Successful Aging for Low-Income Older Adults: Towards Design Principles

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ABSTRACT
Low-income older adults are at risk of poor health outcomes due to rising healthcare costs. When designed to reflect their needs, technologies can provide a cost-effective solution to this problem. We investigated the issues and strategies low-income people encounter in managing their health by conducting interviews and focus groups with fifty older adults. The qualitative analysis revealed eight main themes participants considered important for successful aging. Based on these findings, we propose two design principles to promote successful aging in the target population: (a) support shift-and-persist strategies; and (b) combat impoverished mentalities by providing knowledge, resources and motivation.

CCS Concepts
• Information interfaces and presentation→ Graphical User Interfaces • Screen Design• User-centered Design.

Keywords
Older adults; successful aging; design; low-income; independent living; technology; health

1. INTRODUCTION
Aging is associated with functional decline and increased susceptibility to diseases affecting an individual's performance in various life domains. Therefore, the urgency is to ensure that older adults receive the best care for as long as they are alive. In United States today, due to escalating healthcare costs and rising living expenses, low-income older adults often have difficulties acquiring resources needed to avoid health-related problems and experience a high quality of life or age successfully. This is concerning because target population is typically prone to chronic conditions [14] and lower quality of life [9] due to their disadvantaged past and current circumstances.

Recently, there has been an interest in developing technologies to help older adults (65 and above) age in place and maintain their independence [2, 12, 13]. Moreover, evidence is mounting that older adults are becoming interested in adopting technologies to improve their health and wellbeing [6]. However, it is not clear whether existing research can be extended to low-income older adults. Researchers have just started to explore design needs of the target population [12, 19], but with the number of low-income older adults projected to increase in the future [15], more work is critically needed.

We conducted a qualitative research consisting of focus groups and semi-structured interviews with low-income older adults to gain insight into issues they face in managing their health, and strategies they use to cope with their situation. Based on our results, we suggest technologies designs that support shift-and-persist strategies, and combat impoverished mentalities.

2. RESEARCH PROCESS
We conducted focus groups and semi-structured interviews with older adults residing in low-income, independent living facilities, over a 4-month period. While focus groups helped us understand general trends in the population, semi-structured interviews helped us evaluate each adult individually. The research was done in collaboration with an Aging in Place (AiP) program of a local hospital. AiP provides health oversight and education, community resource navigation and social activities to residents of these facilities through nurses and resident assistants. Residents opt to participate in the program and receive health and well-being opportunities at no cost. AiP's ultimate goal is to help residents live a healthy, productive and independent life. AiP partnered with us to explore the potential of technology to achieve this goal.

2.1 Methods
After obtaining the review board's approval, we sought the help of resident assistants to recruit participants for focus groups and interviews from three independent living facilities. Everyone who volunteered to participate signed an informed consent and answered some demographical questions. We also asked each participant their health related needs including problems coping with chronic conditions. We started each study with an introduction to our research, and the discussion lasted for 1 – 1½ hours each. Participants' responses and comments were voice-recorded and notes were also taken.

Since we wanted to understand participants' needs and strategies that could be solved by any technology, the discussion questions for interviews and focus groups were general. (a) What do you need to live a healthy life? (b) What obstacles are in your way towards healthy aging? (c) What can we do to help you improve your health? Other questions were asked as the meetings progressed guided by participants' responses and interests.

2.2 Participants
A total of fifty participants took part in our qualitative study. Thirty-eight (u=10, v=12, x=12, y=4) were part of our four focus groups, and twelve volunteered for a one-on-one interview. Twenty-seven participants were females and twenty-three were males in the age range of 53-85 years (M=68). Thirty-four

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participants described themselves as Black/ African American, eight were non-Hispanic Whites, three were Asians/ Asian Americans and five were multiethnic. All except six participants lived alone. Five participants were employed/ self-employed; two were looking for a job and the remaining were either retired or unable to work. Six participants had 0-$5K annual income, twenty-four had income within $5K-$15K, seven had within $20K-$30K, and one had $35K-$40K. The rest chose not to disclose their income – according to building rules, income per person could not exceed $25,380 ($28,980 for two and so on). Two participants did not have a formal school education. Ten participants had below high school education, fourteen had finished high school, fifteen had a technical degree (1-3 year college), four had a college degree, and five had advanced degrees. Thirty-seven participants had at least one chronic condition. Two participants owned mobile phones at the time of study, and three owned tablets. Three used community desktop computer 0-1 times a month; others were technology novices.

