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Narrowing the age-based digital divide: Developing digital capability through social activities

Yang Zhao[1] | Tao Zhang[2] | Rohit K. Dasgupta[3] | Renpin Xia[4]

[1]Aston Business School, Aston University, Birmingham, United Kingdom

[2]Institute for Innovation and Entrepreneurship, Loughborough University London, London, United Kingdom

[3]School of Culture & Creative Arts, University of Glasgow, Glasgow, United Kingdom

[4]Department of Organ Transplantation, First Affiliated Hospital of Kunming Medical University, Kunming City, China

Correspondence
Tao Zhang, Institute for Innovation and Entrepreneurship, Loughborough University London, 3 Lesney Avenue, London E20 3BS, United Kingdom.
Email: t.n.zhang@lboro.ac.uk

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Abstract

Healthcare information technologies (HIT) have shown great potential for improving the effectiveness and quality of healthcare services. However, the inequal ability of older adults to use HIT may limit their exploitation of these benefits. To narrow the age-based "digital divide", this research further develops the concept of digital capability and emphasises the link between older adults and their social context. Based on a qualitative inductive study of 33 participants, who included Chinese patients and their family members, we generate a novel theoretical model for understanding the process by which social activities may shape older adults' digital capabilities. Based on the model, we suggest two strategies that might encourage older adults to engage with HIT. This research contributes to the information systems (IS) literature by strengthening digital capability as a conceptual lens to investigate individuals' engagement with information communication technologies (ICTs). It also extends research on the social context for ICT use by revealing how social processes at multiple levels influence digital capability development. Finally, this study offers practical implications for governments and private sectors to encourage and promote ICT use by older adults.

KEYWORDS
digital capability, digital divide, healthcare information technologies, older adults, social context

1 | INTRODUCTION

Recent advances in healthcare information technologies (HIT) such as mobile health applications, wearable devices, digital medicine, virtual healthcare, and big data–based clinical solutions have emerged as a vehicle to transform and improve healthcare services (Behkami & Daim, 2012; Devaraj & Kohli, 2000; Fichman et al., 2011; Singh et al., 2011; Wang et al., 2018). However, the uptake of HIT by older adults remains marginal (Agarwal et al., 2009; Dewan & Riggins, 2005; Francis et al., 2019; Oderanti et al., 2021). The poor adoption of and inequality in the ability to use HIT among older adult points to the existence of an age-based digital divide (Dewan & Riggins, 2005; Fox & Connolly, 2018; Mir & Dangerfield, 2013; Selwyn, 2004). Developing the digital capability of older adults is one of the key approaches to addressing the age-based digital divide at the root, because the success or failure of technology implementation ultimately depends on individuals' use of such technologies (Bellini et al., 2016; Hoffmann et al., 2015; Kvasny & Trauth, 2002; Wei et al., 2011; Windeler & Riemenschneider, 2016).

