

# Toward inclusive digital aging society

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**Abstract.** Against the backdrop of the increasingly severe global aging problem, the elderly group has become an important part of society. With the rapid development of technology, it not only provides convenience in life and spiritual support for the elderly, but also brings potential risks, such as the digital divide, online fraud and obstacles in the use of technology. This article takes an interview with an elderly couple as the entry point, combined with the analysis of known literature, to explore the dual impact of modern technology on the elderly group: On the one hand, technology improves the quality of life of the elderly through virtual social interaction, cognitive intervention and physical exercise, etc. On the other hand, technical complexity, security risks and dependency issues also pose challenges to their autonomy and mental health. The article combines interviews and the analysis of known literature, aims to reveal the advantages and disadvantages of technology for the elderly group and propose cross-disciplinary solutions, including policy support, technology-inclusive design and family collaboration models. The significance of this research lies in calling on society to pay attention to the technological accessibility and safety of the elderly group, promoting technological development to provide more inclusive and humanized support for an aging society, and thereby achieving the core goal of a “technology-inclusive aging society”.

**Keywords:** aging population, technology-inclusive, technology, elderly challenges, digital divide, social isolation

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## 1. Introduction

The elderly group has long become a major and important part of society in this world where the problem of aging is increasingly serious. The World Population Outlook 2024 indicates that the global population is expected to continue growing for another 50 to 60 years and peak in the mid-2080s, increasing from 8.2 billion in 2024 to approximately 10.3 billion, and then gradually decline to 10.2 billion by 2100. The possibility of a population peak in this century is quite high, estimated at 80%, a significant increase compared to 30% in 2013. The total population in 2100 May be about 700 million less than previously predicted, as the fertility rates in some major countries are lower than expected, especially in China [1].

With the continuous increase of the elderly population, the problems and pressures faced by the elderly group in society are also constantly increasing. But at the same time, with the continuous development of technology. Many more convenient tools than before have emerged in life to help the elderly deal with difficulties. While enjoying the convenience brought by technological development, the elderly have limited knowledge of current technological products. This has led to many lawbreakers also keeping a close eye on the elderly, a group that is “easily deceived”. This article takes an interview with an elderly couple as the entry point and analyzes the benefits and disadvantages brought by modern technology. It is believed that by analyzing these advantages and disadvantages, the elderly group can better benefit from technology and avoid its harm.

## 2. Literature review

### 2.1. Difficulties faced by the elderly group

As people age, the elderly face multiple challenges, especially in terms of physical function, cognitive ability and social participation.

The problem is even more serious for elderly people who live alone or lack family support. The early diagnosis of dementia is often delayed, and technical barriers (such as complex code management) further limit their autonomy. Furthermore, the elderly often become the targets of online fraud. AI technology can even forge the voices of relatives to carry out fraud [2], threatening their financial and emotional security.

The rapid development of modern technology enables some advanced technologies at present to help the elderly solve some problems. But at the same time, it will also bring many potential risks to the elderly.

## 2.2. The benefits of technology for the elderly population

### 2.2.1. Mental support and social connection

“Positive spirituality” has been named as one of the most integral parts of successful aging, previously ignored by Rowe and Kahn’s famous model [3]. Positive spirituality is defined as a personal relationship with a sacred presence that is transcendent of earthly limitations [3]. Aggregated research demonstrates the powerful impact that the combination of spirituality and religion can have on all other domains of successful aging. Having hope, via positive spirituality, can impact physical health outcomes, mental health outcomes, and relational outcomes.

Many reported their technological engagement included streaming services, but researchers found 14 other uses of technology to connect spiritually. Particularly popular were apps and websites utilized for individual religious and theological scholarship. Positive spirituality includes community connection and cognitive engagement, which are both important aspects of resilient aging [3, 4].

### 2.2.2. Cognitive health intervention

Aging can be difficult, especially in this new age of technology, social media, and AI. Many older folks do not know how to use the newest iPhone, let alone their own Gmail. However, studies have shown serious benefits for aging adults with access to memory games. If all adults were to be “prescribed” computer games by their general practitioner, accessibility to a diagnosis of dementia would drastically increase as well as the potential for an at-home treatment plan that may slow the progression of the disease, leading to an overall increase in quality of end-of-life care.