2.3 Analysis

We transcribed all discussions and interview responses. Two researchers then independently performed open coding of the transcriptions using constant comparison method. Each researcher clustered similar codes under one category. After creating code categories, the researchers met to compare them. They accepted similar categories. For different and/or missing categories, a discussion ensued in the context of participants' demographics and background until a consensus was reached. Related categories were then grouped to generate themes. Excel was used to code and analyze the qualitative data.

3. FINDINGS

From our analysis, we identified eight main themes around challenges and adaptive strategies. Following, we describe each theme with supporting quotes from participants.

3.1 Finances

Participants cited lack of finances as a major obstacle to acquiring resources needed to live a healthy life. Some participants had jobs but not a substantial income. Others could not work because of their physical limitations. When specifically asked what they would do with more income, participants stated that they would get nutritious food, pay bills, and engage in hobbies and leisure activities. "*People have to care for themselves, but 60-70 percent of this town lives in poverty and with poverty comes impoverished mentality. You got to care a little bit as well*." Financial constraint for some meant making a choice between having a healthy lifestyle and fulfilling their basic needs. "*Our government should have the same income we have, quit paying them because they are not earning their keep. Ms. Michelle started with children healthy food, but you take older people. It is bad people have to make a choice between buying grocery versus medicine*."

3.2 Spirituality

Several participants believed that they could age healthy by having a strong connection with a higher power, and by following principles of their faith. "*I told my doc, my doc is Jesus. I never give up*." "*God gave us the ground work, if we don't use it then how can we age successful.*" Some participants focused on positive aspects of their lives in the light of their faith to bring serenity to their minds and cope with their health problems. "*Even though I have a lot of health problems, I still feel I am blessed by God. As long as I can feel that I am blessed, I may not walk as fast, but as long as God continue to let me feel good about myself, I am aging successfully*". Several participants believed that practicing their faith, and dedicating their time to a higher power will bring them health and wellness. "*I go to church, I play organ and do ministry. It keeps me busy and brings me peace of mind."*

3.3 Physical and Mental Fitness

People had high awareness about health and wellness promoting activities. "*Activities should move all parts of our bodies, going around, walking, painting and doing something with your hands, minds*." Even though some participants were not as physically active as they wanted, they believed that physical activity was the key to healthy aging. "*It is better to wear out than to rust out. You are going to age, it is better to stay active."* Several had adopted activities such as biking, dog walking, climbing stairs and walking in the park with friends to maintain fitness on regular basis. Many participants could not engage in physical activities because of their physical limitations so they tried to compensate through other means. "*I have to exercise but I cannot. I watch what I am eating*". They also wanted to enlist themselves in activities that stimulated their minds. Statements like "*I want to keep my mind active and sharp. I read, I love to do crossword puzzles or any other mental activity to engage my mind. To have entertainment as easy as TV but I love to go out and movies, I budget for entertainment*" sum up the kind of mental stimulation experience participants were seeking.

3.4 Motivation and Independence

Having high level of motivation, and exercising their free will was important for participant. However, they were struggling against lack of motivation and feelings of helplessness embedded in their surroundings and peers. "*A lot of people just appear to be sitting here and waiting to die. Most of the time, same people attend the organized activities. I will die but not today.*" To stay motivated, participants occupied themselves in a range of activities. "*I need a lot of things to do such as activities, shopping, if I do not find something to do I do it in my apartment. I am not a sitter, and I try to provide it for myself, it makes me feel better".* Others sought motivation by seeking recognition for their work. "*I want to have some way to share and get recognized for my artwork.*" Yet, others believed in making the best of their situations by maintaining a positive outlook on life. "*You have to be content with yourself mostly and your circumstances, you cannot just give up, there is no certain activity that I can or cannot do, you got to do yourself."* Others complained that they could not develop the necessary motivation because their health curtailed them. "*My health is my way towards healthy aging. I cannot cook for myself. I cannot bathe myself. I have lost my independence*."

