions, people with different racial, ethnic, and cultural backgrounds, political ideologies, and physical and cognitive abilities. Consider using a diversity indicator using these metrics on the individuals targeted and the outcomes.

6. Promote intergenerational collaboration: engage students from diverse academic areas (i.e., architecture, urban planning, public policy, medicine, occupational therapy, social work, gerontology) and develop approaches with their schools to help them work with older adults to assess needs and design solutions to ensure greater age-friendliness. Make this a multi-step and collaborative process to allow these groups to refine their solutions. Assess well-being, feelings of generativity, and ageist attitudes before and after this collaboration.
7. Design interventions to support and increase connectivity that target older adults who live alone or in rural regions, who have trouble leaving their homes, and who do not feel connected to their neighborhoods, as these groups are at the greatest risk of loneliness.
  - a. Consider supporting a randomized controlled trial that provides tablets (or another device) and Internet for high-risk (e.g., low-income, home-bound older adults), in which students or other volunteers help them work with technology tasks such as how to use Skype, e-mail, Facebook, and other person-specific requests. This will help address the Age-Friendly domains of Respect and Social Inclusion, Communication and Information, and to some extent Community and Health Services.

## REFERENCES

- AARP Foundation. (2012). Framework for isolation in adults over 50. Retrieved from [https://www.aarp.org/content/dam/aarp/aarp\\_foundation/2012\\_PDFs/AARP-Foundation-Isolation-Framework-Report.pdf](https://www.aarp.org/content/dam/aarp/aarp_foundation/2012_PDFs/AARP-Foundation-Isolation-Framework-Report.pdf)
- AARP Research. (2015). Travel Research: 2016 Travel Trends. Retrieved from [http://www.aarp.org/content/dam/aarp/research/surveys\\_statistics/general/2015/AARP-2016-travel-trends.pdf](http://www.aarp.org/content/dam/aarp/research/surveys_statistics/general/2015/AARP-2016-travel-trends.pdf)
- Administration on Aging. (2013). Profile of older Americans: 2014 profile. Retrieved from [http://www.aoa.acl.gov/aging\\_statistics/profile/2014/2.aspx](http://www.aoa.acl.gov/aging_statistics/profile/2014/2.aspx)
- Aguilar, A., Boerema, C., & Harrison, J. (2010). Meanings attributed by older adults to computer use. *Journal of Occupational Science*, 17, 27-33.
- Amante, D. J., Hogan, T. P., Pagoto, S. L., English, T. M., & Lapane, K. L. (2015). Access to care and use of the Internet to search for health information: results from the US National Health Interview Survey. *Journal of medical Internet research*, 17(4), e106-e106.
- Anderson, G. O. (2016<sup>a</sup>). Technology trends among mid-life and older Americans. *AARP Research*.
- Anderson, M. (2016<sup>b</sup>). Technology device ownership: 2015. *Pew Research Center*. Retrieved from [http://www.pewinternet.org/files/2015/10/PI\\_2015-10-29\\_device-ownership\\_FINAL.pdf](http://www.pewinternet.org/files/2015/10/PI_2015-10-29_device-ownership_FINAL.pdf)
- Anderson, M., & Perrin, A. (2017). Tech adoption climbs among older adults. 1-21. Washington, D.C: PEW Internet & American Life Project. Retrieved from [http://assets.pewresearch.org/wp-content/uploads/sites/14/2017/05/16170850/PI\\_2017.05.17\\_Older-Americans-Tech\\_FINAL.pdf](http://assets.pewresearch.org/wp-content/uploads/sites/14/2017/05/16170850/PI_2017.05.17_Older-Americans-Tech_FINAL.pdf)

- Anderson, M., & Perrin, A. (2015). 15% of Americans don't use the internet. Who are they. *Washington, DC: Pew Research Center*. [http:// www. pewresearch. org/ fact-tank](http://www.pewresearch.org/fact-tank), 7, 28.
- Ballantyne, A., Trenwith, I., Zubrinich, S., Corlis, M. (2010). 'I feel less lonely: What older people say about participating in a social networking website. *Quality in Ageing and Older Adults Information*, 11, 25-35.
- Barnard, Y., Bradley, M. D., Hodgson, F., & Lloyd, A. D. (2013). Learning to use new technologies by older adults: Perceived difficulties, experimentation behaviour and usability. *Computers in Human Behavior*, 29(4), 1715-1724.
- Bedney, B. J., Goldberg, R. B., & Josephson, K. (2010). Aging in place in naturally occurring retirement communities: Transforming aging through supportive service programs. *Journal of Housing for the Elderly*, 24, 304-321.
- Bell, C., Fausset, C., Farmer, S., Nguyen, J., Harley, L., & Fain, W. B. (2013). Examining social media use among older adults. Proceedings from the 2013 ACM Conference on Hypertext and Social Media, 158-163.
- Bolle, S., van Weert, J. C., Daams, J. G., Loos, E. F., De Haes, H. C., & Smets, E. M. (2015). Online health information tool effectiveness for older patients: a systematic review of the literature. *Journal of health communication*, 20(9), 1067-1083.
- Bouma, H. (1992). Gerontechnology: Making technology relevant for the elderly. In H. Bouma & J. A. M. Graafmans (Eds.), *Gerontechnology* (pp. 1-5). Amsterdam: IOS Press.
- Brahmandam, S., Holland, W. C., Mangipudi, S. A., Braz, V. A., Medlin, R. P., Hunold, K. M., ... & Platts-Mills, T. F. (2016). Willingness and Ability of Older Adults in the Emergency Department to Provide Clinical Information Using a Tablet Computer. *Journal of the American Geriatrics Society*, 64(11), 2362-2367.
- Brommell, L. & Cagney, K. A. (2014). Companionship in the neighborhood context: Older adults' living arrangements and perceptions of social cohesion. *Res Aging*, 36(2): 228-43.
- Buffel, T. (2018). Social research and co-production with older people: Developing age-friendly communities. *J Aging Stud*, 44: 52-60.
- Burholt, V., Roberts, M. S., & Musselwhite, C. B. A. (2016). Older People's External Residential Assessment Tool (OPERAT): A complementary participatory and metric approach to the development of an observational environmental measure. *BMC Public Health*, 16:1022.
- Cain, C. L., Wallace, S. P., & Ponce, N. A. (2018). Helpfulness, trust, and safety of neighborhoods: Social capital, household income, and self-reported health of older adults. *The Gerontologist*, 58(1): 4-14.
- Carr, D. (2004). The desire to date and remarry among older widows and widowers. *Journal of Marriage and Family*, 66, 1051-1068.
- Carstensen, L. L. (1995). Evidence for a life-span theory of socioemotional selectivity. *Current directions in Psychological science*, 4(5), 151-156.

