

Digital divide: A qualitative study on older adults' digital health literacy in non-first-tier cities in China

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Abstract: As China faces the dual challenge of rapid digitalization and an aging population, disparities in digital health literacy among older adults threaten equitable access to health services. This qualitative study investigates the lived experiences of community-dwelling older adults in non-first-tier Chinese cities in navigating digital health services, aiming to understand the personal, cognitive, and environmental factors influencing their engagement. Grounded in phenomenological methodology, semi-structured interviews were conducted with ten older adults aged 60 to 77. Data were analyzed using Colaizzi's seven-step method, guided by the Health Promotion Model and Orem's Self-Care Deficit Theory. Three major thematic domains emerged: (1) motivational barriers to adopting digital health, such as negative self-efficacy and reliance on traditional healthcare models; (2) constraints in functional and digital health literacy, including memory decline, technological challenges, and fear of online fraud; and (3) the influence of external environmental factors, including familial support, lack of formal training, and the inadequacy of existing service platforms. While participants acknowledged the convenience and potential of digital health, most lacked the confidence, skills, or contextual support to utilize such services meaningfully. These findings highlight the need for age-sensitive design, targeted literacy interventions, and community-based training programs to bridge the digital divide and promote health equity among older adults. The study offers practical insights for policy and practice in digital public health and gerontological care.

Keywords: *Digital divide, Digital health literacy, Health promotion model, Lived experience, Non-first-tier cities, Older adults, Qualitative research, Self-care deficit theory.*

1. Introduction

In the rapidly evolving landscape of healthcare, digital health has emerged as a transformative force, offering innovative tools and services to improve patient care, enhance efficiency, and promote proactive health management [1, 2]. However, the benefits of these advancements are not equally distributed across all populations. Among those at risk of exclusion are older adults, especially those residing in non-first-tier cities where digital infrastructure and targeted support may be limited [3]. Despite the promise of digital health in enabling active aging, the persistent digital divide threatens to exacerbate health inequities for the aging population [4].

Digital health literacy, defined as the ability to seek, comprehend, evaluate, and apply digital health information, is a critical determinant of whether older adults can access and benefit from digital health services [5, 6]. This competency becomes especially important for community-dwelling older adults who are expected to self-manage their health through technologies such as remote consultations, health apps,

and digital monitoring tools [7]. Yet, barriers such as age-related cognitive and physical decline, limited educational background, and insufficient digital training contribute to a low level of digital health literacy in this demographic, thereby hindering their participation in and benefit from modern healthcare systems [8–10].

While quantitative research has documented the prevalence and predictors of low digital health literacy among older adults [11], there remains a significant gap in understanding their lived experiences and the real-world challenges they face when interacting with digital health systems. Addressing this gap is essential to developing context-sensitive strategies and empowerment models that align with their unique needs and socio-cultural environments. With these having said, the current study focuses on exploring these lived experiences among older adults in non-first-tier Chinese cities through qualitative inquiry, aiming to generate practical insights and inform the development of inclusive digital health literacy interventions.

To guide the investigation, this study integrates three complementary theoretical lenses. Pender's Health Promotion Model [12, 13] frames the motivational and behavioral aspects of health promotion, emphasizing how individual characteristics such as prior experience, self-efficacy, and perceived barriers shape health behaviors, here, the uptake of digital health tools. Orem's Self-Care Deficit Theory [14] contributes a nursing perspective, viewing digital health engagement as a form of self-care that may require professional support when older adults lack the capacity to manage independently. Finally, Locsin's Technological Competency as Caring in Nursing [15, 16] bridges technology and person-centered care by emphasizing the need for empathetic, individualized technological support that honors the older adult's dignity and autonomy. Together, these theories provide a robust framework for analyzing the psychological, behavioral, and systemic factors influencing digital health literacy among older adults.

