

Designing Aging-In-Place Technologies to Reflect the Lifestyles and Precious Artifacts of Urban and Rural Older Adults

Ginger White
Indiana University
giwhite@indiana.edu

Robyn Evans
Indiana University
robevans@indiana.edu

Kay Connelly
Indiana University
connelly@indiana.edu

Kelly Caine
Clemson University
caine@clemson.edu

Technology has the potential to support aging in place to enable older adults of all backgrounds to live with dignity and autonomy in their own home for as long as they wish. However, perceptions, needs, and prototype technologies are often studied using convenience samples of older adults comprised of mid to high socioeconomic status (SES) individuals. Such populations do not represent the individuals who may benefit most from aging in place technologies, namely low-SES older adults. In this paper, we present findings from nine 8-hour long contextual observations of low-SES older adults living in rural and urban settings. We organize our findings and implications around the themes of SES status, daily routines and home characteristics. We highlight differences and similarities between rural and urban low-SES populations and discuss implications for design including designing for connection including creating “heirloom technologies”, and designing for lifestyle including space, time, family and supporting rituals.

INTRODUCTION

Projections from the United Nations’ World Populations Prospects estimates that by 2045, the world will have more adults over the age of 60 than children under the age 15, suggesting that there will soon be more older adults in the world than caregivers.

Among US older adults, the groups at the highest risk for extensive care and services are individuals from rural and underprivileged urban areas, with rural individuals making up one fifth of the elderly population. Compared to the average metropolitan counterpart, rural older adults are more likely to live alone after the age of 75, report worse health status, and have more limitations on their physical functioning (Van Nostrand, 2003).

Research in human factors can facilitate the development of technologies that allow older adults to remain in their home, foster independence, and ease the burden on caregivers. Specifically, aging in place technologies have the potential to reduce the need for a major move to assisted living, or a long-term care facility, which may ease economic impact. These technologies may also decrease negative social impacts such as caregivers’ burden.

Despite the potential benefits home-monitoring technologies may offer, the design of these technologies is quite challenging. Older adults have different needs at different stages of aging and are likely to have variable needs based on their access to transportation, informal care services, and cognitive and infrastructure resources.

The goals of this paper are three-fold: (1) gain an overall understanding of urban and rural dwelling older adults individual living environments and lifestyles, (2) highlight similarities and differences between these two populations, and (3) present design implications that may be used to create technologies to support aging in urban and rural older adults that fit the unique needs of these populations and honor the precious artifacts that older adults cherish in their homes.

RELATED WORK

As the need and desire for older adults to remain independent increases, so does the requirement for aging in place devices to support their independent lifestyles. Currently there are a myriad of devices both commercial (Bertolucci, 2008) and academic based (Rowan & Mynatt, 2005; Parker & Sabata, 2004; Dollinger, Chwalisz, Zerth, 2006; Consolvo, Roessler, Shelton, 2004; Caine et al, 2011), that aim to help older adults live more independently. There also has been progress on understanding the factors that influence technology adoption among older adults (Huber et al, 2011) and technology acceptance of high technology products (Caine, O’Brien, Park, Rogers, Fisk, van Ittersum, Capar & Parsons, 2006). However, it has been difficult to obtain long-term technology adoption of aging in place devices.

Unfortunately, few studies have investigated long-term use of aging in place technologies. Even fewer have sought to understand the needs of urban and rural dwelling older adults, yet these two populations have been shown to suffer increased health disparities as they age (e.g., Balfour & Kaplan, 2002). Urban-dwelling older adults residing in neighborhoods with a deteriorating environment, typically have higher rates of functional loss (Balfour & Kaplan, 2002; Cagney, Browning, & Wen, 2005).

Likewise, compared to their urban counterparts, rural older adults have more limited physical functioning (Van Nostrand, 2003). In this paper, we address this gap by examining how aging in place technologies may be developed for long-term, consistent use while meeting the needs of urban- and rural-dwelling older adults.

METHODS

Overview

To be eligible for the study, participants had to be 70 years or older, live alone in either an urban or rural environment, and have an annual income of less than \$20,000.