- Challands, K. G., Lacherez, P., & Obst, P. L. (2017). Does online social connectedness buffer risk of depression following driving cessation? An analysis of older drivers and ex-drivers. *Cyberpsychology, Behavior, and Social Networking*, 20 (4), 232-237.
- Chang, J., McAllister, C. & McCaslin, R. (2015). Correlates of, and barriers to, Internet use among older adults. *Journal of Gerontological Social Work*, 58, 66-85.
- Charness, N., & Jastrzembski, T. S. (2009). Gerontechnology. In *Future interaction design II* (pp. 1-29). Springer London.
- Chiu, C. J., Hu, Y. H., Lin, D. C., Chang, F. Y., Chang, C. S., & Lai, C. F. (2016). The attitudes, impact, and learning needs of older adults using apps on touchscreen mobile devices: Results from a pilot study. *Computers in Human Behavior*, 63, 189-197.
- Choi, N. G., & DiNitto, D. M. (2013<sup>a</sup>). Internet use among older adults: association with health needs, psychological capital, and social capital. *Journal of medical Internet research*, 15(5), e97.
- Choi, N. G., & DiNitto, D. M. (2013<sup>b</sup>). The digital divide among low-income homebound older adults: Internet use patterns, eHealth literacy, and attitudes toward computer/Internet use. *Journal of medical Internet research*, 15(5), e93.
- Choi, N. (2011). Relationship between health service use and health information technology use among older adults: Analysis of the US National Health Interview Survey. *Journal of medical Internet research*, 13(2).
- Chopik, W. J. (2016). The benefits of social technology use among older adults are mediated by reduced loneliness. *Cyberpsychology, Behavior, and Social Networking*, 19(9), 551-556.
- Cohen-Mansfield et al. (2016). Correlates and predictors of loneliness in older-adults: A review of quantitative results informed by qualitative insights. *International Psychogeriatrics*, 28(4): 557-76.
- Cotten, S. R., Ford, G., Ford, S., & Hale, T. M. (2014). Internet use and depression among retired older adults in the United States: A longitudinal analysis. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 69(5), 763-771.
- Cotten, S. R., Ford, G., Ford, S., & Hale, T. M. (2012). Internet use and depression among older adults. *Computers in Human Behavior*, 28, 496-499.
- Cresci, M. K., Yarandi, H. N., & Morrell, R. W. (2010). Pro-nets versus no-nets: Differences in urban older adults' predilection for Internet use. *Educational Gerontology*, 36, 500-520.
- Czaja, S. J., Charness, N., Fisk, A. D., Hertzog, C., Nair, S. N., Rogers, W. A., & Sharit, J. (2006). Factors predicting the use of technology: findings from the Center for Research and Education on Aging and Technology Enhancement (CREATE). *Psychology and aging*, 21(2), 333.
- Czaja, S. J., & Barr, R. A. (1989). Technology and the everyday life of older adults. *The Annals of the American Academy of Political and Social Science*, 127-137.

- Czaja, S. J., & Sharit, J. (1998). Age difference in attitudes toward computers. *Journals of Gerontology: Psychological Sciences*, 53, P329-340.
- Davis, E. M., & Fingerman, K. L. (2016). Digital dating: Online profile content of older and younger adults. *The Journals of Gerontology: Series B*, 71(6), 959-967.
- Drennan, J. et al. (2008). The experience of social and emotional loneliness among older people in Ireland. *Ageing and Society*, 28(8): 1113-32.
- Eastin, M. S., & LaRose, R. (2000). Internet self-efficacy and the psychology of the digital divide. *Journal of Computer Mediated Communication*, 6(1)
- Echt, K. V., & Burrige, A. B. (2011). Predictors of reported Internet use in older adults with high and low health literacy: The role of socio-demographic and visual and cognitive function. *Physical and Occupational Therapy in Geriatrics*, 29 (1), 23-43.
- Elliot, A. J., Mooney, C. J., Douthit, K. Z., & Lynch, M. F. (2014). Predictors of older adults' technology use and its relationship to depressive symptoms and well-being. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 69(5), 667-677.
- Erickson, J., & Johnson, G. M. (2011). Internet use and psychological wellness during late adulthood. *Canadian Journal on Aging*, 30, 197-209.
- File, T. (2013). Computer and Internet Use in the United States: Population Characteristics. *American Community Survey Reports*. Retrieved from <https://www.census.gov/content/dam/Census/library/publications/2013/demo/p20-569.pdf>
- Flynn, K. E., Smith, M. A., & Freese, J. (2006). When do older adults turn to the internet for health information? Findings from the Wisconsin Longitudinal Study. *Journal of General Internal Medicine*, 21(12), 1295-1301.
- Gatto, S., & Tak, S. (2008). Computer, Internet, and email use among older adults: Benefits and barriers. *Educational Gerontology*, 34, 800-811.
- Gitlow, L. (2014). Technology use by older adults and barriers to using technology. *Physical & Occupational Therapy in Geriatrics*, 32(3), 271-280.
- Goodwin, C. L. (2013). Use of the computer and the internet by well older adults. *Activities, Adaptation, and Aging*, 37, 63-78.
- Goswami, S., Köbler, F., Leimeister, J. M., & Krcmar, H. (2010). Using online social networking to enhance social connectedness and social support for the elderly.
- Gupta, B., Dasgupta, S., & Gupta (2008). Adoption of ICT in a government organization in a developing country. *Journal of Strategic Information Systems*, 17 (2), 140-154.
- Hardill, I., & Olphert, C. W. (2012). Staying connected: Exploring mobile phone use amongst older adults in the UK. *Geoforum*, 43(6), 1306-1312.
- Harper, S. (2004). *Families in ageing societies: a multi-disciplinary approach*. Oxford

University Press on Demand

- Heo, J., Chun, S., Lee, S., Lee, K. H., & Kim, J. (2015). Internet use and well-being in older adults. *Cyberpsychology, Behavior, and Social Networking*, 18 (5), 268-272.
- Heo, J., Kim, J., & Won, Y. (2011). Exploring the relationship between Internet use and leisure satisfaction among older adults. *Activities, Adaptation, & Aging*, 35, 43-54.
- Hogeboom, D. L., McDermott, R. J., Perrin, K. M., Osman, H., & Bell-Ellison, B. A. (2010). Internet use and social networking among middle aged and older adults. *Educational Gerontology*, 36, 93-111.
- Hong, Y. A., & Cho, J. (2016). Has the digital health divide widened? Trends of health-related internet use among older adults from 2003 to 2011. *Journals of Gerontology: Social Sciences*, 00 (00), 1-8.
- Houston, T. K., & Allison, J. J. (2002). Users of Internet health information: differences by health status. *Journal of medical Internet research*, 4(2), e7.
- Hughes, G., Bennett, K. M., & Hetherington, M. M. (2004). Old and alone: barriers to healthy eating in older men living on their own. *Appetite*, 43(3), 269-276.
- Ivan Watkins, J. D. (2015). Older adults' perceptions of using iPads for improving fruit and vegetable intake: an exploratory study. *Care Management Journals*, 16(1), 2.
- Iyer, R., & Eastman, J. K. (2006). The elderly and their attitudes toward the internet: the impact on internet use, purchase, and comparison shopping. *Journal of Marketing Theory and Practice*, 14(1), 57-67.
- Joe, J., & Demiris, G. (2013). Older adults and mobile phones for health: A review. *Journal of biomedical informatics*, 46(5), 947-954.
- Kim, J., & Gray, J. (2016). Qualitative Evaluation of an Intervention Program for Sustained Internet Use Among Low-Income Older Adults. *Ageing International*, 41(3), 240-253.
- Kim, J., Lee, H. Y., Christensen, M. C., & Merighi, J. R. (2016). Technology Access and Use, and Their Associations With Social Engagement Among Older Adults: Do Women and Men Differ? *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, gbw123.
- Kim, Y. S. (2008). Reviewing and critiquing computer learning and usage among older adults. *Educational Gerontology*, 34 (8), 709-735.
- Kobayashi, L. C., Wardle, J., & von Wagner, C. (2014). Internet use, social engagement and health literacy decline during ageing in a longitudinal cohort of older English adults. *Journal of epidemiology and community health*, jech-2014.
- Kontos, E., Blake, K. D., Chou, W. Y. S., & Prestin, A. (2014). Predictors of eHealth usage: insights on the digital divide from the Health Information National Trends Survey 2012. *Journal of medical Internet research*, 16(7), e172.