This study holds significant value in advancing equitable healthcare access and inclusion for aging populations in digitally transforming societies. By focusing on older adults residing in non-first-tier cities in China, the research highlights a population that is often overlooked in discussions about digital innovation in health. The insights gained from their lived experiences offer a grounded understanding of how psychological, physical, environmental, and social factors intersect to shape digital health literacy. In doing so, the study contributes to a more nuanced and human-centered approach to addressing digital disparities in healthcare. Furthermore, the research deepens our theoretical understanding of digital health engagement by integrating perspectives from health promotion, self-care, and person-centered technology use in nursing. Rather than relying solely on quantitative indicators of access and literacy, this qualitative inquiry brings forward the voices of older adults themselves, providing rich, contextual data that can inform the design of supportive interventions. These findings can guide healthcare providers, community organizations, and policymakers in developing more inclusive training programs, service platforms, and care strategies that align with the real needs and capacities of older adults. In essence, by identifying barriers and enablers in the use of digital health tools, this study supports ongoing efforts to reduce the digital divide and promote active aging. It ultimately contributes to building a more inclusive healthcare system that values the autonomy, dignity, and participation of older adults in the digital era.

Specific research objectives (RO) are as follows:

- RO1: To explore the psychological and motivational factors that influence community-dwelling older adults' engagement with digital health services, including self-efficacy, perceived need, and reliance on traditional care models.
- RO2: To identify and describe the internal and external barriers that constrain older adults' ability to access and evaluate digital health information, including physical limitations, technological skills, and privacy concerns.
- RO3: To examine the role of external environmental factors, such as support systems, training availability, and platform design, in shaping older adults' digital health literacy and to propose an empowerment model to address these challenges.

2. Literature Review

Aging Population and Its Crisis – Aging population is a global demographic trend that presents serious challenges to public health systems, economies, and social structures [17]. As life expectancy increases due to advances in healthcare and technology, birth rates in many countries continue to decline, leading to a growing proportion of older adults in the population [18]. For instance, countries such as Japan, South Korea, China, and the United States have reported declining fertility rates, exacerbating the aging population problem [19–22]. It is said that by mid-21st century, the global population aged 60 and above will reach more than two billion, representing a quarter of the total world population [23]. Older adults are particularly vulnerable due to age-related physiological decline, increased susceptibility to chronic and multiple diseases, and greater dependency needs [24]. Multimorbidity; defined as the co-occurrence of two or more chronic conditions, is prevalent and associated with reduced quality of life and increased mortality [25, 26]. Hence, the growing need for complex, long-term care will place substantial financial burdens on healthcare systems, particularly in countries like China, where aging is rapidly accelerating [27].

Addressing the Challenge of Aging: Global and National Responses - To address these challenges, global and national organizations have initiated frameworks and strategies promoting healthy and active aging. The World Health Organization's (WHO) active aging policy framework [28], later reframed as “healthy aging,” emphasizes optimizing opportunities for health, participation, and security. Succeeding global strategies such as the “Global Strategy and Action Plan on Aging and Health (2016–2020)” and the “UN Decade of Healthy Aging (2021–2030)” have all stressed health equity, community capacity-building, and integrated care. It also follows that various countries have implemented aging policies with differing approaches. European countries launched projects such as “Pro Health 65+” and “COURAGE in Europe” to study aging and health promotion [29, 30]. Furthermore, the United States enacted the “Older Americans Act” to promote independent living, supplemented by initiatives like “Area Agencies on Aging and the Affordable Care Act” [31]. While, China's response has evolved from institutional care to a community-supported, home-based model, guided by policies such as the “Healthy China 2030 Planning Outline” and “The National Mid- and Long-term Plan for Actively Responding to Population Aging” [32, 33].