For elderly people living alone or in retirement communities and homes it may be less noticeable because of the lack of regular human interaction. Kazmi et al. [5] showed that Serious Games (SG) used with aging adults had the potential to detect mild cognitive impairment, and games that include memory exercises, attention training, and virtual reality allow for a combination of stimulation in everyday tasks with cognitive tasks.

Sunghee et al. [6] conducted a study in which 27 participants with dementia over 7 weeks participated in about 23 sessions involving computer activities such as music, games, browsing and emailing. They found that engagement was the most important measure to adjust in the study. Participants who were taking anticholinergic medication had low engagement and difficulty showing up to sessions. However, of those who were engaged, women and individuals with higher levels of education were more likely to attend sessions and engage. The study’s findings showed that adults who are supported in technology use and have tailored games to their needs and functions can enhance their overall engagement and improve treatment fidelity.

Both articles show that aging adults, particularly those struggling with memory issues, benefit from computer use, whether it be through email, webcall, online shopping, or games. Caregivers who can tailor the games made accessible to the individual, can support the betterment of their engagement and improve end-of-life care. While there are many benefits, there is still a need for significant research to be done on the efficacy of online games in improving memory or measuring dementia and deficits. Additionally, there needs to be a push for making technology more accessible for aging adults.

### 2.2.3. Physical activity and social interaction

Exergames, which are online games that focus on enhancing one’s balance through physical activities, have been developed as a fall-prevention tool for the older population. A review of studies that examined the link between exergames and socialization showed that the majority of exergame studies found an increase in social well-being after participating in the program [7]. The indexes for social well-being included a decrease in loneliness, the formation of social connections and positive attitudes towards others. One study focused on a community-based exergame and wellness program for a rural, older population. The program led to an increase in the participants’ engagement in physical activities, while also providing older adults with a social network [7]. Moreover, the majority of participants identified physical activity and social interaction as the best-liked features of the intervention.

Another study investigated the impact of playing Wii bowling with a young student compared to watching television with a young student among the older population. The research students in both conditions were instructed to be socially responsive to the participants throughout their one-hour session together. The results showed that for older adults, Wii bowling was more effective in reducing one’s sense of loneliness than watching television [8]. While television is a popular leisure activity among older adults, it is a relatively passive hobby. Wii bowling may have a more significant role in fostering social interaction because it is interactive, while also connecting people through a shared interest and a mutual goal. Additionally, the researchers posit that engagement in Wii bowling created a group identity among the participants who resided in a senior apartment [8].

Furthermore, one study exemplifies how exergames can strengthen intergenerational connection [9]. The study explores the correlation between playing Wii sports and feeling socially connected among older women in a Planned Activity Group (PAG). When the researchers asked the participants to identify the benefits of participating in exergames, the most common response was the strengthening of interpersonal connections. The researchers found that some of the participants used their interaction with exergames as a way to relate to their children, grandchildren or great grandchildren. Many participants discussed using exergames as a means of overcoming technology age gaps, which allowed the older women to connect with a younger generation. Additionally, the older women in the study realized that playing exergames together prompted a greater sense of social cohesion within PAG. Participants expressed that exergame technology created stronger bonds between the women due to its ability to facilitate conversation and foster laughter. Some of the participants also reflected on the empowering quality of playing exergames within a group of older women who shared similar health problems and thus did not judge one another during the learning process.

Reviews of exergame interventions underscore the benefit of integrating exergame interventions into rehabilitation programs because of their ability to improve older adults' social health. Moreover, research on exergames shed light on the need for the innovation of more online games that are tailored to seniors. The studies also highlight that exergames can be a motivating factor for engaging in physical activity, which may otherwise seem tedious or daunting among older adults [7, 9]. Older adults' participation in exergames can increase their sense of connectedness with the younger generation, as well as with those who share similar physical changes because of the aging process.