- Lee, Y. S. (2007, October). A survey of mobile phone use in older adults. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* (Vol. 51, No. 1, pp. 1-5). Sage Publications.
- Lehtinen, V. J., Nasanen, J., & Sarvas, R. (2009). A little silly and empty-headed: Older adults' understanding of social networking sites. *Proceedings from the 2009 Computer Society Conference on Human-Computer Interaction* (pp. 45-54).
- Leist, A. K. (2013). Social media use of older adults: A mini-review. *Gerontology*, 59(4), 378-384.
- Levy, H., Janke, A. T., & Langa, K. M. (2014). Health literacy and the digital divide among older Americans. *Journal of general internal medicine*, 30(3), 284-289.
- Lim, F. S., Wallace, T., Luszcz, M. A., & Reynolds, K. J. (2013). Usability of tablet computers by people with early-stage dementia. *Gerontology*, 59(2), 174-182.
- Madden, M., & Zickuhr, K. (2011). 65% of online adults use social networking sites. Washington, D.C.: Pew Research Center. Retrieved from <http://www.pewinternet.org/2011/08/26/65-of-online-adults-use-social-networking-sites/>
- McCloskey, D. W. (2006). The importance of ease of use, usefulness, and trust to online consumers: An examination of the technology acceptance model with older consumers. *Journal of Organizational and End User Computing*, 18(3), 47.
- Michael, Y. L., Berkman, L. F., Colditz, G. A., & Kawachi, I. (2001). Living arrangements, social integration, and change in functional health status. *American Journal of Epidemiology*, 153(2), 123-131.
- Mohadisdudis, H. M., & Ali, N. M. (2014, September). A study of smartphone usage and barriers among the elderly. In *User Science and Engineering (i-USEr), 2014 3rd International Conference on* (pp. 109-114). IEEE.
- Morahan-Martin, J. M. (2004). How internet users find, evaluate, and use online health information: a cross-cultural review. *CyberPsychology & Behavior*, 7(5), 497-510.
- Munoz, D., Cornejo, R., Gutierrez, F. J., Favela, J., Ochoa, S. F., & Tentori, M. (2015). A social cloud-based tool to deal with time and media mismatch of intergenerational family communication. *Future Generation Computer Systems*, 53, 140-151.
- Newall, N. E., Chipperfield, J. G., Clifton, R. A., Perry, R. P., Swift, A. U., & Ruthig, J. C. (2009). Causal beliefs, social participation, and loneliness among older adults: A longitudinal study. *Journal of Social and Personal Relationships*, 26 (2-3), 273-290.
- Nijland, N., van Gemert-Pijnen, J., Boer, H., Steehouder, M., & Seydel, E. (2008). Evaluation of internet-based technology for supporting self-care: problems encountered by patients and caregivers when using self-care applications. *Journal of medical Internet research*, 10(2), e13.

- Olson, K. E., O'Brien, M. A., Rogers, W. A., & Charness, N. (2011). Diffusion of technology: frequency of use for younger and older adults. *Ageing international*, 36(1), 123-145.
- Ono, H., & Zavodny, M. (2003). Gender and the Internet. *Social Science Quarterly*, 84(1), 111-121.
- Perissinotto, C. M., Cenzer, I. S., & Covinsky, K. E. (2012). Loneliness in older persons: A predictor of functional decline and death. *Archives of Internal Medicine*, 172(14): 1078-83.
- Perlman, D., & Peplau, L. A. (1998). Loneliness. In H. Friedman (Ed.), *Encyclopedia of Mental Health* (Vol. 2, pp. 571-581). San Diego, CA: Academic Press.
- Prieger, J. E. (2013). The broadband digital divide and the benefits of mobile broadband for minorities. *J Econ Inequal*, 13, 373–400. DOI 10.1007/s10888-015-9296-0
- Ramsey, A. T., Wetherell, J. L., Depp, C., Dixon, D., & Lenze, E. (2016). Feasibility and acceptability of smartphone assessment in older adults with cognitive and emotional difficulties. *Journal of technology in human services*, 34(2), 209-223.
- Rosenfeld, M. J., & Thomas, R. J. (2012). Searching for a mate: The rise of the Internet as a social intermediary. *American Sociological Review*, 77(4), 523-547.
- Saito, E., Sagawa, Y., & Kanagawa, K. (2005). Social support as a predictor of health status among older adults living alone in Japan. *Nursing & health sciences*, 7(1), 29-36.
- Sar, A. H., Göktürk, G. Y., Tura, G., & Kazaz, N. (2012). Is the Internet use an effective method to cope with elderly loneliness and decrease loneliness symptoms. *Social and Behavioral Sciences*, 55, 1053-1059.
- Savikko, N. et al. (2005). Predictors and subjective causes of loneliness in an aged population. *Archives of Gerontology and Geriatrics*, 41(3): 223-33.
- Schulz, R., Beach, S. R., Matthews, J. T., Courtney, K., Dabbs, A. D. V., & Mecca, L. P. (2016). Caregivers' Willingness to Pay for Technologies to Support Caregiving. *The Gerontologist*, 56(5), 817-829.
- Schulz, R., Wahl, H. W., Matthews, J. T., Dabbs, A. D. V., Beach, S. R., & Czaja, S. J. (2014). Advancing the aging and technology agenda in gerontology. *The Gerontologist*, gnu071.
- Sears-Roberts, S., Mendelsohn, A., & Mendelsohn, G. A. (2009). Partner preference across the life span: Online dating by older adults. *Psychology and Aging*, 24 (2), 513-517.
- Shapira, N., Barak, A., & Gal, I. (2007). Promoting older adults' well-being through Internet training and use. *Aging and Mental Health*, 11 (5), 477-484.
- Sheats, J. L., Winter, S. J., Romero, P. P., & King, A. C. (2017). FEAST: Empowering Community Residents to Use Technology to Assess and Advocate for Healthy Food Environments. *Journal of Urban Health*, 94(2), 180-189.