Digital Health: Development and Application - Amid the pressures of aging populations and overburdened healthcare systems, digital health has emerged as a transformative solution. It encompasses a broad array of technologies, including artificial intelligence, big data, wearable devices, telemedicine, and smart homes, that enable the efficient collection, dissemination, and application of health data [34, 35]. These technologies support diagnosis, treatment, chronic disease management, and health monitoring, and are integral to achieving WHO's vision of people-centered integrated healthcare [36, 37]. More recently, the advent of Artificial Intelligence (AI) Chatbots, which have sparked various innovative improvement in automated driven healthcare software and applications [38–40]. Moreover, for older adults, digital health offers specific benefits in promoting independent living, disease prevention, and social engagement. Remote health services, smart home technologies, and mobile health applications can improve clinical outcomes, reduce loneliness, and optimize care delivery [41–43]. Despite these benefits, uneven access to digital health services has underscored the issue of digital health equity.

Health Literacy and Digital Health Literacy - Health literacy can be defined as an individual's capacity to obtain, understand, and apply health information—is a foundational component of effective healthcare engagement [44, 45]. Digital health literacy (also more commonly known as “eHealth literacy”) extends this concept to the digital domain, requiring skills in navigating online platforms, evaluating digital content, and using digital tools to manage health [46]. Several theoretical models have expanded this concept. Norman and Skinner [47] wherein they outlined six core literacies, such as: basic, health, information, media, computer, and scientific literacy, as foundational to digital health literacy. Later frameworks such as the “Integrative Model of eHealth Use (IMeHU)” and “Transaction Model of eHealth Literacy (TMeHL)”, both emphasize the dynamic interplay between individual skills, behaviors,

and contextual factors [48, 49]. Later on, an ecological model proposed by Levin-Zamir and Bertschi [50] further highlights how digital health literacy is shaped by personal attributes, physical health status, and environmental support systems.

The Digital Divide and Disadvantaged Older Adults - Despite the potential of digital health, older adults often face barriers that limit their participation. The digital divide; the gap in access to and effective use of digital technologies, disproportionately affects older populations due to age-related cognitive decline, limited technical experience, and reduced educational attainment [51-53]. In China, studies show that digital health literacy among older adults remains low across regions, from urban areas like Shanghai to rural communities [8, 54]. More importantly, multiple factors are said to influence digital health literacy in older adults, including age, gender, education, income, social support, and living arrangements [55-57]. For instance, those who live alone or lack spousal support tend to report lower digital engagement. Hence, the understanding these multifaceted barriers is crucial for designing interventions that promote equitable access to digital health services.

Synthesis and Theoretical Integration - The convergence of global aging and digital health innovation presents a pressing need to understand how older adults engage with digital technologies in real-world health contexts. While digital health offers promising pathways for improving access and quality of care, existing research has largely relied on quantitative assessments that overlook the nuanced, lived experiences of older adults; particularly in under-resourced areas. This study addresses this critical gap by employing a qualitative approach to explore the digital health literacy experiences of community-dwelling older adults in non-first-tier cities in China. Grounded in Pender's Health Promotion Model, Orem's Self-Care Deficit Theory, and Locsin's Technological Competency as Caring in Nursing, the study frames digital health literacy as a multifaceted phenomenon influenced by individual motivation, caregiving dynamics, and the meaningful use of technology. These theoretical perspectives help contextualize the barriers and facilitators that older adults encounter in accessing and utilizing digital health services.

3. Methodology

3.1. Study Design

This study adopted a qualitative descriptive design grounded in a phenomenological approach to explore the lived experiences of community-dwelling older adults regarding digital health literacy [58]. Phenomenology is a well-established qualitative method focused on understanding individuals' lived experiences to uncover the essence of specific phenomena [59]. This approach aligns with the study's goal of revealing how older adults perceive, engage with, and navigate digital health services in real-world contexts. As noted by Doyle, et al. [60] qualitative research enables the collection of subjective insights that reflect the complexity and uniqueness of participants' experiences. In this context, the phenomenological method supports a deeper understanding of the barriers, motivations, and contextual factors influencing digital health literacy among older adults [61].