### 2.3. Challenges faced by the elderly in the context of technology

#### 2.3.1. Security risks: the growing threat of AI-powered scams and fraud

Recent developments in AI technology have enabled particularly insidious forms of fraud. Blum [2] details how scammers now use voice-cloning technology to impersonate family members or authority figures, creating a false sense of urgency that compels victims to act quickly. These "grandparent scams" have become increasingly common, with the Federal Trade Commission reporting over \$2.6 billion lost to impersonation scams in 2023 alone.

The financial consequences are equally alarming. A 2022 American Association of Retired Persons (AARP) study found that older adults lose an estimated \$28.3 billion annually to financial fraud, with the average victim losing \$34,200. What makes these statistics particularly troubling is the underreporting of such crimes, as James et al. [10] note that only 1 in 44 cases of elder financial abuse gets reported, often due to embarrassment or fear of losing independence.

Effective countermeasures require a multi-pronged approach. RAZ Mobility [11] recommends technological solutions like call-blocking apps specifically designed for seniors, while consumer education programs can help older adults recognize red flags in suspicious communications. Perhaps most importantly, family members should establish clear verification protocols for any unusual requests involving money or personal information, creating a safety net for their elderly relatives in the digital space.

#### 2.3.2. The digital divide: structural barriers to technology adoption

Zainal et al. [12] identify three primary dimensions of this divide: access (availability of devices and connectivity), skills (digital literacy), and support (availability of assistance). Their research reveals stark disparities, with rural seniors being 30% less likely to have broadband access than their urban counterparts, and low-income seniors being 40% less likely to own a smartphone.

The geographic dimension of this divide is particularly concerning. Choi and DiNitto's [13] study of low-income homebound seniors found that rural participants faced compounded challenges: limited broadband infrastructure, fewer local tech support options, and greater transportation barriers to accessing in-person assistance. For these individuals, the COVID-19 pandemic's shift toward telemedicine and online services often meant complete exclusion rather than convenient alternatives.

Digital literacy represents another critical barrier. Friemel's [14] longitudinal analysis of internet adoption patterns shows that while basic usage rates among seniors have increased, competency gaps persist, particularly in areas like privacy management and security practices. His research identifies what he terms the "second-level digital divide"—where even seniors with access to technology lack the skills to use it effectively or safely.

Addressing these disparities requires systemic interventions. Xie et al. [15] demonstrate the effectiveness of community-based digital literacy programs tailored to older adults, particularly those incorporating peer learning models. Their research shows that seniors taught by slightly more experienced peers (as opposed to younger instructors) show 25% higher retention of digital skills. Policy solutions are equally important; expanding broadband access through initiatives like the Affordable Connectivity Program and developing senior-friendly device subsidy programs could significantly reduce access disparities.

### 3. Interview analysis

#### 3.1. Interviewee background information

On April 6th, an interview was conducted with Henry (88) and Margaret (87) Thompson to learn more about their experiences as they age in place together in their home. Henry and Margaret are both white and cisgender. They identify as Lutheran, upper middle class, Wisconsin residents. They are nearing their 65th wedding anniversary. Henry and Margaret live within a 20-minute drive of all three of their children, as well as most of their grandchildren and great-grandchildren. In 2019, Henry was diagnosed with cancer and has undergone several rounds of chemotherapy. He will have cancer for the rest of his life, though currently has healthy cell counts.

#### 3.2. Challenges and tech barriers in Henry and Margaret's daily life

Both interviewees have experienced increased difficulty with their balance, saying, "But then it very quickly changes when you get a cane in your hand and you immediately slow down" and "I have this ongoing feeling that I'm going to fall." This impaired mobility has resulted in them staying inside their home, rarely leaving. Furthermore, cognitive decline (such as memory loss) makes it difficult for the elderly to master new technologies.