- Silver, M. P. (2015). Patient perspectives on online health information and communication with doctors: a qualitative study of patients 50 years old and over. *Journal of medical Internet research*, 17(1), e19.
- Sims, T., Reed, A. E., & Carr, D. C. (2016). Information and Communication Technology Use Is Related to Higher Well-Being Among the Oldest-Old. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, gbw130.
- Sinclair, T. J., & Grieve, R. (2017). Facebook as a source of social connectedness in older adults. *Computers in Human Behavior*, 66, 363-369.
- Slegers, K., van Boxtel, M. P. J., & Jolles, J. (2012). Computer use in older adults: Determinants and the relationship with cognitive change over a 6 year episode. *Computers in Human Behavior*, 28, 1-10.
- Smith, A. & Anderson, M. (2016). Online shopping and E-commerce. *Pew Internet & American Life Project Report*, 1-29. Retrieved from <http://www.pewinternet.org/2016/12/19/online-shopping-and-e-commerce/>
- Smith, A. (2015<sup>a</sup>). U.S Smartphone Use in 2015. 1-21. Washington, D.C: PEW Internet & American Life Project. Retrieved from <http://www.pewinternet.org/2015/04/01/chapter-one-a-portrait-of-smartphone-ownership/#>
- Smith, A. (2014). Older adults and technology use. Pew Research Center [Internet & American Life Project]. Retrieved from <http://www.pewinternet.org/2014/04/03/older-adults-and-technology-use/>
- Smith, C. (2015<sup>b</sup>). Gen X and Baby Boomers present a huge opportunity for online retailers. *Business Insider: Tech Insider*. Retrieved at <http://www.businessinsider.com/the-age-demographics-of-who-shops-online-and-on-mobile-2015-4>
- Smith, J., et al. (2017). *Psychosocial and Lifestyle Questionnaire 2006-2016: Documentation Report*. Ann Arbor, MI: Health and Retirement Study.
- Stephure, R. J., Boon, S. D., MacKinnon, S. L., & Deveau, V. L. (2009). Internet initiated relationships: Associations between age and involvement in online dating. *Journal of Computer-Mediated Communication*, 14(3), 658-681.
- Sullivan, A. N., & Lachman, M. E. (2016). Behavior Change with Fitness Technology in Sedentary Adults: A Review of the evidence for increasing Physical Activity. *Frontiers in Public Health*, 4.
- Sum, S., Mathews, R., & Hughes, I., (2009). Internet use as a predictor of sense of community in older people. *Cyberpsychology & Behavior*, 12, 235-239.
- Sum, S., Mathews, M., Pourghasem, M., & Ian, H. (2008). Internet technology and social capital: How the Internet affects seniors' social capital and well-being. *Journal of Computer-Mediated Communication*, 14 (1), 202-220.

- Theeke, L. A. (2009). Predictors of loneliness in US adults over age sixty-five. *Archives of Psychiatric Nursing*, 23(5): 387-96.
- Tsai, H. Y., S., Shillair, R., & Cotton, S. R. (2017). "Playing around": An examination of how older adults acquire digital literacy with tablet computers. *Journal of Applied Gerontology*, 36 (1), 29-55.
- Tsai, H. Y. 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 US?. *Educational gerontology*, 41(10), 695-709.
- Tsai, H. Y. S., Shillair, R., & Cotten, S. R. (2014). Social Support and "Playing Around" An Examination of How Older Adults Acquire Digital Literacy with Tablet Computers. *Journal of Applied Gerontology*, 0733464815609440.
- U.S. Census Bureau (2010). Internet Use in the United States. U.S Census Bureau, Washington D.C.
- U.S. Census Bureau (2016). *Computer and Internet Use in the United States: 2016*. (ACS Report No. 39). Retrieved from <https://www.census.gov/content/dam/Census/library/publications/2018/acs/ACS-39.pdf>
- U.S. Census Bureau (2017). American Community Survey 1-Year Estimates. Retrieved from [https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS\\_17\\_1YR\\_S0101&prodType=table](https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_17_1YR_S0101&prodType=table)
- Victor, C., Scambler, S., Bond, J., & Bowling, A. (2000). Being alone in later life: Loneliness, social isolation and living alone. *Reviews in Clinical Gerontology*, 10(04), 407-417.
- Wagner, N., Hassanein, K., & Head, M. (2010). Computer use by older adults: A multi-disciplinary review. *Computers in human behavior*, 26(5), 870-882.
- Wion, R. K., & Loeb, S. J. (2015). Older adults engaging in online dating: What gerontological nurses should know. *Journal of Gerontological Nursing*, 41 (10), 25-35.
- WHOQOL Group (1995). "The World Health Organization quality of life assessment (WHOQOL): Position paper from the World Health Organization," *Social Science & Medicine*, Vol. 4 No. 10, pp. 1403-1409.
- World Health Organization (2007). Global age-friendly cities: A guide. WHO, Geneva.
- Wright, K. (2000). Computer-mediated social support, older adults, and coping. *Journal of Communication*, 50 (3), 100-118.
- Wu, S. I. (2003). The relationships between consumer characteristics and attitude toward online shopping. *Marketing Intelligence and Planning*, 21 (1), 37-44.
- Xie, B., & Jaeger, P. T. (2008). Older adults and political participation on the internet: A cross-cultural comparison of the USA and China. *Journal of cross-cultural gerontology*, 23(1), 1-15.
- Xie, B., Watkins, I, Golbeck, J., & Huang, M. (2012). Understanding and changing older adults' perceptions and learning of social media. *Educational Gerontology*, 38, 282-296.

Yeh, J. S-C., & Lo, S. K. (2004). Living alone, social support, and feeling lonely among the elderly. *Social Behavior and Personality: an international journal*, 32(2), 129-138.

Yu, R. P., Ellison, N. B., McCammon, R. J., & Langa, K. M. (2015). Mapping the two levels of digital divide: Internet access and social network site adoption among older adults in the USA. *Information, Communication & Society*, 1-20.

Zhang, F., & Kaufman, D. (2016). Social and emotional impacts of internet use on older adults. *European Scientific Journal*, 11 (17), 1-15.

Zheng, R., Spears, J., Luptak, M., & Wilby, F. (2015). Understanding older adults' perceptions of Internet use: An exploratory factor analysis. *Educational Gerontology*, 41, 504-518.

Zhou, J., Rau, P. L. P., & Salvendy, G. (2012). Use and design of handheld computers for older adults: A review and appraisal. *International Journal of Human-Computer Interaction*, 28(12), 799-826.

