

Digital Transformation & Healthcare Access: Operational Challenges and Implications of Aging Populations

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ABSTRACT

Digital Transformation has changed the way that Healthcare is delivered, as a result of implementing EHRs, Patient Portals, Telehealth Platforms, Automated Administrative Systems and other technologies. However, while these new ways of delivering healthcare have made hospitals more efficient, they have had inconsistent effects on senior citizens. This study examined how digital transformation has affected senior citizens' ability to access healthcare providers with limited digital literacy. It will also examine the operational effects of digital transformation for all healthcare providers. This study used semi-structured interviews (n=22) from senior citizens, hospital staff, and hospital operational managers in Bergen County, NJ; and an extended literature review across disciplines to identify ongoing barriers associated with usability, cognitive load, trust and dependency. These findings show that there is a digital divide in healthcare, extending beyond physical access to include skill levels, confidence, and health outcomes. The study presents a conceptual model of operational age-inclusive digital transformation. The results provide evidence that hospitals may experience unintended distributional effects from increases in operational efficiency unless they use inclusive approaches to implement digital transformation.

Keywords: Senior citizens; Digital divide; Technology; Healthcare; Digital transformation

INTRODUCTION

Digital transformation has had a transformative impact and structural shift in the delivery, management and access of contemporary healthcare systems. An increasing reliance on digital health technologies (DHTs) such as electronic health records (EHR), patient portals, telemedicine platforms and automated administrative processes reflect an institutionally driven desire for

increased efficiency, scalability, and data-driven decision making. DHTs have been associated with cost savings, better coordination of care, and greater access to care. However, the benefits from these DHTs are not universally realized across all patient populations. Specifically, the oldest adult population who is also the fastest growing segment of the U.S. population and also the heaviest users of healthcare resources exhibit significantly lower rates of use and engagement with DHTs. This difference represents an important intersection of demographic changes and technological advancements. As healthcare becomes increasingly digital, it is likely that those populations that require the most support from technology will be the least able to utilize the new technologies available to them. The Digital Divide theory focuses on the differences between

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specific age groups and regions, in their ability to access modern technology. This theory allows us to find the differences regarding access to technology and find a solution to these issues. This is especially important since the senior population has a hard time adapting to new technology. Research has identified several factors that contribute to low levels of use among senior citizens including low levels of digital literacy, high levels of cognitive load, lack of trust in DHTs, and perceptions of low levels of self-efficacy. Therefore, digital transformation may exacerbate existing disparities in access to healthcare rather than reduce them.

The purpose of this study was to examine how digital transformation affects older adults' access to care and identify ways to address emerging disparities. The study employed a multi-level analytic framework by examining macro-level trends in the application of digital technologies, examining organizational level practices, and examining individual-level patient experiences. In doing so, the study reframed digital inequality as an operational and design issue, rather than solely a technological one.

Using complex and difficult-to-use digital technology in their products limits hospitals and healthcare businesses' ability to reach all populations. These businesses need to focus on the senior population and make their products easier and more accessible for senior citizens to fully maximize their products. They need to start implementing new policies and using new technology for senior citizens to use technology more efficiently.

LITERATURE REVIEW

Digital transformation has gradually become embedded in nearly every aspect of healthcare delivery. What once involved paper charts and in-person scheduling now includes electronic health records, patient portals, automated reminders, and virtual consultations. Researchers in business and information systems describe digital transformation as more than just the adoption of new tools; it represents a broader reorganization of how institutions operate and deliver value (1). In healthcare, this shift has changed not only administrative workflows but also how patients interact with providers.

The COVID-19 pandemic significantly accelerated this transformation. De, Pandey, and Pal [2020] note that healthcare systems were forced to adopt digital solutions rapidly in order to maintain continuity of care (2).

Telehealth, in particular, expanded at an unprecedented rate. Wosik *et al.* [2020] describe how virtual care allowed hospitals to reduce infection risk while continuing to treat patients (3). Although this transition demonstrated the flexibility of digital systems, it also made clear that not all patients were equally prepared to engage with them.

At the same time, the United States is experiencing substantial demographic change. The population aged 65 and older continues to grow, and projections indicate that this group will expand significantly by 2030 (NIC MAP, 2025) (4). Senior citizens also account for a large share of healthcare utilization. This creates a complex situation: healthcare systems are becoming more digitally sophisticated just as their primary users are aging. The intersection of these trends raises important questions about access and inclusion.