3.5 Knowledge to Handle Personal Challenges

There was a consensus among participants that aging is the result of how they had lived and spent their youth. "*Aging starts way back. When you get to a certain age, it is all about what you did before you got there.*" Several participants were suffering from chronic conditions, and stated that they would have been in better health if they had knowledge and resources to make better choices in their youth. "*When you are young, you do not know better. I used to look at the sun all the time to make me cry, I destroyed my eyes. Now you learn on TV, doctors program*." Participants recognized that pursuit of knowledge is important for living a healthy life. "*I got this vitamin book and it tells you what to take to get rid of cancer.*" In particular, they wanted to have information that could help them cope with challenges of aging. "*Have seminars on more subjects of aging*." They desired guidance in making healthy life choices, and wanted help in

staying away from unhealthy ones. "*Older people needs guidance in making choices. Drugs, some people do it and some don't. Some older people still like to drink. Some older people still like to create drama. Some people can be as mental as possible*". Others were seeking greater understanding of their medical conditions to better handle personal challenges. "*I am inquisitive. I try to know as much as possible. Give me more insight. Let us know the medical stuff."*

3.6 Social Community

Participants expressed the desire to have a community where they could engage in healthy social interactions. In essence, they desired care and empathy from community leaders and other residents. "*My depression sets in and I cannot do what I used to do because my illness comes around, I start isolating, that is when my level of care stops. Ms. L* [leader] *comes down and checks on me, I see Ms. R. and M.* [residents]. *Some people I see, and I knock on people's door when I have not seen them in a while."* Presence of community leaders was deemed necessary to gain inspiration and motivation. "*She* [leader] *is smiling every now, it makes a cheerful setting. If you want to be motivated you have to see other people who are motivated, if you are able and beneficial to try something new, they* [staff] *both help to do that, it is depressing otherwise*." Participants wanted to interact with other community members to bring meaning and purpose to lives. "*My job is helping people, living day by day and accomplishing things day by day, just little things, opening the door, taking the trash, helping people older than me, those things that are truly useful from day to day, accomplishing things around the house, being useful by helping others it makes me feel good."*

3.7 Neighborhood Facilities

Effectively utilizing neighborhood resources was important for participants to continue their quest for healthy aging. "*I like this town. I like that I am close to things that are stimulating. You want to walk to the theatre, market, where ever you want, I like the diversity. I like the availability of a lot of things so I am not bored."* While some enjoyed what was available, others were bothered by the lack of various facilities and considered them as an obstacle for living a healthy life. "*This place is boring, bad transportation, you have to wait hours for public transportation, you cannot go anywhere after 6 pm.*" Others could not benefit from neighborhood facilities even when they wanted to because their specific needs were not met. "*This wheelchair is my way towards healthy aging. Mainly I want to get out of it. It limits me. I cannot take my wheelchair to work. When it snows I cannot go out. Sidewalks do not work. This is a nice place."*

3.8 Relationships with One's Doctor

Many participants thought that having a productive relationship with their doctors was necessary for healthy aging. We identified three schools of thought around older adults-doctor relationships. The first school believed that it is doctors' responsibility to advise their patients about their health problems. They wanted increased and clearer communication from their doctors to help them make sense of their medical conditions. "*We need better healthcare. Doctors promise things but they do nothing. They give you pills. I have questions, I want to know what they are doing when they are working on me."* The second school believed in taking ownership of their own problems, and believed in holding themselves accountable for their health. The third school of thought believed in a collaborative partnership with the doctor. They believed that doctors should be empowered with patients' data so they can make appropriate decisions for their patients. "*We should bring something to them. If they don't see it, they don't believe it.*" Other participants were struggling to understand how to communicate effectively with their physicians.