Zickuhr, K., & Madden, M. (2012). Older adults and Internet use. Washington, D.C.: Pew. Research Center. Retrieved at <http://www.pewinternet.org/2012/06/06/main-report-15/>

**APPENDIX A: PROMISING PROGRAMS AND INTERVENTIONS**

No.	Policies/Practices	Description	Articles/News
Los Angeles Area			
1	GoGoGrandparent	A hotline service to use delivery/ride services. Older adults without smart phones can use services without downloading the app by pressing 1) Uber ride; 2) return trip; 3) order a meal; 4) get groceries delivered; 5) other delivery options.	<a href="https://phys.org/news/2016-05-gogograndparent-seniors-smartphones.html">https://phys.org/news/2016-05-gogograndparent-seniors-smartphones.html</a>
2	AARP TEK academy	AARP’s TEK Academy premiered early in 2015, and offers free two-hour workshops covering the use of tablets, smartphones, and social media, as well as online safety.	<a href="https://aarptek.aarp.org">https://aarptek.aarp.org</a>
3	Senior Services   YWCA Greater Los Angeles	Offers basic computer learning classes to seniors in Los Angeles area to eliminate isolation and promote lifelong learning.	<a href="https://www.ywcagla.org/what-we-do/programs/senior-services/">https://www.ywcagla.org/what-we-do/programs/senior-services/</a>
4	Exergamers Wellness Club	Exergamers Wellness Club is a public/private partnership between City of Los Angeles Department of Aging (LADOA) that promotes technology and evidence-based health promotion (EBHP) in association with the Microsoft Xbox 360 program and St. Barnabas Senior Services, encouraging exercise and personal health monitoring to reduce isolation and improve health and well-being.	<a href="https://news.microsoft.com/2012/04/04/exergamers-wellness-club-uses-kinect-and-healthvault-to-enhance-seniors-well-being/#XsfPw7sD04fwrZxd.97">https://news.microsoft.com/2012/04/04/exergamers-wellness-club-uses-kinect-and-healthvault-to-enhance-seniors-well-being/#XsfPw7sD04fwrZxd.97</a>
California			

5	SF Connected	SF Connected initiative provides free computer tutoring to seniors and adults with disabilities in association with San Francisco's Department of Aging and Adult Services (DAAS), aiming to increase broadband adoption and demonstrating the value of broadband based technologies.	<a href="https://sfconnected.org/aboutus/">https://sfconnected.org/aboutus/</a>
6	California Emerging Technology Fund (CETF)	The CETF is pushing to establish Lifeline program for affordable high-speed Internet access for Los Angeles County seniors, low-income residents and people with disabilities. Allow broadband access to \$10 per month for low-income households.	<a href="http://www.latimes.com/local/california/la-me-county-internet-20151127-story.html/">http://www.latimes.com/local/california/la-me-county-internet-20151127-story.html/</a>
7	Computers for Low-Income families and Seniors	CFC refurbishes computers and provides them at reduced prices to low income families and senior citizens. The CFC is a non-profit organization that is Microsoft Authorized Refurbishers and takes off sales tax for credit/debit card transactions.	<a href="http://www.computersforclassrooms.org/computers-for-low-income-families/">http://www.computersforclassrooms.org/computers-for-low-income-families/</a>
8	San Francisco Community Broadband Opportunities Program (SF-CBOP)	The City's Departments of Technology, along with several other key partners in the nonprofit, propose to provide broadband-oriented training to seniors, low-income and ESL youth, and other economically and socially vulnerable groups. The project intends to include an online support group for seniors via partner TYZE.com and collaborate with digital media nonprofit groups to provide training in digital media and dissemination of local user-generated digital content in ways that encourage broadband adoption.	<a href="https://www2.ntia.doc.gov/grantee/city-and-county-of-san-francisco/">https://www2.ntia.doc.gov/grantee/city-and-county-of-san-francisco/</a>
9	Telehealth Network to Virtually Link Remote Metro Caregivers Statewide	An initiative to connect more than 300 California health care providers in underserved areas to a state and nationwide broadband network dedicated to health care. The UC system will manage the first phase of the project's development on behalf of a consortium of state agencies, health care and broadband providers and foundations. Earlier this month, UC Irvine announced that it would open a telemedicine training center as part of its \$40.5 million medical education building.	<a href="https://www.caltelhealth.org/">https://www.caltelhealth.org/</a>

National

10	SeniorNet	<p>A nonprofit organization specializing in computer and Internet education for adults age 50+. Its roots go back to a research project in 1986 at the University of San Francisco, which sought to demonstrate that computer technology could expand a sense of community among older adults. SeniorNet has grown to more than 60 Learning Centers in the U.S. and other countries, staffed by more than 3,000 volunteer instructors and mentors. The volunteers include older adults who exemplify the “seniors teaching seniors” methodology.</p>	<p><a href="http://www.seniornet.org">http://www.seniornet.org</a></p>
11	Generations on Line	<p>This Philadelphia-based national nonprofit developed software programs and organizational partnerships that make it easier for seniors to learn how to access the Internet. Since its inception, GoL has helped more than 80,000 older adults through its online training tutorials, now offered in Spanish as well as English. It has expanded its reach to 1800 institutions serving older adults in 49 states.</p>	<p><a href="http://www.generationsonline.org/">http://www.generationsonline.org/</a></p>
12	eWIRED: An Elder Empowerment Initiative	<p>A senior digital literacy project created by Alliance for Aging, Inc. (AAI), the Area Agency on Aging (AAA) for Miami-Dade and Monroe Counties, FL. The pilot project focused on low-income minority elders and used Older Americans Act Title III-B supportive services dollars for contracts with three competitively-selected organizations.</p>	<p><a href="http://www.allianceforaging.org/wp-content/uploads/website-link-computer.pdf">http://www.allianceforaging.org/wp-content/uploads/website-link-computer.pdf</a></p>
13	OASIS Connections	<p>Offers a comprehensive course on not only how to use Internet, but also make photographs, do online markets, use health information, and write resumes and cover letters.</p>	<p><a href="https://www.oasisnet.org/National-Programs/Connections-Technology/Course-Descriptions/">https://www.oasisnet.org/National-Programs/Connections-Technology/Course-Descriptions/</a></p>
14	Older Adults Technology Services (OATS)	<p>Based in NY, the organization developed a comprehensive municipal technology program, serving over 20,000 older adults each year and sustaining 24 technology labs across the city.</p>	<p><a href="https://oats.org/">https://oats.org/</a></p>

## APPENDIX B: REVIEW OF THE LITERATURE

The 21st century has been shaped by the influence of unprecedented longevity and advanced digital technology. As a result, understanding the use of technology and its effect on the older population has become increasingly important. The population of older Americans is expected to total 80 million by 2050, nearly doubling in size. The concept of promoting the use of technology for older populations – or gerontechnology – began in 1980s with an open question about how to design new technology to better assist older populations to cope with aging processes and maintain functional ability in their chosen environments (Czaja & Barr, 1989; Charness & Jastrzembski, 2009; Schulz, Wahl, Mathews, Dabbs, Beach & Czaja, 2014). The earliest definition of gerontechnology was “the study of technology and aging for the improvement of the daily functioning of the elderly” (Bouma, 1992, p. 1).