Earlier discussions of the digital divide focused mainly on whether people had access to the internet or digital devices. In many developed countries, basic access has improved. However, more recent research suggests that inequality now operates in subtler ways. Kunonga *et al.* [2021] argue that even when senior citizens have internet access, they may struggle with the skills required to use digital health platforms effectively (5). The divide, therefore, is not only about connectivity but also about confidence, literacy, and the ability to benefit from digital systems.

Qualitative studies provide insight into how these barriers are experienced in everyday life. Wilson *et al.* [2021] identify recurring challenges, including limited digital literacy, concerns about privacy, physical impairments, and financial constraints (6). These factors often overlap. For example, a patient with mild vision impairment may find small fonts and multi-step login procedures especially frustrating. Zhao *et al.* [2021] similarly report that senior citizens using internet-based home care services often worry about making mistakes online, which discourages engagement (7).

Telehealth illustrates both the advantages and limitations of digital healthcare. Virtual visits reduce travel time and can make follow-up appointments more convenient. However, adoption is not uniform across age groups. Wildenbos *et al.* [2018] found that senior citizens were less likely to register for and consistently use patient portals, even after these systems had been available for a year (8). Complex registration processes and password requirements created barriers that many found discouraging. Zhao *et al.* [2021] observed similar patterns in home care settings, where some senior

citizens relied on family members to navigate digital systems (7).

Importantly, research does not suggest that senior citizens are uniformly opposed to technology. Chu *et al.* [2025] show that when digital tools are designed with usability in mind, they can support healthy aging (9). Chopik [2016] even found that social technology use among senior citizens associated with reduced loneliness and improved well-being (10). These findings complicate the narrative that digital technology is inherently exclusionary. Instead, they suggest that outcomes depend heavily on design and implementation.

Psychological factors also play a significant role. An *et al.* [2024] demonstrate that technology anxiety and self-perception strongly influence senior citizens' willingness to use digital public services (11). Even when individuals recognize potential benefits, fear or uncertainty can limit engagement. Research on aging and decision-making provides additional context. Carpenter and Yoon [2011] find that senior citizens often prefer familiar routines and may be less comfortable with complex decision environments (12). In healthcare, this may translate into a preference for in-person visits, where communication feels more direct and reassuring.

Trust is particularly important in medical settings. Reyes *et al.* [2023] note that senior citizens' experiences with digital self-management tools vary widely (13). Some feel empowered, while others describe frustration or a sense of distance from their providers. Balci and Aslan [2025] report that participants sometimes interpret difficulty with technology as evidence that they are "too old" to learn, which can reinforce avoidance (14). These emotional responses are as significant as technical barriers.

Design choices further shape these experiences. Knowles *et al.* [2021] argue that accessibility should not be treated as an afterthought (15). Many systems are built around assumptions about speed, memory, and dexterity that reflect younger users. Zoorob *et al.* describe how older patients often perceive online healthcare systems as insufficiently tailored to their needs (16). When interfaces prioritize efficiency over clarity, they can unintentionally marginalize users who require more straightforward navigation.

Socioeconomic factors add another layer of complexity. Wilson *et al.* [2021] highlight that lower-income senior citizens may lack updated devices or reliable internet connections (6). Carrillo Soubic's work on technologies and senior citizens emphasizes that affordability and infrastructure continue to shape

access globally. Age, therefore, intersects with income, education, and geography in ways that influence digital health engagement.

From an institutional perspective, digital transformation is often framed as an efficiency strategy. Kraus *et al.* [2021] describe how organizations adopt digital systems to streamline operations and reduce costs (1). In healthcare, this can mean fewer paper-based processes and more automated communication. Bs *et al.* [2025] discuss the growing role of health technology navigators who assist patients with digital tools (17). While these roles help reduce barriers, they also reflect the fact that many systems are not intuitive for all users.