Participants' demographics and technology inventory was collected using two separate questionnaires, which are described in more detail below. Eight-hour contextual observations were conducted at each of the participant's home to get a better understanding of older adults' daily routine, and to discover the types of unmet needs that may be present.

Participants

Participants were nine older adults (1 male, 8 females) between the ages of 69 and 86 ($M=77$, $SD=5.45$). One participant was 69 but was within weeks of her 70th birthday at the time of participation. Participants resided in urban ($n=5$, Age $M=76$) or rural ($n=4$, Age $M=77$) environments. They lived alone in an apartment ($n=6$), single-family house ($n=2$), or mobile home ($n=1$) and had an income of less than \$20,000 per year. In general, they were retired, but one participant, an urban male, worked part time.

Materials

Questionnaires. The questionnaires were designed to elicit information about participant demographics, health status, and the types of technologies participants used.

Semi-structured interview. The interview contained questions related to types of resources available and the challenges older adults faced within their communities. The interview also contained questions about their typical daily routine.

Field note and contextual observation template. The field note and contextual observation template contained items of specific interest to the research team, such as neighborhood condition, home amenities and assistive technologies. The primary goal of the template was to ensure consistent data gathering across participant homes and to facilitate data collection for research assistants.

Procedure

The entire study took place over eight consecutive hours in the home of each older adult, for a total of 72 hours of data collection across participants.

First, participants provided informed consent. Next participants were asked to complete a series of questionnaires. After the questionnaires were completed, a semi-structured interview was conducted with each participant. The interview lasted approximately 45 minutes and was audio recorded. The interviewer also took field notes during each interview.

After the interview was complete, the researcher began the contextual observation. The contextual observation consisted of the researcher observing the routine of the participant for the entire day (eight hours). Throughout the day, participants provided a tour of their home to the researcher and described various home artifacts. The researcher documented this interaction by taking photographs of various artifacts within the home and recording field notes.

At the conclusion of the study, participants were debriefed, thanked for their participation, and offered an

additional opportunity to ask any remaining questions. Participants were remunerated \$80 for their time.

Data preparation and analysis

Interviews were transcribed verbatim and coded for emergent themes using the grounded theory approach (Walker & Myrick, 2006).

RESULTS

In this section, we present data about the make-up of our sample including their daily routine and their lived environment. We focus on these two attributes because designing technologies that fit into existing routines (Talamo, Giorgi, & Mellini, 2011) and homes (Newell & Gregor, 2002) is important factor when designing home-based technologies.

Daily routine

Both urban and rural older adults reported similar routines upon waking. They maintained personal hygiene, got dressed, prepared breakfast, and cleaned the home. Most of the older adults (6) discussed spending time in the living room, while the rest (3) spent time in the kitchen. Our contextual observations also uncovered an important ritual that rural and urban older adults shared. Three rural and three urban participants made "an event" of getting ready whenever they left their home. They would change their clothing, brush their hair and generally make sure they looked ready for interacting with others. Overall, we observed eight distinct activities that were common across all participants: community center visits, family visits and communication, caring for and interacting with pets, crafting, running errands, watching television & reading magazines, meals, and preparation for leaving the house.

The contextual observations revealed that rural and urban older adults indulge in different daily activities and hobbies while at home. Rural older adults mainly worked on crafts throughout the day and ran errands (See Figures 1 and 2).



Figure 1: Rural participant showing handcrafted item.

For example, one rural participant created handcrafted decorative items (see Figure 1). Another repurposed discarded items from friends and family members to create a quilt (See Figure 2).



Figure 2: Rural participant displays a quilt that she handcrafted using friend's and family member's ties.

In contrast, urban older adults primarily watched TV and read magazines while at home alone. While most of the urban older adults visited a community center, only one rural participant did. Other differences that stood out included that while half of the rural participants had pets that they cared for and interacted with [Fig. 3], no urban participants had pets. In addition, rural older adults made a ritual of going out (to eat, or to a particular store) in order to maintain social relationships, whereas the urban older adults had such contact more organically throughout their day. Rural participants engaged in many out-of-home routine activities such as crafting, running errands and eating out, urban older adults spent more time in the home watching television and reading magazines and preparing meals in the home.



Figure 3. Rural participant with pet cat.