Technology can be an effective tool to help older adults age in place by providing assistance with instrumental activities of daily living, including communications, shopping, health management, banking, and transportation. Even food preparation can be arranged and carried out online. Innovative technological approaches present government, service providers, friends and families with new ways to meet the needs of older people from the convenience of their homes (Goodwin, 2013). Previous studies suggest that 80% of caregivers are willing to pay for technology, which provides assistance with self-care for older adults (Schulz et al., 2016). The connection to community and services, which the internet affords, has the potential to mitigate the geographical challenges posed to older adults, particularly those in remote and unsafe neighborhoods, supporting aging in place efforts and helping them avoid institutional care for as long as possible (Kim & Gray, 2016; Kim, 2008). The current literature review aims to provide an overview of technology use for older adults and its association with social connectedness.

### SECTION I: INTERNET USE AND LIVING ARRANGEMENT

The Internet offers important opportunities for connecting older adults to their families and social networks. An increasing number of older adults are living by themselves and apart from their family members. Approximately one in three (28%) living in the community live by themselves, with 46% of women aged 75 and over living alone in the US (Administration on Aging, 2013) reflecting a global preference for independent living for older adults apart from their family members (Harper, 2004). Spurred in part by industrialization and lower birthrates (beanpole families), developed countries have seen an exponential increase of the older population living alone. Because they live longer, living alone is more likely among older women than among older men. Although living alone does not automatically indicate social isolation, it is identified as one of the main risk factors for social isolation (AARP Foundation, 2012; Victor, Scambler, Bond & Bowling, 2000). At the same time, social connection has especially important implications for women who live alone, as maintaining contacts with friends and relatives is a significant protective factor against decline in psychological well-being and the delayed onset of disabilities (Michael et al., 2001; Saito et al., 2005). In addition to psychosocial factors, older adults who live alone may have additional risk factors: they are more vulnerable to food insecurity and poor energy intake (Hughes et al., 2004), have a higher number of instrumental activities of daily living (IADL) limitations, increased sense of loneliness, and less perceived social support (Yeh et al., 2004), and higher depressive symptoms in later life (Heikkinen & Kauppinen, 2004).

---

## INTERNET USE CAN HELP PREVENT SOCIAL ISOLATION OF OLDER ADULTS

Internet use has been found to increase social connectivity among older people (Zhang & Kaufman, 2015). Prior studies have found that internet use was associated with improved psychological well-being of older adults (Sims, Reed & Carr, 2016), lower loneliness (Sar et al., 2012), and reduced depression (Cotten, Ford, Ford & Hale, 2012). In particular, the effect of reducing depression was strongest for older adults living alone in the U.S. (Cotten, Ford, Ford & Hale, 2014). This effect may partially be caused by the use of social networking sites (SNS) which enable older adults to interact with family and friends (Goswami, Köbler, Leimeister & Krcmar, 2010; Sinclair & Grieve, 2017). Internet use is also associated with promoting more social engagement in offline interactions, such as volunteering and visiting family and friends (Choi & DiNitto, 2013a; Kim, Lee, Christensen & Merighi, 2016). Internet use and social engagement together have been found to have synergistic effect to promote health literacy for older adults (Kobayashi, Wardle & von Wagner, 2014).

Social support augmented by online interaction among older adults is thought to be an intermediary explanatory factor of wellbeing (Heo, Chun, Lee, Lee, & Kim, 2015). Internet use among older people varies directly with explanatory factors such as support from the community, personal fulfillment, and confidence in oneself (Erickson & Johnson, 2011; Sum, Matthews, & Hughes, 2009; Chang, McAllister, & McCaslin, 2015). Gatto and Tak (2008) show that older people in America can gain long term connection and personal fulfillment through use of the Internet to keep in touch with friends and family and for recreational purposes. Beyond mere communication with others, online interaction is also shown to increase participation in community organizations, including churches, clubs, and senior centers (Hogeboom, McDermott, Perrin, Osman, & Bell-Ellison, 2010), as well as increase leisure and the quality of relationships (Heo, Kim, & Won, 2011). Self-efficacy, improved learning, and better health are also positively connected to online activity among older people (Cresci, Yarandi, & Morrell, 2010; Shapira, Barack, & Gal, 2007). Using the Internet to communicate with others has been associated with an increase in positive attitude (Aguilar, Boerema, & Harrison, 2010; Ballantyne, Trenwith, Zubrinich, & Corlis, 2010; Czaja & Sharit, 1998). It also affords professional support, connecting older people with doctors and health care providers virtually rather than in person, which can be burdensome to carry out, depending on location and functional status (Berner et al., 2015).

## SECTION II. TYPE OF DEVICES USED

Almost 70% of Americans aged 65 and over use the Internet, 42% use smartphones, and 32% use tablets (Anderson & Perrin, 2017). The most frequently cited activities for using devices was to send emails, and 71% of those older adults said they use them to “stay in touch with friends and family” (p. 6, 2016a). ‘Ease of use’ was another important factor for adoption of mobile devices rather than price or service carriers, which drew sharp contrast to standards of younger generations (Lee, 2007). Overall, the adoption and preferred functions of devices among older adults differed from those of younger adults, indicating the need for designing special features such as larger texts and touch screens (Zhou, Rau & Salvendy, 2012).

One of the primary reasons for widespread use of smartphone is its function as a main tool for communication and emergency contacts (Hardill & Olphert, 2012; Mohadisududis & Ali, 2014). There is also evidence that smartphones provide a means to access Internet services for those who otherwise have no options to use the Internet, particularly for African American and Hispanic populations and lower-income households (Prieger, 2013;

Smith, 2015a). The Census Bureau report estimated that while the gap between racial groups with the highest and the lowest rates of home Internet use is 27.1%, this is reduced to 17.5% when smartphone use is taken into account as a means to access the Internet (File, 2013). However, most smartphone user demographics still mirror those of Internet users, suggesting that those who are younger, highly educated and socially advantaged are more likely to use smartphones (Smith, 2015a). Limited knowledge on using advanced features, low self-efficacy, and mild vision impairments were also found to act as significant barriers to using smartphones for older adults (Mohadisududis & Ali, 2014). Despite these barriers, using smartphones was found to be associated with reduced loneliness, which was then related to better self-rated health, fewer chronic conditions, and fewer depressive symptoms for people aged 50 and over (Chopik, 2016). In addition to these benefits, an increasing number of clinical studies have examined the potential of using mobile phones as an intervention method to promote health management and physical activities for older adults (Joe & Demiris, 2013; Ramsey, Wetherell, Depp, Dixon & Lenze, 2016; Sullivan & Lachman, 2016).

Another type of device that is increasingly popular among older adults is tablets. Similar to computers, older adults using tablets were likely to be younger, highly educated, and had higher income (Anderson, 2016 b). Studies examining older adults aged 65 and over who own tablets found that most older adults felt that tablets were intuitively easier than laptops or other computers to use, and 90% of these adults cited benefits as feeling connected to their families and communities (Tsai, Shillair, Cotten, Winstead & Yost, 2015). Additionally, social support both in technical (e.g., how much help older adults can get from their family in learning to use the device) and emotional (e.g., how much interaction they have by using tablets) were important determinants of tablet use (Barnard, Bradley, Hodgson & Lloyd, 2013; Tsai, Shillair & Cotten, 2014). In this regard, social connections and technology use had mutually reinforcing associations rather than a unidirectional relationship. Because of their intuitive functions, several studies examined the use of tablets as a tool to help older adults with mild cognitive impairment maintain social networks and interactions with their caregivers (Lim, Wallace, Luszcz & Reynolds, 2013). Use of tablets in clinical settings has also increased recently. In this case, offering assistance to older adults regarding how to use the device properly is an important consideration (Brahmandam et al., 2016).