Social Exclusion theory is the process of people being disregarded and isolated within society. With senior citizens having difficulties with technology, they are being left behind and ignored because of their lack of skills with technology. This situation can be further explained with Behavioral Economics. Behavioral economics, according to UChicago News, is the "empirical observations of human behavior, which have demonstrated that people do not always make what neoclassical economists consider the 'rational' or 'optimal' decision". This theory is relevant to this paper in the sense that even with digital use in healthcare and all business being much more efficient, it is just something the senior population doesn't want to do. The Digital Divide theory looks at the differences between age groups and regions' access to modern technology. Using this theory, we can find the differences regarding access to technology and assess and find solutions to these issues. People adapting to new technology also differ by age. The senior population has a harder time adapting to new types of technology since they aren't even familiar with the previous versions. The Social Exclusion theory describes the process of people being pushed away and not included in society. With difficulties with technology in the senior population, they are being left behind. They are being ignored due to the fact that they can't adapt to this digital-based society we now live in.

Taken together, the literature suggests that digital healthcare offers clear advantages but also creates uneven experiences. Senior citizens are not uniformly resistant to technology, nor are they incapable of adaptation. However, adoption depends heavily on usability, emotional comfort, socioeconomic context, and institutional design. The challenge is not simply technological but structural. As healthcare continues to digitize, understanding how these systems affect aging populations becomes increasingly important.

METHODS AND MATERIALS

This study uses a qualitative case study approach to better understand how digital transformation in healthcare affects senior citizens and how healthcare institutions are responding to these changes. Because the goal of this research is to explore lived experiences, perceptions, and operational practices, a qualitative design was most appropriate.

Participants

The research was conducted in Bergen County, New Jersey. A total of twenty-two participants were included in the study, consisting of three groups: ten senior citizens, ten healthcare workers, and two hospital operational managers. Including multiple perspectives allowed for a more comprehensive understanding of how digital systems function across different levels of the healthcare process. Senior participants were recruited through local nursing homes, as they regularly interact with healthcare providers and digital health systems such as patient portals and telehealth platforms. Healthcare workers, including nurses and a physical therapist, were contacted through professional networks and email outreach. Operational managers were identified by reaching out to hospitals in the region and requesting interviews with individuals involved in digital implementation and administrative strategy. With the sample size being 22 and within Bergen County, New Jersey, there are some limits. Some of these limitations may be homogeneity of context, outliers, lack of diversity, and low statistical power.

Data Collection

Semi-structured interviews were conducted with each participant. This format allowed for consistency across interviews while also providing flexibility for follow-up questions and clarification. Questions for senior participants focused on their experiences using digital healthcare tools, including patient portals, appointment systems, and telehealth services. They were asked about specific challenges, perceived benefits, and how digital systems affected their access to care. Healthcare workers were asked about how digital tools influenced their daily responsibilities, their interactions with patients, and whether they observed differences in how senior citizens navigated these systems. Operational managers were asked about institutional decisions related to digital adoption, perceived efficiency gains, and strategies used to address barriers faced by senior patients. 15 questions

were asked to each interviewee. Questions like “What are your opinions on the use of digital technology within the healthcare system, and how have you seen it hurt or help the system?” were asked throughout the interview.

Analysis

Interviews were analyzed using thematic analysis. Responses were reviewed multiple times to identify recurring patterns, including usability challenges, emotional responses such as frustration or anxiety, reliance on family members, and institutional adaptations. Rather than focusing on isolated statements, the analysis examined how themes appeared across different participant groups. This approach made it possible to connect patient experiences with operational decisions.

Ethics

This study adhered to standard ethical research practices. All participants provided informed consent prior to participation and were informed of the study’s purpose, the voluntary nature of their involvement, and their right to withdraw at any time. To protect confidentiality, no personal identifiable information was collected, and all responses were anonymized during transcription and analysis. Given the inclusion of potentially vulnerable populations, particularly senior citizens, additional care was taken to ensure that questions were clear, non-coercive, and did not cause distress.

RESULTS

To provide a structured account of how digital transformation is experienced across the healthcare system, findings are organized by participant groups: senior citizens, healthcare workers, and hospital operational managers. While each group engages with digital healthcare from a distinct perspective, their accounts reveal consistent and overlapping patterns related to usability, dependency, trust, and operational trade-offs. The four major themes identified across participant groups are summarized in Table 1. Representative quotes are included to ground each theme in participant experience. The results also support the Digital Divide theory and the Social Exclusion theory. The senior citizens are being isolated, due to their lack of knowledge of technology. Therefore, they are not able to access healthcare, if gone digital. The Digital Divide theory is also supported with the fact that senior citizens

Table 1. Major themes identified from interviews on older adults' experiences with digital healthcare.