Digital capability has been broadly defined as the ability to live, work, participate, and thrive in a digital world (Brown et al., 2020). However, current studies often take digital capability for granted or use it interchangeably with concepts such as digital literacy. Consequently, digital capability lacks conceptual and construct clarity. To clarify digital capability and position it in the information systems (IS) literature, we discuss how digital capability is closely linked to, but also different from, three strands of literature regrading individuals' information and communication technology (ICT) use. First, digital capability and digital literacy have appeared simultaneously in a few studies (e.g., Malchenko et al., 2020; Turner, 2021) since both literature streams inquire into the technical and cognitive skills required for individuals to participate in a digital society (Bawden, 2008; Eshet-Alkalai, 2004; Gilster, 1997; Selwyn, 2003). However, while digital literacy describes an individual's ICT level as an outcome, digital capability emphasises life-long learning and self-development processes (Biggins et al., 2017). Furthermore, the process of developing digital capability is influenced by the socio-cultural context, in which the diversity in people's lives, relationships, and personal interactions is considered (McDougall et al., 2016). The second relevant stream of literature considers mindfulness, revealing the psychological mechanisms through which individuals become involved with ICTs (Dane, 2010; Dernbecher & Beck, 2017; Langer, 1997; Nevo & Nevo, 2012; Sun, 2011). Although mindfulness helps explain the cognitive reasons behind ICT use and digital capability development, it focuses on the willingness to build capabilities rather than actual practices. Moreover, mindfulness is dominated by the organisational level of analysis while digital capability is shaped by wider individual experiences, social roles, and social networks. The third strand of research investigates the effective use of IS (Burton-Jones et al., 2017; Burton-Jones & Grange, 2013; Burton-Jones & Volkoff, 2017), suggesting that users can take learning and adaptation actions to improve the representation of IS and create access to systems (Burton-Jones & Straub, 2006). This can inform the understanding of how individuals build digital capabilities to improve the use of ICTs through actions. However, the effective use of IS focuses on actions in organisational settings whereas studies of digital capability suggest that capability is both personal and collective and can be shaped by individual users and their broad social contexts.

Taken together, digital capability is related to existing IS literature streams but is distinctive on its own. Extending and refining the existing definition of digital capability, we define digital capability as the ability to build knowledge, skills, and mindsets related to living, working, participating, and thriving in the digital world, which is developed by individuals through continuous actions in the social environment. Digital capability is characterised by its dynamic nature. It goes beyond a status, type of knowledge, or skill set, in which individuals

build, develop, enhance, and accumulate capabilities through ongoing efforts. This requires individuals to take actions; thus, digital capability emphasises activities rather than willingness or attitude. More importantly, digital capability addresses the learning environment in which individuals build capability in the social context. It highlights how individuals build capabilities through communication, collaboration, and participation at the group, community, organisational, and societal levels.

Social activities (e.g., interacting with family, going out with friends, joining life-enrichment programs, and participating in interest clubs and communities) are particularly relevant for the digital capability development of older adults (Czaja & Sharit, 2012; Mettler et al., 2021; Neves et al., 2019; Niehaves & Plattfaut, 2014). Such activities can trigger older adults' adoption of ICTs (Tsai et al., 2017). For instance, recommendations and advice from people in close contact with older adults often encourage the latter to begin using ICTs (Age UK, 2011). Families, friends, and co-users in elderly communities can help older adults learn and configure new technologies (Independent Age, 2017). Although current research acknowledges the influencing role of social interaction in driving ICT use, there has been little systematic empirical enquiry into the multiple levels of social activities and the process by which these social activities can influence older adults' digital capability.

To address this gap, this study, drawing on the nature of digital capability, asks the following question: How might the processes underlying social activities shape the development of older adults' digital capabilities, enabling them to understand, explore, practice, and gain benefits from HIT? We conducted a qualitative research project at a hospital in China, interviewing older patients and their family members to inquire into their experience of using HIT. In contrast to the classic view that older adults are relatively less willing to engage with technological innovations (Francis et al., 2019; Gordon & Hornbrook, 2018; Lam & Lee, 2006; Niehaves & Plattfaut, 2014), we found positive attitude towards HIT use among older patients. Comparing social activities and digital capability development among older patients, this research reveals three possible pathways that might translate older adults' HIT intentions into actions. We further explain how these pathways are interrelated by exploring how older patients might move between the pathways.