### SECTION III. TECHNOLOGY, SOCIAL MEDIA, AND CONNECTIVITY TO FAMILY AND FRIENDS

Some studies suggest that the effect of technology use may vary depending on types of activities and motivation. Older adults who used technology for socially meaningful goals (e.g., social connections) were significantly more likely to have reduced loneliness, higher life satisfaction, and goal attainment, while those who used technology for information purposes (e.g., searching for health information) had better subjective health and fewer ADL/IADL limitations (Sims, Reed & Carr, 2016). However, many studies found that older adults cited social interaction as the primary reason for their use of technology (Gitlow, 2014; Wagner, Hassanein & Head, 2010).

Despite slower progress in connecting older people to family and friends through online media compared to younger age groups, 50% of American older adults are connected to and using the Internet, and more than a third make use of social media such as Facebook and online networking applications such as LinkedIn (Zickuhr & Madden, 2012). 16% connect with others on Twitter, and 12% on Pinterest (Bell, Fausset, Farmer, Nguyen, Harley, & Fain, 2013). Many new interventions are being designed and implemented to encourage and test the feasibility and usefulness of connecting older adults with others in online communities (Leist, 2013).

In fact, according to Zickuhr et al. and Madden and Zickuhr (2011), the use of social networking sites has increased from a mere 1% to 34% among older people aged 65 and over between 2005 and 2011, with the 50-64 age group increasing from 5% to 50% in the same timeframe. Relating the extent of recent usage among this group in an Internet project survey at the Pew Research Center, Madden et al. report that 15% of older adults used an online networking site within the last day.

Some older adults may be unwilling or unable to use mobile devices or computers, (Munoz, Cornejo, Gutierrez, Favela, Ochoa, & Tentori, 2015). Cognitive impairment and other functional limitations that increase with age may limit the use of technology that requires mental agility and willingness to learn new skills (Newall, Chipperfield, Clifton, Perry, Swift, & Ruthig, 2009). However, those who are willing and able to explore technology benefit.

Not unlike younger adults, older adults report that learning how to use devices and communication applications is typically a process of trial and error, one that involves “playing around” with the technology (Tsai, Shillair, & Cotton, 2017, p. 29). For many older people, the use of social media and communication technology is a means to a very specific end: keeping in touch with friends and family – particularly children and grandchildren – which motivates them to apply themselves to the learning curve (Chiu, Hu, Lin, Chang, Chang, & Lai, 2016). Studies show that even moderate amounts of time improve older adults’ attitudes about using the Internet, communication technology, and social media, reducing distrust and increasing comfort and ease of use (Xie, Watkins, Golbeck, & Huang, 2012). Although older people have concerns about privacy and the risks of exposing their personal and private information on social media, (Lehtinen, Nasanen, & Sarvas, 2009), they also recognize its value in maintaining a sense of control, garnering social support, strengthening relationships, and reducing stress (Shapira, Barak, & Gal, 2007; Gatto & Tak, 2008; Leist, 2013; Wright, 2000). Additionally, social networking tools and websites provide older adults with opportunities to solve both social and practical problems, such as social inclusion and assistance with instrumental activities of daily living (IADLs), through the wide array of social supports and services available at one’s fingertips via online networking (Sum, Mathews, Pourghasem, & Ian, 2008).

Bell et al. (2013) report that the use of social media helps older people connect with their families and forge innovative and adaptive long-distance relationships with loved ones and friends in ways not possible prior to online networking and widespread computer usage. For older adults, becoming familiar with the technology is paramount in making the most use of it; older people who spend sufficient time with the technology experience device and application skill development and increased self-efficacy; overtime they come to embrace technology use as a key tool that helps them meet their goals (Czasa, Charness, Fisk, Hertzong, Nair, Rogers, & Sharit, 2006; Eastin & LaRose, 2000).

## SECTION IV: OTHER TYPES OF INTERNET USE

### HEALTH CARE

One type of Internet use among older adults that has received increasing attention is searching for online health information (Bolle et al., 2015; Morahan-Martin, 2004). Using the Internet and devices for health-related purposes appears to be the only domain where older adults used technology more than younger adults (Olson, O’Brien,

Rogers & Charness, 2011). Research has shown that health-related Internet users were younger, more highly educated, had better cognitive functioning, and better health literacy (Amante et al., 2015; Flynn, Smith & Freese, 2006; Levy, Janke & Langa, 2015). They were also more likely to be women than men (Houston & Allison, 2002; Kontos, Blake, Chou & Prestin, 2014). The use of online health information was also associated with more visits to a doctor among older adults in the U.S. (Choi, 2011; Flynn, Smith & Freese, 2006). However, concerns remain for the accuracy, reliability, and validation of online health information and time as well as effort involved in searching for online health information (Nijland et al., 2008; Silver, 2015).

---

## ONLINE DATING

Another area that may be important for promoting psychological wellbeing of older adults is online dating. As socioemotional selectivity theory suggests, emotional goals become prioritized over other types of goals as people age (Carstensen, 1995). Therefore, finding a partner is an important goal for some and online dating can be a good strategy to explore dating environments, especially where age may make it harder to rely solely on friends and family (Rosenfeld & Thomas, 2012). According to Wion and Loeb (2015), approximately 14% of unattached adults between the ages of 57 and 85 were dating. Additionally, nearly 40% of men and 15% of women found the idea of dating appealing, showing that men are perhaps more interested in finding a partner in older age (Carr, 2004). Sears-Roberts, Mendelsohn, and Mendelsohn (2009) found that older men pursue relationships more often than women and they are less selective than women, using online dating forums and applications. Older adults were found to be more active in online websites than younger adults, not only spending significantly longer time but also showing more serious commitment (Stephure, Boon, MacKinnon & Deveau, 2009). They also had significantly different self-presentations, using more first-person plural pronouns (e.g., we) rather than single pronouns (e.g., I) and positive emotion words than younger adults (Davis & Fingerman, 2016).

---

## GETTING NEWS

Checking the news is another common Internet activity among older adults (Olson, O'Brien, Rogers & Charness, 2011). Challands et al. (2017) found that reading the news is the second most common activity for going online among older adults aged 65 and over, next to communicating with other people. About 64% of older adults in the study accessed the Internet at least once in every few weeks.