3.2. Research Locale

This study was conducted in a community setting within a non-first-tier city in China, characterized by moderate urban development and limited access to high-end digital infrastructure compared to major metropolitan areas. The selected locale reflects a typical aging residential population in transition, facing both opportunities and challenges in the adoption of digital technologies for health. Community managers and local health workers served as facilitators during participant recruitment, ensuring a safe and familiar environment for the older adults to share their lived experiences.

3.3. Participants

Ten older adults were selected through purposive sampling for semi-structured in-depth interviews [62]. This sampling strategy was used to ensure that participants could provide rich and relevant insights related to digital health literacy, reflecting diverse sociodemographic backgrounds [63]. Factors

considered for maximum variation included gender, marital status, education level, income, and digital experience. As previous studies indicate, digital health literacy in older adults is shaped by a combination of individual, interpersonal, and environmental factors such as age, education, living arrangement, and health status [55–57]. Inclusion criteria were: (1) age ≥ 60 years; (2) clear consciousness and no communication impairments; (3) residence in a community setting for at least six months; and (4) voluntary participation. While, exclusion criteria included: (1) long-term hospitalization or institutionalization; (2) diagnosed mental illness or cognitive dysfunction; and (3) serious physical or psychological conditions preventing participation. Community managers facilitated recruitment by distributing invitations and confirming participant eligibility.

3.4. Instrument

A semi-structured interview guide was developed based on the study's aims and relevant literature [50, 55]. The guide included both demographic questions and open-ended items exploring digital health experiences, such as, “*Can you share your experience using digital technology to access health services?*” Probing questions were used to elicit deeper insights (e.g., “*Can you tell me more about that experience?*”). The guide was reviewed and refined by experts in nursing and qualitative research to ensure content relevance and appropriateness for older adult participants [64].

3.5. Data Collection Procedure

Data collection took place from September to November 2024 through face-to-face interviews conducted in either community activity rooms or participants' homes, depending on their preference. The researcher obtained ethical clearance and written informed consent prior to the interviews. Participants were briefed on the purpose, method, and confidentiality of the study. Pseudonyms were used to protect identities, and interviews were recorded using a digital audio recorder with participants' permission. Each interview lasted approximately 30 minutes. Researchers created a relaxed environment to build rapport and encourage open communication. Field notes were taken to capture non-verbal cues such as facial expressions and emotional tone. Within 24 hours, the recordings were transcribed using iFLYTEK software and verified manually. Supplementary interviews were conducted when clarification was needed. Transcripts were returned to participants for member checking to ensure accuracy and authenticity.

3.6. Data Analysis

Data were analyzed using Colaizzi's seven-step method [65]. First, transcripts were read multiple times to gain a holistic understanding. Second, significant statements related to digital health literacy were extracted. Third, these statements were coded and categorized using NVivo 14.0 software. Fourth, related codes were grouped into themes and theme clusters. Fifth, each theme was defined and supported by direct quotations. Sixth, themes were compared and synthesized into a comprehensive understanding of participants' experiences. Finally, findings were validated by returning the results to participants to confirm their accuracy and resonance with lived experiences. To ensure trustworthiness, the study employed multiple validation strategies [64]. Credibility was enhanced through expert review of the interview guide and member checking. Dependability was ensured through peer debriefing and dual-coding by two researchers. Transferability was addressed through maximum variation sampling. Confirmability was maintained through reflective journaling and detailed documentation of analytical steps. All data, including raw transcripts and field notes, were securely stored and organized for audit and replication purposes.