This study makes four major contributions to the IS literature. First, we further develop digital capability as a conceptual lens to understand how individuals engage with ICTs by clarifying its links with existing IS studies and discussing its characteristics. Second, addressing the learning environment of developing digital capability, we extend studies of social context for ICT use (Agarwal et al., 2009; Goolsbee & Klenow, 2002; Munshi, 2004). We emphasise social activity as the central engine for digital capability development among older adults (Czaja & Sharit, 2012; Neves et al., 2019; Tsai et al., 2017). We show that social activities at multiple levels (i.e., the core social network, extended social network, and wider public network) can drive and support older adults' engagement in, learning about, and sharing of ICT knowledge. Third, we highlight the dynamic nature of digital capability (Biggins et al., 2017) and adopt a process perspective (Berends & Deken, 2021; Langley, 1999), introducing a model that maps the three pathways to digital capability development and theorises the relationships among them. This process model provides a faithful account (Newman & Robey, 1992) of the actual experience of older adults that enables them to establish, strengthen, and enhance their digital capability through various social interactions. Finally, we contribute to the literature on the digital divide (Fox & Connolly, 2018; Francis et al., 2019; Selwyn, 2004) by investigating how individuals take actions to build digital capability for ICT use. We offer guidance for older adults to increase their ability to use HIT, which reflects the value of individuals' actions in narrowing the digital divide. Based on our research, we suggest two strategies that could build and improve access to HIT for older adults. Therefore, we offer theoretically informed and evidence-based insights and recommendations for policymakers and private sector managers to engage older adults in HIT use.

The rest of this paper is organised as follows. Section 2 reviews the literature, including studies of the age-based digital divide, individual digital capability, and ICT use in social contexts. Section 3 explains this study's qualitative inductive research design while Section 4 presents the findings. Section 5 establishes the process model of digital capability development. Finally, we conclude with the theoretical and empirical implications of the research, a discussion of the limitations, and suggestions for future research.

2 | LITERATURE REVIEW

2.1 | Age-based digital divide

The term *digital divide* is widely used to explain the phenomenon in which certain population groups are unable to access or unwilling to use ICTs owing to a variety of factors (Dewan & Riggins, 2005). Among the demographic variables that affect ICT adoption and use (Brown & Venkatesh, 2005; Bucy, 2000; Katz & Aspden, 1997; Selwyn, 2004; Shih & Venkatesh, 2004; Venkatesh & Brown, 2001), the digital divide literature identifies age as significant (Fox & Connolly, 2018; Francis et al., 2019; Lam & Lee, 2006; Niehaves & Plattfaut, 2014). "Older age" tends to have negative connotations and be associated with limited physical mobility, a decline in learning ability, and an inability to be an active participant in society (Anderson & Perrin, 2017; Gorman, 1999; Hill et al., 2015; Wu, 2020). As a result, many older adults lack the willingness or capability to use ICTs (Czaja & Lee, 2007; de Veer et al., 2015; Fox & Connolly, 2018; Gordon & Hornbrook, 2018; Smith, 2014; Yagil et al., 2016). ICT's potential to empower older adults remains underexploited due to the exclusion of many older adults from ICT activities and practices (Hanley, 2002; Madden & Savage, 2000; Wright, 2000). Thus, building older adults' ability to use ICTs is an essential prerequisite for allowing this vulnerable group to fully benefit from HIT and for narrowing the digital divide (Selwyn, 2004).

2.2 | Developing individual digital capability

To understand how older adults can build their digital capability, we expanded the literature review to include three streams of literature that are relevant to individuals' use of ICTs and can inform digital capability development.

First, digital literacy discusses why individuals choose to use or not use digital technologies and how they build the skills required to use them. Digital literacy depends on ICT skills, which allow the individual to "retrieve, assess, store, produce, present, and exchange information and to communicate and participate in collaborative networks via the Internet" (Ferrari et al., 2014, p. 8). On the one hand, studies have explored the reasons for the non-use of ICTs (Selwyn, 2003). Individuals rule out their use because they do not consider ICTs relevant to their lives, and its adoption evokes fear and anxiety (Cushman & Klecun, 2006). On the other hand, researchers and organisations have conceptualised digital literacy through multi-dimensional frameworks across sectors and countries (Jin et al., 2020). For example, in 2013, the European Commission published its Digital Competence Framework (DigComp), aimed at promoting digital literacy in five areas: information, communication, content creation, safety, and problem solving. Such frameworks provide guidance for which areas older adults can develop their digital skills in and what skills facilitate the potential benefits that can be derived from using ICTs.