---

## SHOPPING

Shopping is another popular activity for older adults to engage in online. About 59% of people aged 65 and over said they had made online purchases (Smith & Anderson, 2016), and the gap in usage between younger and older generations is narrowing (Smith, 2015b). Older adults shop online to avoid expending too much energy, to experience the online market, and to enjoy the commerce community (Gupta, Dasgupta, & Gupta, 2008). Older adults who engaged in online shopping showed more confidence and higher ease of use and trust in Internet use (Iyer & Eastman, 2006; McCloskey, 2006). Additionally, according to Wu (2003), older men typically approach online shopping with better expectation of the experience and outcome than older women.

---

## OTHER ACTIVITIES INCLUDING TRAVEL, VOLUNTEERING, RELIGION, POLITICS, AND FOOD

The use of Internet for traveling is also increasing, although there is a wide generational gap. Only 50% of Baby Boomers reported using websites to make their travel reservations compared to 77% of Millennials and 74% of Generation X, and less than 10% used mobile apps to book their trips (AARP, 2015). Additionally, Internet use was found to be associated with more engagement in volunteering activities and religious organizations (Kim, Lee, Christensen & Merighi, 2016). Lastly, using technology for promoting healthier food consumption has been explored using tablets. Concerns for costs of obtaining and learning to use tablets is a consideration when exploring the feasibility of mobile app-based health interventions (Ivan Watkins, 2015; Sheats, Winter, Romero & King, 2017).

## SECTION V. BARRIERS TO TECHNOLOGY ACCESS AND LOW-INCOME OLDER ADULTS

Since its inception in the late 20th century, the Internet has grown in use and functionality, becoming a part of everyday American life. This is true for older Americans as well as their younger counterparts even though older people have historically been considered digitally deprived. The 'digital divide' seems to be narrowing, with computer and Internet usage up more than two-fold among older adults in the U.S. following the turn of the century (Hong & Cho, 2016). Additionally, some studies indicated that gender divide in Internet use among older adults in the US may have been reversed beginning in 2000 with increasingly more older women using the Internet (Yu et al., 2015; Ono & Zavodny, 2003). There are still gains to be made in the gap between young and old in such usage, however, as nearly 90% of young adults aged 18 and over have access to and use the Internet, while just 59% of older people age 65 and over have access (Smith, 2014). In terms of computer ownership, only a third of older people own a computer, whereas nearly two-thirds of all households have at least one (U.S. Census Bureau, 2010).

Although the digital divide among young and old is diminishing, it remains among low income older adults. Socioeconomic inequality is one of the strongest determinants of older adults' use of the Internet. Berglund et al. (2015) analyzed computer and Internet use among older Americans by education, living alone, cognition, household income, and rural versus urban living, demonstrating that being younger, living in urban areas, having higher education, and reporting higher cognitive function is associated with higher online activity. Similarly, ethnic minorities and those with low education are less likely to use the Internet, with differences in socioeconomic status a likely explanation for differences in usage (Czaja et al., 2006). Zheng, Spears, Luptak, and Wilby (2015) found that health status, experience with computers and the Internet, and perceptions of older people regarding the Internet are additional factors linked to Internet use. Other health-related characteristics such as health literacy and vision are also strongly associated with Internet use (Echt & Burrige, 2011; Elliot, Mooney, Douthit & Lynch, 2014).

In regards to income, Anderson & Perrin (2015) found that those with the highest income were eight times more likely to have access to the Internet than those with lowest income (Anderson & Perrin, 2015). In another study, low-income older adults were more likely to be either never users or to discontinue services due to cost, and more likely to be Black or Hispanic (Choi & DiNitto, 2013b). Negative attitude towards computers were more prevalent among those living alone, having multiple chronic conditions, and older age (Choi & DiNitto, 2013b). Additionally, distrust of governmental and social programs and perceived difficulty in technology use were identified as the main barriers to Internet access, and environmental support such as free Wi-Fi system for the building or neighborhood was suggested as a promising intervention to remove these barriers (Kim & Gray, 2016). Overall,

prior evidence suggest that more effort needs to be made to reduce the digital divide for low-income older adults who have disadvantaged socioeconomic backgrounds and poorer health.

## CONCLUSION

The literature presents a wide range of technology and Internet uses among older adults, with different motivations and predictors of this use among various groups. Future work surrounding technology use to alleviate feelings of loneliness among older adults should address barriers to access, including concerns about privacy, economic inequalities, language differences, and motivations for usage. Individual, person-centered interventions should be offered to help further narrow the digital divide. To help target intervention strategies, it will also be important to explore which groups or individual characteristics are associated with reducing loneliness through technology and which groups or individuals are less likely to benefit.

## APPENDIX C: COMPOSITION OF FOCUS GROUPS

### Demographics of focus group participants

	English 1 (N=7)	English 2 (N=8)	Spanish 3 (N=10)	Spanish 4 (N=9)	Korean 5 (N=9)	Korean 6 (N=5)	Total (N=48)	Percent (%)
<b>Gender</b>								
Female	4	4	7	5	4	4	28	59.6
Male	3	3	3	3	5	1	18	38.3
Other	0	1	0	0	0	0	1	2.1
<b>Age</b>								
54-64	2	1	0	0	0	0	3	6.4
65-74	3	4	4	6	1	1	19	40.4
75-84	1	1	6	2	8	4	22	46.8
85+	0	2	0	1	0	0	3	6.4
Average	67.6	71.5	73.9	73.4	78.0	78.2	73.8	
<b>Race/Ethnicity</b>								
White	1	1	0	0	0	0	2	4.3
Hispanic	0	2	10	9	0	0	21	44.7
Black	3	2	0	0	0	0	5	10.6
Asian	3	2	0	0	9	5	19	40.4

Note: Some categories do not add up to the full sample size due to missing data

## APPENDIX D: NEIGHBORHOOD SOCIAL COHESION

### HEALTH AND RETIREMENT STUDY

These questions ask how participants feel about their local area: everywhere within a 20-minute walk or about a mile of their home.

Coding is on a 7-point scale. Participants are asked to mark on box on each line, with the following statements on either end of the line. The closer the participant marks to a statement, the more strongly they agree with it. All items are reverse-scored and averaged across the four items. The final score is set to missing if there are more than two items with missing values (Smith et al., 2017). Higher scores indicate higher social cohesion.

1. I really feel part of this area (7)/I feel that I don't belong in this area (1)
2. Most people in this area can be trusted (7)/Most people in this area can't be trusted (1)
3. Most people in this area are friendly (7)/Most people in this area are unfriendly (1)
4. If you were in trouble, there are lots of people in this area who would help you (7)/If you were in trouble, there is nobody in this area who would help you (1)

### CALIFORNIA HEALTH INTERVIEW SURVEY

Participants were asked how strongly they agree or disagree with the following statements. Coding is on a 4-point scale. All items are averaged to create a final score of neighborhood social cohesion (Cain, Wallace, & Ponce, 2018). Higher scores indicate higher social cohesion.

1. People in my neighborhood are willing to help each other (strongly disagree (1) to strongly agree (4))
2. People in this neighborhood can be trusted (strongly disagree (1) to strongly agree (4))
3. Do you feel safe in your neighborhood? (none of the time (1) to all of the time (4))