##### 3.2.1. Technological complexity: when security measures become barriers

Henry's frustration with password management—specifically his inability to access a Google Meet session due to a forgotten password—highlights a critical challenge in technology design for older users. While cybersecurity experts advocate for frequent password changes and two-factor authentication as essential security practices, these very measures can create significant barriers for seniors. Wild et al. [16] found that password requirements are among the top three technological challenges reported by older adults, with 68% of seniors in their study admitting to writing down passwords due to memory concerns.

The cognitive aspects of aging further complicate this issue. Research by Czaja et al. [17] demonstrates that normal age-related changes in working memory and executive function make multi-step authentication processes particularly challenging for older adults. Their longitudinal study showed that while seniors can learn new technologies, they require significantly more time and support to master authentication protocols compared to younger users. This explains why Henry, despite being generally tech-savvy enough to use FaceTime and photo-sharing apps, struggles with password recovery processes.

The consequences of these design shortcomings are substantial. Sonderegger et al. [18] documented how password-related frustrations lead many older adults to either abandon certain online services altogether or develop insecure workarounds like password reuse across multiple accounts. This creates a paradox where security measures intended to protect users actually push them toward less secure practices. In Henry's case, his inability to access Google Meet not only caused immediate frustration but potentially limited his social connections—a serious concern given the well-documented importance of social engagement for healthy aging.

Emerging solutions offer hope for bridging this usability gap. Eiman et al. [19] found that biometric authentication methods like fingerprint or facial recognition are much more popular among older adults compared to traditional passwords. At the same time, implementing these alternatives can reduce frustration while maintaining security. Additionally, "passwordless" authentication systems using physical security keys or single sign-on solutions are showing promise for senior users. Tech companies must prioritize such inclusive design principles to ensure their security measures don't inadvertently exclude older populations.

##### 3.2.2. The dependency paradox: technology's impact on autonomy and family dynamics

As care-providing roles reverse due to the natural aging process, parents may experience frustration from their decreased autonomy [20]. Henry and Margaret often have to ask for help, which can be frustrating for them because they now receive more support than they provide. The Internet has created an abundance of opportunities for them to ask for help. Henry talked about a parallel example of reliance on his children by sharing, "I can't get the covers off of jars anymore. We get a jar of jam and we have to wait for David [son] to come over to open it up!"

Henry's poignant comparison between needing help with technology and requiring assistance to open a jar encapsulates what Perlman and Gamburd [20] term the "dependency paradox" of aging—where individuals who once provided care now find themselves needing support. This role reversal can be particularly challenging when it involves technology, as it represents a domain where adult children often have significantly more expertise than their parents. Clarke and Bennett's [21] ethnographic work reveals how this dynamic can threaten older adults' sense of competence and self-worth, particularly for individuals like Henry and Margaret who previously occupied leadership roles in their family.

The psychological impact of this shift shouldn't be underestimated. Research by Seifert et al. [22] shows that older adults who perceive themselves as burdensome to their families experience significantly higher rates of depression and social withdrawal. Their study found that 42% of seniors avoided asking for tech support due to fears of being perceived as incompetent or bothersome statistics that highlight the emotional complexity underlying what might seem like simple requests for help with passwords or device setup.

Family dynamics play a crucial mediating role in these situations. Silverstein et al. [23] longitudinal study of intergenerational support patterns identify two distinct approaches: "autonomy-supportive" assistance (where children provide help while respecting parents' independence) and "paternalistic" support (where children take complete control). The former approach, their research shows, leads to better psychological outcomes for both generations, with seniors maintaining higher self-esteem and adult children experiencing less caregiver stress. This suggests that how Brian assists his parents with technology, whether he patiently guides them through solutions or simply takes over task profoundly impacts their emotional well-being and continued engagement with technology.

Technology design could play a role in mitigating these tensions. Recent work by Niksirat et al. [24] demonstrates that systems designed to facilitate "collaborative use" (where seniors and caregivers interact with technology together) can help maintain seniors' sense of autonomy while still providing necessary support. Features like shared device management interfaces or family tech-support platforms could formalize these interactions, making help-seeking feel like collaboration rather than dependence. For multigenerational families like Henry and Margaret's, such innovations could transform technological support from a source of tension into an opportunity for meaningful connection.