Second, the emerging body of research on mindfulness offers new insights into how mindfulness influences individuals' ICT use behaviour from a psychological perspective (see Dernbecher and Beck (2017) for a comprehensive review). Mindfulness at the individual level can be defined as an individual's psychological state of "alertness and dynamic awareness" (Dernbecher & Beck, 2017, p. 121; Langer, 1989a, 1989b). Building digital capability to use HIT requires older adults to make behavioural decisions (e.g., to use or not use HIT, when to use it, and how to make the most effective use of it). All these behavioural decisions are affected by older adults' mindfulness, which is a psychological state reflecting the individual's: "(1) openness to novelty; (2) alertness to distinction; (3) sensitivity to different contexts; (4) implicit, if not explicit, awareness of multiple perspectives; and (5) orientation in the present" (Langer, 1997, p. 23). Therefore, mindfulness can positively affect an individual's perceived usefulness of ICTs (Nevo & Nevo, 2012; Sun & Fang, 2010), in which mindful older adults are more likely to be open to HIT, respond to life changes, and actively adopt new ways of thinking.

Third, studies of effective use of IS have not explicitly investigated digital capability but have done so implicitly by considering how users can take actions to improve IS use (Burton-Jones & Grange, 2013; Burton-Jones & Volkoff, 2017). To use IS effectively, the user must be able to obtain faithful representations and take informed actions based on these representations (Burton-Jones & Grange, 2013; Eden et al., 2019). For example, the use of a mobile doctor appointment system requires older adults to search for information in the system, which involves typing and searching on a mobile phone to check the specialties, workplaces, and schedules of doctors. These faithful

representations allow older adults to decide which doctor to consult and to make appointments. Therefore, the effective use of the system depends on the user's digital capability (Burton-Jones & Grange, 2013; Burton-Jones & Volkoff, 2017; Hornyak et al., 2020; Serrano & Karahanna, 2016; Weeger & Gewald, 2015). Users can take adaptation actions to improve the system's representation of the domain of interest and enhance their access to the system (Dendere et al., 2019; Kretzer & Maedche, 2018; Lin et al., 2019). They can also engage in learning activities to improve their understanding of the system and find ways to take more informed actions (Burton-Jones & Volkoff, 2017; Grublješič & Jaklič, 2015).

These three literature streams provide valuable insights into the skill sets, cognitive drivers, and learning actions related to individuals' engagement with ICTs. By contrast, digital capability emphasises the process of building the knowledge, skills, and mindsets that are required for individuals to participate in a digital society, highlighting the continuous actions that are shaped by the wider learning environment. For example, the JISC (Joint Information Systems Committee) in the UK's higher education sector introduced a digital capability framework (2018) with six core elements: ICT proficiency; information data and media literacies (functional skills); digital creation, problem solving, and innovation (critical use); digital communication, collaboration, and participation (creative production); digital learning and development (participation); and digital identity and wellbeing (development). In addition to technical skills, cognitive and sociological skills are highlighted in the framework, which situates capability development in the social setting and emphasises the core elements of social involvement and interaction. In another example, the UK National Health Service (NHS) developed a healthcare digital capability framework to help "the health and social care workforce to be fully competent, confident and capable in the use of digital in the workplace" (NHS, 2018, p. 2). In this framework, the highest levels of digital capability are concerned with individual ability to provide leadership, guidance, and support to others in the analysis, interpretation, and evaluation of information. Thus, digital capability goes beyond skill sets to be mapped against competency frameworks. It exists at the intersection of people and technology, whereby creating a social environment for learning and self-development is crucial to capability development. Table 1 positions digital capability in the IS literature.