3.7. Ethical Considerations

This study was conducted in compliance with ethical standards and approved by the relevant institutional review board. Participants were fully informed about the study's objectives, procedures, potential risks, and benefits. Written informed consent was obtained prior to participation, and individuals were free to withdraw at any point without penalty. Privacy and confidentiality were strictly maintained,

real names were not used, and data were anonymized in all publications. Sensitive information was handled with care. If participants became uncomfortable, they were offered breaks or the option to discontinue. The study also ensured that participants could follow up with the researcher for clarification or support after the interview. All audio files and transcripts were stored in a secure, password-protected location. Paper-based documents were destroyed after digitization. Data will be retained for two years following the completion of the study and then permanently deleted. By prioritizing ethical rigor and methodological transparency, this study contributes meaningful, participant-centered insights into the digital health literacy challenges faced by older adults in community settings.

4. Results and Discussions

4.1. Participants' Demographics

A total of ten community-dwelling older adults participated in this study. Each semi-structured interview lasted approximately 24 minutes on average. This section presents the basic demographic profile of the participants and offers contextual narratives to support the later thematic analysis. To ensure confidentiality, real names were not used; instead, each participant was assigned a pseudonym: Alice, Betty, Caroline, Dean, Emily, Fiona, George, Helen, Ian, and Jessica. The following are short descriptive of each of the participants:

- Alice is a 60-year-old woman with primary school education. She has three children and currently lives with her son and grandchildren. A former rural resident, her family relocated after their land was expropriated. Her daily activities include caregiving for grandchildren. Her income comes from her husband's salary and a government land subsidy. Alice has health concerns such as hypertension, hyperlipidemia, and cerebral atrophy but shows low digital engagement. Although she uses a smartphone, she struggles with digital health services and fears being scammed. Despite her challenges, she demonstrates an objective and optimistic demeanor but lacks confidence in her abilities.
- Betty is a 62-year-old woman with a high school education. She lives with her husband and frequently helps her children care for grandchildren. She has hypertension and is attentive to her and her family's health. Betty utilizes digital tools for health monitoring and education. Though reserved during the interview, she appeared cooperative and showed a willingness to learn and adapt to digital tools.
- Caroline, aged 61, lives with her husband and daughter. With a high school background and previous experience in sales, she has received training in mobile and computer use. Post-retirement, she continues to work part-time. Caroline manages multiple chronic conditions, including diabetes and hypertension, and regularly uses digital tools for health management. She was highly expressive during the interview and often shared not only her own experiences but also those of peers in her community.
- Dean is a 70-year-old man living with his wife. Although he has three children, none live with him. Financially, he is supported by government assistance and works as a hospital cleaner. He assesses his health as fair, with minor age-related issues. Dean uses basic mobile functions but finds digital health services difficult to access.
- Emily, aged 77, is a widowed woman living alone. She has three children and minimal formal education, having completed only two years of primary school. She recently transitioned from using a feature phone to a smartphone. Despite suffering from hypertension and heart issues, she finds digital platforms difficult to navigate and remains hesitant to rely on them for health management.
- Fiona is 62 and holds an associate degree. She is retired and lives with her husband and one son. Formerly employed in human resources, she is skilled with smartphones and computers. Fiona experiences lower back pain and hyperlipidemia. She actively uses digital tools for health-related queries but expressed concern over excessive advertising on health apps, which discouraged her

from continued use.

- George is a 60-year-old man with junior high school education. He lives with his wife and has one child. Formerly self-employed, he now depends on savings and government support. George practices health-conscious behaviors and is knowledgeable about his medications. Uniquely, he has both national and commercial health insurance, reflecting a proactive approach to health.
- Helen, aged 62, lives with her husband and has two children. She received some junior high school education but did not complete it. She uses her mobile phone primarily for communication and entertainment. Although she acknowledges the convenience of digital health services, she lacks motivation to engage. She frequently relies on her children for health-related support.
- Ian is 61 years old with two children. He lives with his wife and has a high school education. He suffers from cervical spine issues and a past cerebrovascular condition. Ian takes prescribed medications but occasionally self-adjusts his regimen. He prefers relying on personal experience and medical acquaintances over digital platforms for health decisions.
- Jessica is a 68-year-old widowed woman living independently. She has three children and a high school diploma. She supports herself through part-time cleaning work. Jessica reports significant memory decline, which hinders her ability to learn digital tools. Fear of making costly mistakes contributes to her avoidance of digital health applications.