Home Characteristics

The majority of older adults (5) reported living in a two-bedroom, one-bathroom residence. Only one participant (rural) lived in a larger home, which had four bedrooms and two-bathrooms. Urban older adults had carpet (2) and hardwood (3) throughout their homes. All rural older adults had carpet throughout their home. Three rural older adults had areas in their homes devoted to crafting. Homes were generally clean and uncluttered (8). Rural older adults' homes had either a traditional (2) or eclectic (2) décor, while urban older adults' homes were decorated using an eclectic (2), traditional (1), or transitional (2) style. Trinkets, family photographs, and paintings were placed throughout the homes of all participants. The major reoccurring complaint across all participants was the lack of available storage. All of the older adults (9) had at least one closet available, but this was not sufficient for their storage needs. For additional storage, urban older adults reported using containers or boxes (4) or wardrobes (3). Two rural older adults also reported using containers and boxes for storage.

Throughout the interviews and contextual observations, participants discussed how they obtained their home. Some participants inherited their current home through marriage. One participant, R7, discussed how she moved in with her husband and his parents after getting married.

R7: "He was fifty-two years old when we got married, and he'd never been married. He stayed right here with his mommy and farmed."

Her husband passed away five years ago and she continues to live in the inherited house alone. An urban older adult, U5, also lives in the home once owned by her husband's parents. She still resides in the house even though she cannot afford to live there.

U5: "I don't know what I'm going to do with them [the house]. I don't have enough income to cover my expenses... I can't afford to fix the gutter and...Siding and all that stuff."

Other participants also discussed living in their current residence to keep the homes in the family, making it a family heirloom. U5 wanted to move to a low-income housing unit but her daughter insisted she remain in the family home.

U5: "My daughter says, 'Stay home, Mama. They'll help you. Somebody help you. Stay here.'"

U3 however did decide to move due to health reasons but kept her house and let her children and grandchildren live in the home.

Participants also described how they had inherited a variety of assistive technologies from parents or spouses, and were keeping them for future use. One participant has multiple assistive technologies that she acquired after the death of her father. She uses some of the technology.

R8: “No. My dad had them, but he left them. He told me long time ago, don’t let the other kids take them because you may need them sometime.”

DISCUSSION

Our study indicates several important implications for the design of aging-in-place technologies for low-SES, older adults. These include design for connection and heirloom status and design for lifestyle factors such as space, time, family and rituals. In this section, we suggest design opportunities and considerations for designing for urban and rural dwelling, low-SES older adults.

Design for Connection: Heirloom Status

Many of the older adults either lived in or still owned a home that had been in their family for multiple generations, making it a family heirloom. Even assistive technologies were cherished as heirlooms. R8 saved multiple assistive technologies when her father passed away.

R8: “I use the cane and the walker. I did need it. I got ramps. Railings, I got railings. (Laughter) ... elevated toilet seat, I’ve got one if I need one.... Grabber, reacher, oh yes, I’ve got about four of them. Shoehorn, I’ve got one of them.”

This was an unexpected finding because previous research indicated that many older adults reject assistive technologies because they indicate frailty (Tomita, Mann, Stanton, Tomita, & Sundar, 2007).

This attachment to the objects within the home and the home itself suggests that not only should technology be designed to fit aesthetically into the home (Newell & Gregor, 2002), but that the technology itself may become an heirloom to be passed on to future generations.

Design for Lifestyle: Space, Time, Family and Rituals

Both urban and rural older adults spent the majority of their time at home in the living room and kitchen. Therefore, when designing aging-in-place technology for rural and urban dwelling older adults, technology should be tailored specifically for those highly occupied spaces (Ceccacci, Germani, & Mengoni, 2012). To truly tailor technologies to these environments, designers must consider the home’s overall characteristics and explore how the smoothly the technology will operate within the home. Furthermore, the older adults in our study tended to perform a single activity in a given space for a lengthy period of time (over an hour). This trait affords opportunities to design technologies to support in-depth activities.

While both urban and rural participants spent a similar amount of time in the spaces in their homes, there were some important differences between the two. For example, the rural population tended to get out of their homes and neighborhoods more often in order to seek out social contact, indicating that portable technologies would benefit rural older adults.