TABLE 1 Digital capability in the IS literature

	Digital capability	
	Links	**Differences**
Digital literacy	Both digital literacy and digital capability investigate the technical and cognitive skills required for individuals to participate in a digital society	• Digital literacy considers digital skills as an outcome while digital capability focuses on the dynamic process of developing digital skills • Digital capability highlights the ability for life-long learning and self-development and how these continuous developments in turn shape capability • The process of developing digital capability is influenced by diversity in people's lives, relationships, and personal interactions
Mindfulness	Mindfulness explores the psychological mechanisms of behavioural decisions regarding ICT adoption and use, which are influenced by personality traits and cognitive style. This can help explain the psychosocial rationale of building digital capability for ICT use	• Mindfulness considers willingness and attitudes towards ICTs, especially in the organisational context • Digital capability investigates the actions required for capability development, which is shaped by individual experiences, social roles, and social networks

TABLE 1 (Continued)

	Digital capability	
	Links	**Differences**
Effective use of IS	Effective use of IS proposes that learning and adaptation actions can improve access to IS, which can inform the understanding of how individuals build digital capability and use IS through actions	• Effective use of IS explores actions that improve the representation of IS in the organisational setting • Digital capability considers the broad social context beyond organisations, investigating how the learning context shapes the capability development of individual users

2.3 | Social context of ICT use

Despite variations in theoretical roots, studies of individuals' ICT use have acknowledged the learning context for ICT use. In particular, mindfulness research has suggested that individuals' intention, frequency, and satisfaction related to ICT use can be influenced by other people in a group or organisation (Carter et al., 2011; Langer, 1989a, 1989b; Sun & Fang, 2010). For instance, organisation-wide mindfulness training aimed at improving organisational performance can trigger mindful dynamics in a group as a result of team synergies (Dernbecher & Beck, 2017). From the effective use of IS perspective, Burton-Jones and Grange (2013) argued that it is valuable to study IS artefacts in their social context because users can both leverage representations themselves and share these representations with others in their networks. For example, a team member can demonstrate and explain to other colleagues how an enterprise resource planning system works, whereby the whole team decides, in an informed manner, when and where to place orders and with whom. Moreover, learning actions that improve the effective use of systems can take place within and across social networks (Dendere et al., 2019; Lin et al., 2019). For example, a user might learn ICTs from colleagues in an organisation and obtain online support from professional communities.

While research on effective use of IS and mindfulness focuses on organisational settings as the influential context (i.e., people and ICTs in the workplace), digital capability considers the broader social context of ICT use. The development of digital capability extends beyond users' direct interactions with ICTs. It is related more to environmental factors and social influences from family, friends, peers, and others important in an individual's life (Agarwal et al., 2009; Goolsbee & Klenow, 2002; Munshi, 2004). Such social contexts are particularly relevant to older adults' digital capability development. For example, Tsai et al. (2017) suggested that watching others use ICTs and knowing they can seek help from others are essential for older adults' learning. Czaja and Sharit (2012) found that older adults considered family and friends to be more useful than training programs for learning how to use new technologies, because many training programs leave users feeling frustrated and challenged. Selwyn (2004) found that older adults are more likely to use computers at home if there is support from immediate family and close relations. The use of ICTs, in turn, can potentially facilitate older adults' desire to be social and improve their connection with the outside world (Selwyn, 2004). Although some older adults experience stress related to using everyday technologies, HIT have become increasingly important for their quality of life and ability to be independent (Nikou et al., 2020). Table 2 summarises the key characteristics of digital capabilities derived from our literature review.

TABLE 2 Characteristics of digital capability

Digital capability The ability to build knowledge, skills, and mindsets related to living, working, participating, and thriving in the digital world, which is developed by individuals through continuous actions in the social environment	
Dynamic process of capability development	Digital capability refers to abilities developed in a dynamic process instead of a static status. Individuals build, enhance, and accumulate digital knowledge, skills, and mindsets through continuous effort
Actions for capability development	Development of digital capability requires individuals to take action, which emphasises activities rather than willingness or attitude
Social context for capability development	Digital capability addresses the learning environment in which individuals build capability in the social context
Level of digital capability	Digital capability is both personal and collective, which can be shaped by individual users and their learning context at the group, community, organisational, and societal levels

Thus, addressing the broad social context for ICT use, this study approaches digital capability development from the perspective of social activity. We explored how interactions between older adults and the outside world may shape their HIT use and how these actions might narrow the age-based digital divide.