Overall, the participants in this study represent a diverse group of older adults, aged 60 to 77, with varied educational backgrounds, health statuses, living arrangements, and digital competencies. Most participants had some familiarity with smartphones and internet access, yet they varied widely in their ability and motivation to use digital health services. Common barriers included fear of technology misuse, cognitive decline, lack of training, and reliance on others. Nonetheless, a few participants, particularly those with higher education or prior digital training, demonstrated initiative in integrating digital tools into their health routines. This variability in lived experience sets the stage for identifying the key themes discussed in the next section.

4.2. Barriers to Motivation: Psychological and Experiential Constraints in Digital Health Adoption

The findings under RO1 uncovered multiple internal psychological and experiential factors that affect older adults' motivation to adopt digital health technologies. These were grouped under the theme "*Barriers to Motivation for Adopting Digital Health Services*," with subthemes (1a) negative self-efficacy, (1b) dependence on the traditional medical model, and (1c) contradiction between recognition and demand. Consistent with the Health Promotion Model [12], low self-efficacy emerged as a key inhibiting factor. Several participants expressed internalized ageist beliefs that discouraged digital participation. For instance, Dean noted, "*Generally, the older adult doesn't understand this... We can't do it.*" Similarly, Jessica remarked, "*People like me, it's hopeless. I can't do anything.*" Self-efficacy was further constrained by perceived deficits in educational and digital competence. Helen admitted, "*I can't handle these devices... My level is too low,*" while Alice expressed, "*I can't read, don't understand, and have no education.*" The literature confirms that educational background strongly predicts digital health literacy [56].

In terms of behavioral inertia, participants exhibited reliance on conventional healthcare pathways. Despite some exposure to digital services, they preferred hospital visits. Emily shared, "*When I'm not feeling well, I just go to the hospital to get medicine.*" Interestingly, even when recognizing the advantages of digital health, convenience, efficiency, and accessibility, participants did not translate this into actionable demand. Caroline commented, "*Whatever knowledge I want to obtain, I can usually get it... but I don't really pursue it.*" This contradiction reflects low intrinsic motivation, despite extrinsic value recognition, suggesting cognitive dissonance; a tension that impedes behavior change. These results underscore a gap between potential and practice. Although participants acknowledged digital health's benefits, as Jessica admitted, "*It's so convenient... But I can't use it,*" they lacked both the drive and self-belief to act. These findings reinforce the need for interventions that not only build skills but also target psychological empowerment to enhance older adults' self-perceived efficacy and readiness. These motivational barriers

are compounded by systemic and environmental gaps discussed in subsequent objectives, further highlighting the multi-layered nature of digital exclusion.

4.3. Functional and Cognitive Barriers to Digital Health Access: Constraints on Ability and Literacy

RO2 is focused on how functional capacity and literacy constraints affect older adults' ability to access and engage with digital health services. Thematic analysis revealed the overarching theme "*Constraints on the Ability and Literacy to Access Digital Health*," with subthemes: (2a) limited physical ability, (2b) difficulties in using equipment and technology, (2c) multiple obstacles to information access, (2d) shortcomings in information comprehension, and (2e) concerns about privacy and security. Many participants identified memory decline as a primary hurdle. Jessica admitted, "*I watch how others do morning exercises... but when I watch them on the phone, I can't remember the movements.*" Similarly, Alice noted, "*My mind doesn't work well... I can't learn and can't remember.*" This aligns with prior research emphasizing how physiological aging impairs memory and hinders information retention, limiting the ability to benefit from digital content [4].