### 3.3. Benefits of technology

#### 3.3.1. Virtual church

When asked about their favorite part of their day, participants Margaret and Henry highlighted their virtual church service. Other than going to bed and reading the news, church is the part of their week that stands out most to them. Their virtual church service is something they always do together, and they have been able to choose a service that matches their favorite style of worship. They joked that their church service features "fewer guitars and similar elements." Margaret and Henry have a sense of agency in what spiritual community they join, have connecting activity in their relationship, and have access to a community that reflects their lifelong practices and values. Additionally, they can access photos of their growing great-grandchildren on an app called Moment Garden. Technology enables them to be participants in their community even though they rarely leave their home.

By many measures, Margaret and Henry are successfully aging, and their well-being reflects the value they place on their church service. Despite the causal and correlative barriers to accessing technology, older adults from all backgrounds demonstrate resilience in using technology to access spirituality. A qualitative study done with 90 older adults showed that 77% of them reported utilizing technology within their religious and spiritual lives [25].

This study highlighted one correlation with technology-savvy older adults - most have post-high school education [25]. This correlation points to many of the disparities that exist with access to technology, including socioeconomic status, race, geographical location and family support. Margaret and Henry have family members close by with high technology literacy, they have socioeconomic means to pay a Wi-Fi bill, they have education. All of these factors are also impacted by their racial privilege.

Though there are causal and correlative barriers to accessing technology, older adults from all backgrounds are resilient in accessing spirituality via technology. A study completed with a small sample size of nine participants who were Caribbean/African American, Christian, and attending virtual services, showed that even without the privilege of whiteness, family support, or education, access can be found [26]. All participants were supported to attend virtual services by a non-family community member, like a church member or neighbor. Participants noted that even though they did not consider virtual services an adequate "replacement" for a brick-and-mortar church, they found the services spiritually enriching [26].

#### 3.3.2. Cognitive health intervention

As elucidated in the interview with Henry and Margaret Thompson, mobility impairment can be a significant challenge for older adults. More specifically, the common experience of struggling to maintain one's balance can prevent the older adult from engaging in their preferred hobbies and engender a preoccupation with falling [27]. In addition to serving as an intervention for fall prevention, exergames can also be a social hub for the older adult.

### 3.4. Risks of technology: Internet scams

However, this technology comes with risks. Margaret shared that they get many spam calls throughout the day. Their experience is shared by many elders who are prime targets of internet scams [11]. These scams are dangerous because they use fear tactics to scare elders into giving up money and personal information. Artificial Intelligence is making these scams even more difficult to detect [2]. Generated phone calls use the simulated voices of an elder's loved ones or use the voices and personas of public figures like politicians to direct the elder to take certain actions. Increased Internet use may put some elders more at risk of being scammed by increasing their odds of exposure. These scams are often frightening and demand urgent action.

For individuals like Henry and Margaret, who maintain close family connections through technology, the psychological impact of these scams can be devastating, potentially eroding trust in digital communications altogether.

## 4. Conclusion

The case of Henry and Margaret Thompson illuminates both the transformative potential and significant challenges of technology use in later life. Their successful adoption of tools like FaceTime and virtual church services demonstrates how digital connectivity can combat social isolation—a critical factor given the well-established link between social engagement and healthy aging. Yet their struggles with scams, password management, and dependency on family support reveal systemic issues in how technology is designed and implemented for older populations.

Addressing these challenges requires coordinated action across multiple sectors. Policymakers must prioritize expanding broadband access and funding digital literacy initiatives tailored to seniors. Technology companies need to embrace universal design principles, developing interfaces and authentication methods that accommodate age-related cognitive changes without compromising security. Families play a crucial role in providing patient, autonomy-respecting support that maintains elders' dignity while ensuring their safety online.

Perhaps most importantly, Henry and Margaret's story reminds us of that technological adoption in later life isn't simply about adding years to life, but life to years. When designed and implemented thoughtfully, digital tools can help older adults maintain the social connections, spiritual practices, and family relationships that give meaning to their lives. The challenge for society is to ensure these benefits are accessible to all seniors, regardless of technical aptitude, financial resources, or family support networks. By addressing the security, usability, and equity issues highlighted in this case study, we can work toward a future where technology truly enhances quality of life across the entire lifespan.