Major Themes	Description	Example
Usability	Technology is difficult to use for senior citizens, since technology does not take into account physical impairments senior citizens may have. It is also hard for senior citizens to navigate through a digital system.	Font on blood pressure monitor being too small too read. Hard to navigate through multiple menus and barriers to logging in.
Cognitive load	There is a lot of mental effort needed in order to learn and remember how to do tasks through digital technology.	Senior citizens get anxious when pressing buttons since it can lead them to erasing important information. Passwords can also be forgotten, which is needed for access to medical records.
Trust/Privacy	There are low levels of confidence in digital systems. Senior citizens are used to in-person doctors. They also fear that their information is not secure online.	Senior citizens trust doctors who they have met and talked to more than doctors who they have met through a screen.
Dependency	Senior citizens need to rely on family members or care takers to use digital technology. They are not able to interpret the technology used in healthcare.	Senior citizens' daughters help them set up video calls with doctors or help email nurses for medication.

throughout the study have been found to differentiate from other age groups with the use of technology. While the young adults may have a good understanding of how technology works within healthcare, senior citizens struggle with this.

While these results are a generalization of the entire senior population. There are differences depending on where the senior citizen lives. For example, when a senior citizen lives in a more urban area, they are exposed to more technology and have more access. While senior citizens who live in rural areas tend to have less technology exposure and have less access overall.

These themes were derived from a multistep process. With the 3 types of interviews, with nurses, senior citizens, and operational managers, we stratified each one into separate sections. Then we looked for key words like isolation, help, and difficulties within the interviews to find the theme throughout that interview. Then with each interview having a theme, we put interviews with similar themes together and create sub sections. The overall themes on the chart above were made from the collection of themes from each interview. The examples were found from each interview allowing us to use real life experiences from interviewees.

Potential Bias

With these results there may be bias due to the interviews being conducted within Bergen County, NJ. Some bias also may come from me believing that

some aspects of digital transformation have harmed or negatively impacted senior citizens.

Senior Citizens

Participants repeatedly expressed the notion that digital health has become an ever-present part of receiving health care. They stated that MyChart and other digital platforms are not "nice-to-haves" or "optional," but rather necessary components for completing various aspects of health care. Although many participants have normalized the use of these digital platforms; many of them also report substantial difficulties in using these platforms independently.

The primary source of participants' frustrations was the complexity of each platform's multi-step processes. The following quote represents a participant's experience with the workflow after an appointment: "After my appointment, I had to go to MyChart and obtain my prescription, then I had to forward it to the imaging center... I'm not really familiar with all those systems, so I needed someone's help." The quote above illustrates how patients must now navigate multiple digital platforms to complete routine administrative tasks. As a result, patients may encounter confusion and/or frustration at any point during this process.

Another major pain point experienced by participants was credential management (i.e., managing passwords). Participants frequently reported forgetting their password(s) to access healthcare related applications.

Therefore, many participants were unable to access digital applications because of forgotten passwords. The issues with credential management highlight larger problems of cognitive overload. Participants experienced cognitive overload attempting to create/remember continuity among multiple steps, while simultaneously interpreting/understanding application user interfaces.

Many participants relied heavily upon family members to assist in accomplishing digital tasks. Participants frequently cited dependency on their children to complete digital tasks out of necessity. Notably, many participants did not view this reliance as a convenience. Rather, they viewed this dependency as a constant requirement. For example, a participant indicated she relies “constantly” on her daughter to assist in navigating health care

Healthcare Workers and Aids

Healthcare workers generally emphasized the operational benefits of digital transformation, particularly in improving documentation and coordination. Electronic health records were described as reducing paperwork and making patient information more accessible. However, these benefits were consistently qualified by challenges observed among older patients.

Providers reported that many senior patients struggle with basic digital tasks. Common issues included forgotten login credentials, difficulty navigating applications, and challenges related to sensory impairments. One provider noted that “the more times that the patients need to do things on the computer or on their phone, it becomes more difficult for them.” This highlights how repeated digital interactions can accumulate into a significant barrier.