Visual impairments also constrained interaction with devices. Helen explained, "*I can't see small characters... even when I enlarge them, I still struggle.*" Such sensory limitations, which is quite common among older adults, challenge the accessibility of health information unless interfaces are adapted for visual clarity and usability [50]. In addition to physical limitations, technological difficulties were a pervasive theme. Participants cited struggles with basic functions. Helen recalled, "*Sometimes the kids mute it for me, and then I don't know how to fix it.*" Jessica added, "*I can't type... I don't know which button to click.*" Despite owning smartphones, many lacked the operational literacy to effectively use them for health-related purposes; highlighting a gap between access and meaningful usage [56]. Moreover, the process of accessing online health information was frequently passive and fragmented. Caroline noted, "*I scroll through the literature... sometimes there's health info, sometimes just entertainment.*" The tendency to passively consume unverified content underscores what can be describe as "*ecological gaps*" in digital health literacy; where access to content doesn't equate to engagement or comprehension.

Compounding these issues were the participants' difficulties in distinguishing credible from misleading information. George expressed uncertainty: "*We just take it as reference... Who knows about the authenticity on the internet?*" Fiona echoed, "*Sometimes what they say gives me a sense of distrust... some exaggerate.*" Without the evaluative tools to assess digital content, older adults risk misinformation or disengagement. Lastly, concerns about security, particularly financial loss, created hesitation [51]. Emily shared, "*If I operate too quickly and make a mistake, it'll be bad... I'm afraid of being cheated.*" Although several participants claimed to be unconcerned about data privacy, fears of financial fraud, rather than identity theft, were more salient. This perception reflects a nuanced understanding of digital risk shaped by personal experience rather than systemic awareness [55].

Taken together, these findings illustrate that digital health literacy encompasses far more than device ownership. It requires physical capability, technical fluency, critical evaluation skills, and trust in systems. As emphasized by Orem's Self-Care Deficit Theory [14], the older adults in this study demonstrated deficits in physiological, intellectual, and psychosocial self-care abilities, hindering their capacity to engage in digitally mediated health care. Therefore, literacy-enhancement interventions must be multimodal, accessible, and age-appropriate to empower sustainable engagement in digital health ecosystems.

4.4. External Forces Shaping Participation: Interpersonal and Structural Influences on Digital Health Engagement

RO3 explored the external environmental factors that influence older adults' use of digital health technologies. Thematic analysis generated the overarching theme "*Influence of External Environmental Factors*," with subthemes: (3a) support and substitution from others, (3b) lack of digital technology training, and (3c) deficiencies in existing service platforms. A recurring narrative was the reliance on children and family members to navigate digital tools. Caroline shared, "*I turn to my daughter, colleagues around me, or neighbors... some teach me orally, and some show me how to operate things on the phone.*" While such

support enhances access in the short term, it can limit opportunities for older adults to build autonomous digital capabilities. Helen exemplified this dilemma, stating, *“I just sit there waiting for my number to be called... I leave all the operations to my daughter or son.”* Her experience reflects how well-intentioned substitution can disempower and reduce self-learning motivation.

Ian highlighted a different dynamic, using personal networks to bypass digital systems entirely. *“I know some directors and section chiefs... I just make a call, and they reserve a bed.”* This case of personalized privilege underscores inequities in digital health engagement and reveals how social capital can shape healthcare access, digital or otherwise [10]. Regarding digital skills development, the absence of structured learning opportunities was evident. Caroline and Fiona, the only two who had received workplace digital training, were also the most confident users. Caroline noted, *“We graduated from high school, and later we also received computer training... These trainings were really helpful.”* Most others, however, lacked access to any formal digital health education, highlighting a structural barrier. Even when older adults are motivated and supported, platform design may pose usability challenges. Caroline further observed, *“There are so many digital things now... the more intelligent it is, the worse it gets.”* Fiona deleted a health app because of intrusive advertisements. These frustrations reveal mismatches between platform design and user needs, particularly for older adults who require simple, accessible, and distraction-free digital environments.