In contrast, the urban participants were more likely to have structured time with family in their own homes. Instead of designing monitoring technology that pushes information to family members (Caine et al, 2010; Mynatt, Rowan, Jacobs, & Craighill, 2001) there is a design opportunity to display data in the homes of the older adults and shared when family members visit. This could encourage in-person contact, while simultaneously providing important information about the overall health and wellbeing of the older adult to their loved ones. In-person contact was a concern for older adults considering adopting an aging-in-place technology (Huber, Shankar, Caine, Connelly, Camp, Walker & Borrero, 2013).

One design possibility that may be particularly well suited for rural older adults is to include a hand-made portion of the technology. Those older adults who enjoy crafting may be highly motivated to be involved in making an heirloom technology that could be passed on to future generations (Goodman & Rosner, 2011). Hurst and Tobias (2011) found that individuals could easily build cost effective assistive devices that were tailored to their specific needs. They also found that these handcrafted devices were preferred over off-the-shelf products (Hurst & Tobias, 2011).

Finally, both urban and rural populations had rituals that could be incorporated into a design. The urban older adults made a ritual of “getting ready” to go out. Rural older adults did not get ready to go out in the same way; they made rituals of going out to perform certain social activities, such as having lunch. When designing a mobile technology, incorporating the technology into the daily ritual is likely to increase regular use and compliance. Understanding these rituals in depth is thus necessary (Talamo, Giorgi, & Mellini, 2011). Technology such as in-home tracking systems can help provide a better understanding of the daily movements and activities of older adults (Kim, Jeong, & Park, 2013).

CONCLUSION

Low-SES, rural- and urban-dwelling older adults have distinct living environments and access to personal resources that affect their daily routines. In this paper, we provide a glimpse into the lives and lifestyles of this population. We preview findings from nine 8-hour long contextual interviews and present implications for researchers and designers who are interested in building technologies to support this population as they age in place. Our subsequent work will focus on delving further into the contextual data, evaluating and building potential designs based on this work, and on studying the designs in the homes of low-SES rural- and urban-dwelling older adults.

ACKNOWLEDGMENTS

This material is based upon work supported by the National Science Foundation under Grant No. 1117860. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. We thank the Christamore House and the Paoli Senior Citizens Center for assistance with data collection.