Healthcare workers also emphasized that digital tools can be beneficial under the right conditions. For example, one physical therapist explained that “you could have them watch videos of their exercise, which I believe can actually improve compliance.” However, such benefits depend on the patient’s ability to independently access and use technology.

In practice, this condition is often unmet. Providers observed that many senior citizens require assistance from family members to engage with digital systems. Without such support, patients may be unable to access key aspects of care. This reinforces the idea that digital healthcare systems assume a level of user capability that is not universally present.

Telehealth was described as dependent context. While effective for follow-ups and routine consultations, it was seen as less suitable for initial evaluations or complex

discussions. Providers noted that in-person interactions allow for better communication and trust-building, particularly when dealing with sensitive health issues.

Importantly, healthcare workers highlighted that time saved through digitization is often offset by new demands. Assisting patients with technical issues, explaining system use, and compensating for incomplete digital engagement require significant time and effort. As a result, digital transformation does not eliminate workload but redistributes it in less visible ways.

Hospital Operations and Administrators

Administrative hospital managers have generally framed digital transformation in operational terms — as a way to increase efficiency and modernize operations. The movement to digital health records and systems was characterized by hospital managers as a process of increasing efficiency through reduced paperwork, improved communication and streamlined operations. Thus, the use of digital tools has been framed as a competitive necessity and will be required to maintain an organization’s ability to scale and respond to evolving environments.

Administrators recognized that many patients do not easily adapt to new digital systems. Consequently, hospitals have developed a variety of strategies designed to assist patients in adapting. A manager explained that her institution has added additional entry points into digital systems; she noted that patients can now enter the system via text messaging, eliminating the need for them to remember login credentials. Managers stated that patients who experience difficulty accessing the system via text messaging may still utilize telephone-based entry points.

Administrators noted that hospitals provide additional support mechanisms such as instruction manuals, technical assistance or “help desks” and scheduled training sessions to improve patient’s digital literacy skills. These additional support mechanisms demonstrate an acknowledgment that some electronic health record (EHR) systems are not currently accessible to all potential users.

While the additional support mechanisms are important in helping patients access EHR systems, they represent a secondary choice — the primary means of communicating with a provider remains the EHR platform. An administrator expressed this concept when stating “despite our expansion digitally...they would actually benefit from going in to see a doctor.” This statement further emphasizes the ongoing importance of

direct, face-to-face interactions between providers and patients — especially for those over age 65.

Administrative hospital managers also reported that the transition to digital health records and systems results in decreased reliance upon administrative personnel and paper-based workflow. Additionally, hospital managers acknowledge that a complete transition to entirely digital health care delivery is not possible. Therefore, hybrid approaches — utilizing both digital systems and providing in-person and telephonic support — will continue to be used to ensure access for diverse patient populations.

DISCUSSION

The research adds to what is known about the gap of equality in the way that people interact electronically with health care. By showing that the barrier to using electronic platforms extends well past the point of accessing the platform itself, the study provides evidence that while many senior citizens are capable of utilizing electronic platforms, there are very few ways in which they will actually utilize them.

Participants repeatedly demonstrated a clear inability to complete multi-step processes, enter login credentials, and navigate other elements of digital systems. This supports prior research by Robinson *et al.* [2015] which demonstrates that even once someone has access to a digital platform, there exists a large “digital divide” -- especially for those older than 65 years old, and who lack sufficient education/skills to make efficient use of digital platforms (18). Additionally, the interview data demonstrated that access alone is not enough. Seniors may be able to get into a digital system, however they typically cannot obtain the information needed to assist with their health care needs efficiently. Both trust and self-efficacy emerged as important factors in addition to usability. Similar to the studies cited previously, participants indicated discomfort in using digital platforms for managing sensitive health care information and preferred in person interactions as they felt those interactions allowed for better communication and transparency.

This feeling is supported by other studies which indicate that limited exposure to technology reduces an individual’s confidence to participate in activities involving technology. Even if a digital system was created to provide efficiencies for healthcare providers, these psychological barriers can greatly hinder participation. As evidenced in participant statements regarding digital healthcare being stressful and prone to errors, digital

platforms create a barrier for seniors to become engaged versus empowered.