4. DISCUSSION

Given their complex healthcare needs, financial constraints and living situations, we recognize that technology cannot be the elixir. Following, we suggest two main design principles to address some challenges of aging: (a) support shift and persist strategies; and (b) combat impoverished mentalities by providing knowledge, resources and motivation.

4.1 Support Shift and Persist Strategies

In addition to living with limited resources, participants were exposed to a barrage of stressful circumstances. Majority (~ 75%) were living with a disability or chronic condition(s). Many were struggling to cope with their declining health and decreasing ability to perform tasks. Moreover, they had little hope for change in their financial circumstances (and health conditions). Evidence shows these events tend to increase vulnerability in older adults, and consequently they fear negative consequences when dealing with others [3]. The spiritually inclined participants our study resorted to finding meaning in their life events to cope with their limitations. Chen and Miller call this shifting-and-persisting, that is switching to a broader perspective on life and widening one's awareness of oneself, and dimensions bigger than self [5]. They explain that such strategies train the nervous system to avoid stress leading to better health outcomes [5].

Hence, not surprisingly, spirituality has been recognized as an important dimension of successful aging in numerous studies and theoretical models [10]. However, knowledge about designing applications to fulfill spiritual needs or enhance spirituality of older adults remains largely unknown. We found only one study that researched spiritual experiences of older adults in relation to their usage of religious-practices-supporting mobile applications [1]. Some researchers have explored design elements that facilitate spiritual experiences such as mindfulness, awe and wonder [4]. Others have shown that sacred imaginary invokes feelings of spirituality, and connects people to their religious practices and faith [18]. However, research is needed to validate these designs with low-income older adults. Moreover, impact of spiritual design on one's health has to be studied. A greater understanding about designing spiritual experiences within secular aspects of life (e.g. health data), without compromising the usefulness of either, is also needed. Finally, other shift-and-persist strategies e.g. proactive coping, i.e., shifting to a broader and positive outlook by focusing on creating goals, and accumulating resources for the future [16] can be explored for non-spiritual individuals.

4.2 Combat Impoverished Mentalities

Our findings suggest that on a day-to-day basis guarding against impoverished mentalities was an important consideration for participants. In this mindset, people stop trying to get out of negative situation because from past failures they had learned they could not do anything to change their situation. Participants demonstrated awareness of this mindset and wanted to avoid it. Therefore, it is not surprising that we found them actively engaged in combating it by taking actions within their means such as occupying themselves in hobbies or activities, reaching out to others, or seeking knowledge and information. The purpose of these activities, as implied by research [17] and supported by participants' quotes, was to increase perception of control and level of motivation.

Research suggests that perception of control can be enhanced by allowing people to make voluntary choices, helping them understand options, and supporting them to meet their goals, even if they have to rely on others [11]. We propose to design these techniques in two ways. First, by preparing instructional materials to provide perception of control in life domains (e.g. physical activities, nutrition) applicable for low-income older adults. Instructional videos [7], games [8] and virtual characters [2] are some ways that have proven to be effective in educating low-socioeconomic individuals. But their feasibility needs to be tested with the target population. Second, by creating organic connections between older adults and their community resources with respect to each of their needs. The evolving nature of this connection would ensure that older adults have access to up-to-date resources. White and colleagues also found that low-income older adults lacked knowledge about helpful resources in their neighborhood and suggested connecting older adults with those resources [19].

Research has shown that health motivation of older adults can be improved with mobile applications [6], and mobile applications based on relational agents (artificially intelligent animated characters) [2]. However, these designs require validation with low-income older adults [13]. Our results suggest that older adults derive motivation to engage in positive, healthy activities by connecting with their motivated peers and by receiving motivational messages from their community leaders.

5. CONCLUSION

Life-long adaptive strategies of low-income older adults in synergy with community resources can provide directions for designing mobile health technologies for the target population. Many questions about understanding the mindset of low-income people still need to be asked and answered to successfully implement the design principles proposed in this paper. We have started validating them by implementing technology solutions for the target population.

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