REFERENCES

- Balfour, J., & Kaplan, G. (2002). Neighborhood environment and loss of physical function in older adults: Evidence from the Alameda County Study. *American Journal Of Epidemiology*, 155(6), 507-515. doi:10.1093/aje/155.6.507
- Barrett, L. L. AARP Foundation, (2008). *Healthy at home..* Retrieved from website: http://assets.aarp.org/rgcenter/il/healthy_home.pdf
- Bertolucci, J. (2008). Is Dad Up and About? Check His Monitor. *Kiplinger's Retirement Report*, 15(5), 15-16.
- Cagney, K., Browning, C., & Wen, M. (2005). Racial disparities in self-rated health at older ages: What difference does the neighborhood make? *Journals Of Gerontology - Series B Psychological Sciences And Social Sciences*, 60(4), S181-S190.
- Caine, K. E., O'Brien, M. A., Park, S., Rogers, W. A., Fisk, A. D., Van Ittersum, K., Capar, M. & Parsons, L. J. (2006). Understanding acceptance of high technology products: 50 years of research. *Proceedings of the Human Factors and Ergonomics Society 50th Annual Meeting*. Santa Monica, CA: Human Factors and Ergonomics Society.
- Caine, K. E., Zimmerman, C. Y., Schall-Zimmerman, Z., Hazlewood, W. R., Camp, L. J., Connelly, K. H., Huber, L. L., & Shankar, K. (2011). Digiswitch: A device to allow older adults to monitor and direct the collection and transmission of health information collected at home. *Journal of Medical Systems*, 35(5), 1181-1195. doi: 10.1007/s10916-011-9722-1
- Caine, K. E., Zimmerman, C. Y., Schall-Zimmerman, Z., Hazlewood, W. R., Sulgrove, A. C., Camp, L. J., Connelly, K. H., Huber, L. L., Shankar, K. (2010). *Digiswitch: Design and evaluation of a device for older adults to preserve privacy while monitoring health at home*. In Veinot, Tiffany (Eds.), *IHI '10 Proceedings of the 1st ACM International Health Informatics Symposium* (pp. 153-162). doi: 10.1145/1882992.1883016
- Ceccacci, S. S., Germani, M. M., & Mengoni, M. M. (2012). User centred approach for home environment designing. *ACM International Conference Proceeding Series*, (5th International Conference on Pervasive Technologies Related to Assistive Environments, PETRA 2012 - Conference Program), doi:10.1145/2413097.2413136
- Consolvo, S., Roessler, P., & Shelton, B. (2004). The CareNet display: Lessons learned from an in home evaluation of an ambient display. *Ubicomp 2004: Ubiquitous Computing, Proceedings*, 32051-17.
- Dollinger, S. C., Chwalisz, K. & Zerth, E. O. (2006). Tele-help line for caregivers (TLC): A comprehensive telehealth intervention for rural family caregivers. *Clinical Gerontologist*, 30(2), 51-54.
- Goodman, E., & Rosner, D. (2011). In Desney Tan (Chair). *From garments to gardens: negotiating material relationships online and 'by hand'*. In *CHI '11 Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 2257-2266). doi: 10.1145/1978942.1979273
- Huber, L., Shankar, K., Caine, K., Connelly, K., Camp, L. J., Walker, B. A. & Borrero, L. (2013). How In-Home Technologies Mediate Caregiving Relationships in Later Life. *International Journal of Human-Computer Interaction*, 29 (7), 441 - 455.
- Hurst, A., & Tobias, J. (2011). Empowering individuals with do-it-yourself assistive technology. *Proceedings Of The 13Th International ACM SIGACCESS Conference: Computers & Accessibility*, 11. doi:10.1145/2049536.2049541
- Kim, S., Jeong, Y., & Park, S. (2013). RFID-based indoor location tracking to ensure the safety of the elderly in smart home environments. *Personal And Ubiquitous Computing*, 17(8), 1699-1707. doi:10.1007/s00779-012-0604-4
- Mynatt, E. D., Rowan, J., Jacobs, A., & Craighill, S. (2001). *Digital family portraits: Supporting peace of mind for extended family members*. In *CHI '01 Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 333-340). doi: 10.1145/365024.365126
- Newell, A. F., & Gregor, P. (2002). Design for older and disabled people - where do we go from here?. *Universal Access in the Information Society*, 2(1), 3-7. doi: 10.1007/s10209-002-0031-9
- Parker, M. H., & Sabata, D. (2004). Home, safe home: Household and safety assistive technology. In D. C. Burdick & S. Kwon (Eds.), *Gerotechnology: Research and Practice in Technology and Aging : a Textbook and Reference for Multiple Disciplines* New York, NY, USA: Springer Publishing Company Inc.
- Rowan, J., & Mynatt, E. D. (2005). In Wendy Kellogg (Chair). *Digital family portrait field trial: support for aging in place*. In *CHI '05 Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 521-530). doi: 10.1145/1054972.1055044
- Talamo, A. A., Giorgi, S. S., & Mellini, B. B. (2011). Designing technologies for ageing. Is simplicity always a leading criterion?. *ACM International Conference Proceeding Series*, (Facing Complexity, CHIItaly-2011 - Proceedings of the 9th ACM SIGCHI Italian Chapter International Conference on Computer-Human Interaction), 33-36. doi:10.1145/2037296.2037308
- Tomita, M. R., Mann, W. C., Stanton, K., Tomita, A. D., & Sundar, V. (2007). Use of currently available smart home technology by frail elders: Process and outcomes. *AbleData*, 23(1), 24-34.
- Van Nostrand, J. Office of Rural Health Policy, Health Services and Resources Administration, U.S. Department of Health and Human Services, (2003). *Assisted living in rural america: A national survey*. Rockville, MD, USA: Federal Office of Rural Health Policy, U.S. Dept. of Health & Human Services, Public Health Service, Health Resources & Services Administration.
- Walker, D., & Myrick, F. (2006). Grounded theory: An exploration of process and procedure. *Qualitative Health Research*, 16(4), 547-559. doi: 10.1177/1049732305285972