In addition to these issues, the study also highlights that one of the most commonly held assumptions that digital transformation will universally improve healthcare efficiency does not hold true across all demographics. While young, technologically-savvy populations may see improvements in workflow due to streamlined systems, senior citizens typically view digital systems as creating friction resulting in slower access and increased time/effort required. Wildenbos *et al.* [2018] reported similar findings, indicating that “22% of respondents encountered usability issues at login and/or viewing test results,” along with other problems stemming from fragmented information access (8). Participant comments in the interview portion of the study describe difficulty locating test results and completing simple administrative tasks, thus continuing to demonstrate that designers of digital systems fail to adequately address older users’ needs.

Lastly, the study identifies several “hidden costs” associated with digital transformations. Instead of removing administrative burdens from healthcare organizations, digital systems appear to shift them onto patients/families. Many senior participants relied on family members (in particular adult children) to help facilitate their access to digital platforms. Reyes *et al.* [2023] identified a similar dynamic noting that approximately 14 percent of senior citizens rely on family members for technology-assisted healthcare-related tasks (13); however, the qualitative data suggest this dependence is likely more prevalent. Many seniors cannot independently interact with digital systems and therefore place caregivers in an unacknowledged role within the larger healthcare ecosystem. These dynamics clearly support and expand previous digital divide theories, highlighting differences between access, skill development, and desired outcomes. First level “digital divides”, which include access to devices/internet etc., have closed somewhat. Second- and third-level divides, which relate to skill acquisition/development, user-confidence levels and ability to acquire meaningful benefits, have not been closed. The study illustrates that when seniors have access to technology but have poor literacy skills and high levels of cognitive loads, they cannot capitalize on the full functionality provided by technology, thus increasing gaps in healthcare outcomes based on age. Therefore, digital transformation may widen existing inequities by providing advantages to users who already possess technological proficiency.

The study supports various behavioral rationales for why senior citizens resist technology. Status quo bias and loss aversion (i.e., preferences for familiar systems and a perception of higher risks with new systems) explain why many senior citizens express a preference for in-person care. Ladin *et al.* [2021] showed that patients value interpreting physicians' personality characteristics and communication styles during in-person visits more than during virtual visits (19), a concept illustrated in the interviews in this study. Senior citizens stated that virtual visits feel less personalized and decrease their trust. Combining the loss of relational qualities with the cognitive stressors imposed by interacting with digital tools increases many seniors' desire for traditional care delivery models.

Additionally, the study highlights how rapidly digital transformation has occurred compared to the rate at which senior populations develop and implement the adaptations necessary to interact with these changes. The rapid implementation of digital systems throughout healthcare has placed many seniors under pressure to learn technologies they do not fully comprehend. A great deal of stress and decreased confidence accompany this pressure. When benefits exist for seniors from using digital tools, the associated cognitive/emotional costs will often result in seniors preferring face-to-face care options because they believe they are more competent, independent and safe.

Different areas of living came with different usage of digital technology. A study conducted found that urban respondents were more likely to use common household electronics, rather than rural respondents (20). These household electronics are items like televisions, microwaves, cell phones, etc. Rural areas are often associated with lower average education and income compared to urban areas. Because of this, exposure to technology for senior citizens is limited within certain areas. Making the switch from physical to digital in healthcare systems even more challenging for rural citizens, while urban citizens may have more familiarity.

These results further support the Digital Divide theory. The senior citizens in urban areas are able to have access and more exposure to digital technology, therefore being more comfortable with technology in healthcare. However, the senior citizens are being isolated and are not limited to the usage of technology, making them uncomfortable with technology in general.

Overall, the integration of these findings suggests that digital transformation in healthcare should not be evaluated solely in terms of aggregate efficiency

gains. Instead, it must be understood as a process that redistributes effort, reshapes patient experience, and introduces new forms of inequality. For senior citizens in particular, the challenge is not simply gaining access to digital systems, but navigating them effectively, confidently, and without disproportionate burden.