## References

- [1] United Nations, Department of Economic and Social Affairs, Population Division. (2024). *World population prospects 2024: Summary of results* (UN DESA/POP/2024/TR/NO. 9). <https://desapublications.un.org/publications/world-population-prospects-2024-summary-results>
- [2] Blum, L. S., & K. (2024, February 26). Elder scams can have real-world health effects: Will AI make it worse? *Association of Health Care Journalists*. <https://healthjournalism.org/blog/2024/02/elder-scams-can-have-real-world-health-effects-will-ai-make-it-worse/>
- [3] Crowther, M. R., Parker, M. W., Achenbaum, W. A., Larimore, W. L., & Koenig, H. G. (2002). Rowe and Kahn's model of successful aging revisited: Positive spirituality - The forgotten factor. *The Gerontologist*, 42(5), 613-620. <https://doi.org/10.1093/geront/42.5.613>
- [4] Fazio, S., Pace, D., Maslow, K., Zimmerman, S., & Kallmyer, B. (2018). Alzheimer's Association dementia care practice recommendations. *The Gerontologist*, 58(suppl\_1), S1-S9. <https://doi.org/10.1093/geront/gnx182>
- [5] Kazmi, S., Ugail, H., Lesk, V., & Palmer, I. (2014). Interactive digital serious games for the assessment, rehabilitation, and prediction of dementia. *International Journal of Computer Games Technology*, 2014, Article 701565. <https://doi.org/10.1155/2014/701565>
- [6] Sunghee H. Tak, Zhang, H., Patel, H., & Hong, S. H. (2015). Computer activities for persons with dementia. *The Gerontologist*, 55(Suppl\_1), S40-S49. <https://doi.org/10.1093/geront/gnv003>
- [7] Li, J., Erdt, M., Chen, L., Cao, Y., Lee, S.-Q., & Theng, Y.-L. (2018). The social effects of exergames on older adults: Systematic review and metric analysis. *Journal of Medical Internet Research*, 20(6), e10486. <https://doi.org/10.2196/10486>
- [8] Kahlbaugh, P. E., Sperandio, A. J., Carlson, A. L., & Hauselt, J. (2011). Effects of playing Wii on well-being in the elderly: Physical activity, loneliness, and mood. *Activities, Adaptation & Aging*, 35(4), 331-344. <https://doi.org/10.1080/01924788.2011.625218>
- [9] Liamputtong, P. (2010). *Physical and psychosocial effects of Wii video game use among older women*. Academia. [https://www.academia.edu/18125254/Physical\\_and\\_Psychosocial\\_Effects\\_of\\_Wii\\_Video\\_Game\\_Use\\_among\\_Older\\_Women](https://www.academia.edu/18125254/Physical_and_Psychosocial_Effects_of_Wii_Video_Game_Use_among_Older_Women)
- [10] James, B. D., Boyle, P. A., & Bennett, D. A. (2014). Correlates of susceptibility to scams in older adults without dementia. *Journal of Elder Abuse & Neglect*, 26(2), 107-129. <https://doi.org/10.1080/08946566.2013.821809>
- [11] RAZ Mobility. (2024, October 23). *Phone scams: A guide to protecting seniors and how to stay safe*. <https://www.razmobility.com/assistive-technology-blog/protecting-seniors-experiencing-cognitive-decline-a-guide-to-common-phone-scams-and-how-to-stay-safe/>
- [12] Zainal, A., Ahmad, N. A., Razak, F. H. A., & Nordin, A. (2015, October). A multi-method exploration: The use of mobile spiritual applications amongst older adults. In *2015 International Conference on Information Technology Systems and Innovation (ICITSI)* (pp. 1-7). IEEE. <https://doi.org/10.1109/ICITSI.2015.7437676>