Overall, drawing from Pender, et al. [12] model, interpersonal influences such as social support and situational barriers like inaccessible infrastructure strongly affect behavior. While external support can reduce perceived barriers, it can also foster dependency if not coupled with empowerment. Similarly, from the lens of Orem’s [14] theory, external aids may temporarily compensate for self-care deficits but risk entrenching those very gaps if not complemented by skill-building. Thus, digital inclusion efforts must address both the content and context of older adults’ environments, balancing help with habilitation, and assistance with autonomy.

5. Conclusions, Limitations, and Recommendations

This qualitative study revealed the complex interplay of psychological, cognitive, and structural factors influencing older adults’ engagement with digital health services in non-first-tier Chinese cities. Despite recognizing the benefits of digital health, such as convenience, speed, and accessibility, many older adult participants struggled with negative self-efficacy, entrenched reliance on traditional healthcare models, and a lack of perceived personal health needs. These motivational constraints align with Pender’s Health Promotion Model, highlighting the role of self-belief and cognitive appraisal in shaping health behavior. Functionally and cognitively, participants faced a host of challenges: memory decline, visual impairments, limited technological fluency, and inability to assess digital content credibility. Even when owning smartphones or accessing the internet, they often remained passive users, engaging with content incidentally rather than intentionally. These findings echo Orem’s Self-Care Deficit Theory, demonstrating how gaps in physical, intellectual, and psychosocial capacities undermine independent health management in a digital context. Moreover, the external environment, such as: family support, lack of formal training, and poorly optimized service platforms, either enabled or inhibited digital health engagement. While interpersonal assistance often served as a temporary scaffold, it sometimes reinforced dependence and deterred long-term learning. Ultimately, this study shows that promoting digital health literacy in aging populations requires a multidimensional approach that addresses not only knowledge and skills but also motivational readiness, social contexts, and design accessibility.

Limitations - Several limitations should be noted. First, the study focused on a small sample of 10 older adults from non-first-tier Chinese cities, which limits generalizability. Although efforts were made to ensure participant diversity, the findings may not fully reflect the experiences of older adults in rural areas or first-tier urban centers. Second, self-reporting bias may have influenced the participants’ responses, particularly concerning their perceived abilities or technology use. Lastly, while the phenomenological approach allowed deep exploration of lived experiences, the cross-sectional design captured only a snapshot in time and did not account for potential change over time or with interventions.

Recommendations - Based on the findings, several practical recommendations can be made. First, local governments and healthcare providers should implement age-tailored digital health training programs that emphasize gradual learning, peer mentoring, and hands-on practice. Second, platform designers should improve accessibility by enlarging fonts, offering voice commands, minimizing steps, and reducing advertisement clutter—thus making digital health applications more user-friendly for older adults. Third, health campaigns should integrate digital confidence-building strategies and challenge ageist stereotypes to enhance self-efficacy and intrinsic motivation among older adults. Finally, future research should explore longitudinal interventions and test empowerment models to assess how older adults' digital health literacy evolves when given sustained support and structured opportunities.

Institutional Review Board Statement:

The study was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the panel of evaluators of the Graduate Program at the University of St. La Salle.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

Author Contributions:

Conceptualization, R.Y. and S.M.T.; methodology, R.Y. and S.M.T.; software, G.S.C.; validation, R.Y., S.M.T., and G.S.C.; formal analysis, R.Y.; investigation, R.Y., S.M.T., and G.S.C.; resources, R.Y., S.M.T., and G.S.C.; data curation, R.Y.; writing—original draft preparation, R.Y.; writing—review and editing, R.Y., S.M.T., and G.S.C.; visualization, G.S.C.; supervision, S.M.T.; project administration, R.Y. and S.M.T.; funding acquisition, R.Y., S.M.T., and G.S.C. All authors have read and agreed to the published version of the manuscript.

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