3 | METHOD

We aimed to investigate how the processes underlying social activities might shape the development of older adults' digital capability. This question relates to a complex phenomenon in which the development of older adults' digital capability is influenced by their personal perceptions, views, and actions. Thus, we adopted an inductive qualitative research method that enabled us to generate in-depth insights into multi-dimensional socio-psychological mechanisms in real-life contexts (Yin, 2013).

3.1 | Research setting

We studied a sample of older patients in China, a country in which population ageing is a widely acknowledged social phenomenon. The United Nations definition of an ageing society is one in which at least 10% of the country's population is over age 60. In 2017, 228 million people in mainland China were aged 60 years or over, accounting for 16.2% of the total population (United Nations, World Population Ageing, 2017). This is more than twice the number in 2000, and ageing is increasing at a faster rate in China than in almost any other country in recent history (Forbes, 2017). The proportion of China's population aged 65 or over is forecast to double from 10% to 20% by 2037 (World Population Ageing, 2017, United Nations). Such doubling of the ageing population took 23 years in Japan (1984–2007), 61 years in Germany (1951–2012), and 64 years in Sweden (1947–2011).

Population ageing is a major social transformation, and in the case of China, it creates profound challenges for the healthcare system. China's existing healthcare system is fragmented and poorly equipped to address the needs of a growing population of older adults (WHO, 2015). Recently, HIT and its associated services and business model innovations have shown great potential for providing accessible, affordable, high-quality

healthcare services (Deloitte, 2018, 2019). The Chinese government proposed a national strategy called Healthy China (WHO, 2016) in which HIT is expected to empower older adults to engage in behaviours aligned with healthy ageing.

The realisation of such benefits depends on the uptake of HIT, but gaps remain in China, in which such technologies are used sparingly by older adults. According to the Chinese Ministry of Public Health, people aged 65–69 have the lowest health literacy (3.81%) (China Daily, 2009), and the rate of adoption of telemedicine, wearable devices, and remote health monitoring among adults over 65 is lower than the average (Wu & Dang, 2013).

Given China's rapidly ageing population, its fast development of digital healthcare technologies, and its gap between intentions and outcomes related to healthy ageing, older patients in China provide a fruitful context for an investigation of developing older adults' digital capability, which may help to bridge the digital divide.

3.2 | Research design

This study is part of a larger research project on the digital transformation of the Chinese healthcare system. We conducted field research at a hospital in Yunnan Province. The hospital was selected because various stakeholders (e.g., doctors, management teams, HIT suppliers, and patients) were involved transitioning from PC-based HIT to mobile-based HIT, which could enable mobile doctor appointments, mobile medical payments, and e-consultations, and the hospital was looking for ways to facilitate more effective HIT use. We focused initially on interactions between healthcare professionals and HIT. However, during the investigation period, the head of the Transplant Department raised a question about how older patients might use HIT more effectively. Although healthcare professionals in the hospital had invested enormous effort in using HIT, HIT use by patients—also key stakeholders in the healthcare system—was at a much lower level. Doctors observed that many older patients were unfamiliar with the latest HIT. For example, increasing numbers of young people were using mobile apps to make doctors' appointments, leaving very few appointments available for older adults. In another example, it was also difficult for doctors to explain to older patients the value of telemedicine because these patients did not understand HIT and the value that could be obtained from its use. As a result, the effectiveness of HIT was being questioned owing to its sparse use by older patients. The researchers therefore conducted a literature review on older adults' digital capability, finding that the pathways to developing this capability have yet to be discovered. Thus, to connect theory and practice, this study was co-developed with doctors in the Transplant Department.