- [13] Choi, N. G., & DiNitto, D. M. (2013). The digital divide among low-income homebound older adults. *Journal of Gerontological Social Work*, 56(3), 1-20. <https://doi.org/10.1080/01634372.2012.739604>
- [14] Friemel, T. N. (2016). The digital divide has grown old: Determinants of a digital divide among seniors. *New Media & Society*, 18(2), 313-331. <https://doi.org/10.1177/1461444814538648>
- [15] Xie, B., Charness, N., Fingerman, K., Kaye, J., Kim, M. T., & Khurshid, A. (2020). When going digital becomes a necessity: Ensuring older adults' needs for information, services, and social inclusion during COVID-19. *Journal of Aging & Social Policy*, 32(4-5), 460-470. <https://doi.org/10.1080/08959420.2020.1771237>
- [16] Wild, K., Wiles, J. L., & Allen, R. E. S. (2020). Resilience: Thoughts on the value of the concept for critical gerontology. *The Gerontologist*, 60(1), 1-10. <https://doi.org/10.1093/geront/gnz086>
- [17] Czaja, S. J., Boot, W. R., Charness, N., & Rogers, W. A. (2019). Improving social support for older adults through technology. *The Gerontologist*, 59(1), 1-12. <https://doi.org/10.1093/geront/gny113>
- [18] Sonderegger, A., Schmutz, S., & Sauer, J. (2015). The influence of age in usability testing. *Applied Ergonomics*, 52, 291-300. <https://doi.org/10.1016/j.apergo.2015.06.012>
- [19] Ahmed, E., DeLuca, B., Hirowski, E., Magee, C., Tang, I., & Coppola, J. F. (2017). Biometrics: Password replacement for elderly? In *2017 IEEE Long Island Systems, Applications and Technology Conference (LISAT)* (pp. 1-6). IEEE. <https://doi.org/10.1109/LISAT.2017.8001958>
- [20] Perlman, M., & Gamburd, M. (2025, February 11). *How roles change as parents become older*. *Raya's Paradise*. <https://rayasparadise.com/blog/family-resources/how-roles-change-as-parents-become-older/>
- [21] Clarke, L. H., & Bennett, E. V. (2013). Constructing the moral body: Self-care among older adults with multiple chronic conditions. *Health*, 17(3), 211-228. <https://doi.org/10.1177/1363459312464072>
- [22] Seifert, A., Cotton, S. R., & Xie, B. (2020). A double burden of exclusion? Digital and social exclusion of older adults in times of COVID-19. *The Journals of Gerontology: Series B*, 76(3), e99-e103. <https://doi.org/10.1093/geronb/gbaa098>
- [23] Silverstein, M., Gans, D., & Yang, F. M. (2018). Intergenerational support to aging parents: The role of norms and needs. *Journal of Family Issues*, 27(8), 1068-1084. <https://doi.org/10.1177/0192513X06288120>
- [24] Niksirat, K. S., Rahmamuliani, F., Ren, X., & Pu, P. (2021). Understanding intergenerational fitness tracking practices: 12 suggestions for design. *CCF Transactions on Pervasive Computing and Interaction*, 4(1), 13-31. <https://doi.org/10.1007/s42486-021-00082-2>
- [25] Kang, S. L., Endacott, C. G., Gonzales, G. G., & Bengtson, V. L. (2019). Capitalizing and compensating: older adults' religious and spiritual uses of technology. *Anthropology & Aging*, 40(1), 14-31. <https://doi.org/10.5195/aa.2019.194>
- [26] Russell, S. L. (2016). *Effects of a virtual church on the perceived spiritual well-being of the elderly: A qualitative study of participants in a virtual religious community* (Publication No. 288) [Doctoral dissertation, St. John Fisher University]. Fisher Digital Publications. [https://fisherpub.sjf.edu/education\\_etd/288](https://fisherpub.sjf.edu/education_etd/288)
- [27] Auburn University. (2024, September 20). *How fear of falling can impact older adults' physical, mental health*. AUWire. <https://wire.auburn.edu/content/ocm/2024/09/201104-fear-of-falling-ea.php>