Recommended Conceptual Model: Operational Age-Inclusive Digital Transformation

The use of digital transformation within the healthcare system begins at the systematic level with the use of electronic health records (EHR), portals, and telehealth. These technologies were implemented with the healthcare system to help the overall efficiency of the institution. However, with these being implemented, senior citizens encounter barriers. These barriers include the complex usability requirements, high cognitive load, and lack of trust and dependency. These barriers lead to less use and access to care, frustration, and reliance on others to navigate through the use of digital tools. This creates a hidden system effect, where the workload of the digital tool is distributed to family members and providers due to their low ability to use digital tools. To address this mismatch requires a shift to a solution highlighting age-inclusive strategies to bridge the gap between technology and senior citizens (Figure 1).

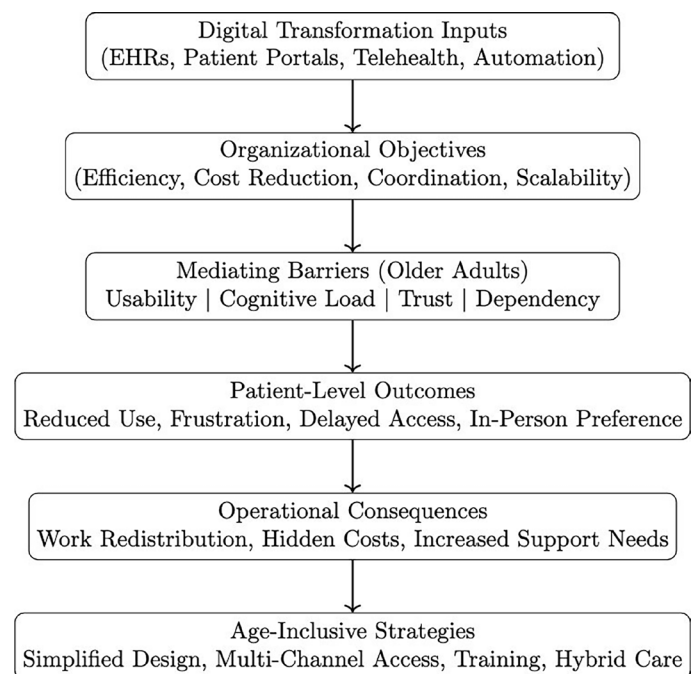


Figure 1. Conceptual Model of Operational Age-Inclusive Digital Transformation.

Building on empirical research and theoretical frameworks, the proposed model of Operational Age-Inclusive Digital Transformation provides a framework for understanding both efficiency gains through the deployment of digital healthcare systems and the disparate access created through the same systems.

The central mechanism of the proposed model is the deployment of DHT's (digital health technologies) which include electronic health records, patient portals, telehealth platforms, etc. As such, they have been designed to serve the needs of hospitals and other healthcare organizations as a means to meet their organizational goals; such as increasing efficiency, decreasing administrative burden, improving communication between departments, and creating scalable systems. As stated above, the institutional benefits of using DHT's to streamline operations and reduce reliance on paper-based systems is substantial. However, the model also illustrates that these institutional efficiencies are contingent upon a number of user-level barriers which tend to disproportionately affect senior citizens. The four primary mediators identified were usability issues related to interface complexity, step-by-step task completion requirements, and navigation difficulties. Cognitively-based mediation is represented through the need for senior citizen users to expend greater amounts of mental energy to remember passwords, navigate through confusing system layout designs and sequentially complete numerous tasks. A third mediator is represented by "trust" in digital systems. Senior citizens are less likely to trust digital systems when accessing their personal health information. The fourth mediator is "dependency." This represents the degree to which senior citizens rely on others (such as family members or caregivers) to assist them in completing digital tasks. Each of these barriers affects senior citizen patient-level outcomes. Specifically, barriers to independent use of digital systems lead to lower rates of independent use. Barriers create higher levels of frustration among senior citizen users. Barriers result in senior citizens experiencing delays or being unable to obtain complete care. Finally, barriers result in a continued desire for senior citizens to interact in person with providers and healthcare systems. While access to technology exists for senior citizen users, the barriers mentioned limit the extent to which senior citizens are able to realize all of the potential benefits offered by digital healthcare, thereby reinforcing differences in access and outcomes.

In addition to its impact at the patient level, the proposed model also recognizes there are operational

effects extending beyond the patient level. While digital transformation decreases administrative labor in some areas of healthcare organizations, it increases the amount of labor in other areas. More specifically, while digital transformation reduces certain types of administrative labor in healthcare organizations, it shifts those responsibilities onto patients, caregivers, and healthcare workers. In turn, this results in a greater reliance on informal support networks and more time spent on resolving technical issues. These "hidden costs," therefore, indicate that organizational-level efficiency gains realized through digital transformation may be mitigated by increased burdens experienced elsewhere.

These themes were found from the interviews conducted with patients, nurses, and operational managers. With all 3 of these perspectives, we are able to have insight on the institutional level and the consumer level. However, interviews with the patients and senior citizens were used the most for their perspective and opinion on digital healthcare and how it has affected them. The themes of senior citizens having barriers and difficulties with using digital technology helped create the theme of barriers being in place. The literature review was mainly used for data and other experiments with healthcare systems to find the changes made within the system and how it has affected the senior population and healthcare as a whole. The themes that were found from literature review were how the system changed for efficiency while forgetting about the senior population, allowing them to fall behind.

Finally, the proposed model includes a series of age-inclusive design and implementation strategies for overcoming the barriers identified. The proposed strategies include designing simpler user interfaces; eliminating unnecessary authentication procedures; developing alternative entry points (e.g. text-based and phone-based); providing technical support exclusively focused on assisting senior citizens; incorporating caregivers into the care process; and preserving hybrid models of care delivery that allow for face-to-face interaction between senior citizens and healthcare providers. These strategies function as corrective measures intended to decrease user-level barriers and mitigate the disparate outcomes associated with unequal access.

Overall, the conceptual model reframes digital transformation in healthcare as an operational and design problem rather than solely a technological one. It highlights that the success of digital systems should be evaluated not only by efficiency gains, but by their ability

to deliver equitable access across diverse populations. Without intentional, age-inclusive design and implementation, digital transformation risks amplifying existing disparities by privileging users who are already digitally proficient.

CONCLUSION

This study examined whether the increasing digital transformation of healthcare services improves senior citizens' access to medical care and how healthcare organizations respond operationally to these changes. The analysis drew on semi-structured interviews with senior citizens, healthcare professionals, and operational managers in Bergen County, New Jersey, as well as a comprehensive interdisciplinary literature review, to assess how the growing reliance on digital healthcare creates both positive institutional effects and negative barriers at the patient level.

The findings identified three major areas of challenge experienced by senior citizens in accessing healthcare through digital means. First, the digital divide extends beyond physical access to technology; senior citizens face substantial difficulties related to usability, confidence and trust in technology, dependence on others for assistance, and the ability to achieve meaningful care outcomes. Many older participants reported difficulty navigating portals, remembering passwords or credentials, and completing multi-step administrative tasks. Healthcare worker participants explained that although digital tools such as electronic health records improve documentation and patient coordination, they also increase the need for additional support for older patients. Hospital administrators similarly reported clear gains in efficiency resulting from digital transformation, while also recognizing the continuing need for human support, analog alternatives, and hybrid models of care.

A central contribution of the study is the development of a conceptual model of age-inclusive digital transformation in healthcare operations. This model demonstrates that digital systems produce unequal effects because organizational efficiencies are mediated by user-facing barriers, including cognitive overload, poor usability, lack of trust in technology, and reliance on family members or caregivers. Without deliberate age-inclusive implementation strategies, digital transformation may shift burdens onto senior citizens, their families, and frontline healthcare workers rather than reduce them.

The findings further suggest that age-inclusive digital

transformation requires more than simply increasing the availability of digital tools. Instead, it requires redesigning healthcare delivery around the realities of aging populations through simpler systems, multiple access pathways, dedicated support structures, and the preservation of in-person care when appropriate. Future evaluations of digital transformation should therefore assess not only conventional metrics such as cost reduction and workflow speed, but also the extent to which these changes expand equitable access across diverse patient populations.

Although the study is limited by its small sample size and geographic concentration, it offers valuable insight into how digital healthcare is experienced and managed at both the patient and organizational levels. As healthcare systems become increasingly reliant on digital solutions, the central issue is no longer whether further digital transformation will occur, but how to ensure that such transformation is both operationally efficient and socially inclusive.

CONFLICT OF INTEREST

The author declares that there are no conflicts of interest related to this work.

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