The recruitment of participants followed a purposeful sampling strategy. Doctors in the Transplant Department provided a list of patients over age 60 (although there are some differences between countries, 60 is the age most frequently used to define an "older adult"; WHO, 2018), whose health condition allowed them to be interviewed. The doctors also asked the Cardiology Department to provide a similar list, because older patients with heart disease were mostly assigned to that department. It has been suggested that "older adults as a group are heterogeneous, and individual differences are very prevalent throughout the life course" (Czaja & Lee, 2007, p. 344). Thus, we opted for demographic diversity in the sample by asking doctors to include patients who were diverse in terms of occupation, income, education, gender, and family structure. A total of 19 older patients were identified. The doctors contacted them, and 12 of the patients and their family members agreed to participate in the project. With the permission of the participants, prior to the interviews, the doctors provided the patients' demographic information to the researchers. Moreover, aiming to achieve the broadest possible view of the participants' perceptions of HIT use, we purposefully included a range of ages (60+ to 90+). Table 3 shows that participant age was not directly related to their level of digital capability (see also the data analysis and findings): in the 61–69 age group, two out of five patients were deemed incapable of using HIT compared to only one out of six in the 80–93 age group. Data were collected on the hospital wards. Our sample included a total of 33 participants: 12 older patients and 21 family members (Table 3).

TABLE 3 Profile of interviewees

Patient	Age	Gender	Occupation	Education level	No. of family members interviewed	Interview length (minuets)	Level of digital capability
1	61	Female	Farmer	Low	1	40	Incapable
2	62	Male	Farmer	Medium	1	40	Intermediate
3	65	Male	Farmer	Low	2	45	Incapable
4	66	Male	Farmer	Low	4	45	Intermediate
5	69	Male	Engineer	High	2	58	Advanced
6	77	Female	Worker	Medium	1	56	Incapable
7	80	Female	Worker	Medium	2	70	Basic
8	81	Male	Technician	High	1	56	Incapable
9	83	Male	Government officer	High	2	70	Intermediate
10	81	Female	Teacher	High	1	61	Advanced
11	89	Male	Government officer	High	2	58	Basic
12	93	Female	Teacher	High	2	63	Basic
Total	• Number of patients interviewed: 12 • Number of family members interviewed: 21 • Interview length: 662 minutes						

3.3 | Data collection

The interviews were conducted at the hospital in January 2019. Two of the authors conducted the interviews; one was a native speaker, and the other was assisted by a translator. Patients were interviewed with their family members, thus generating 12 interviews in total.

We used a semi-structured approach, in which an interview guide served as the basis for the exploratory study. We started by asking whether the interviewees had used certain HIT, such as health-information platforms and apps, online doctor appointments, mobile medical payments, e-consultation, telemedicine, appointment-making machines, or the hospital diagnosis-result collection machine. If the interviewees indicated HIT use, they were asked how they had come to know about the HIT, why they had decided to use it, and how they used it. If they declared not using HIT, they were asked why and whether they might consider using HIT in the future. We also asked interviewees about their social activities and how and why such activities affected their adoption and use of HIT. Patients' family members were encouraged to engage in the conversations by giving their views on their parents' or grandparents' adoption of HIT and how they supported or discouraged their HIT use. Interviews lasted 40–70 min. After each interview, the authors discussed and briefly evaluated the digital capability of the interviewees. At the end of the data collection period, the two authors engaged in the field work were confident that the sample had included participants with different levels of digital capability.

Following the standard procedure in interpretive research, the interviews were audio recorded, transcribed, and supplemented by field notes. The field notes recorded the behaviours of patients and their family members during the interviews; this was useful for complementing the data gathered via the interviews. The notes also included reflective comments from the researchers regarding questions, insights, and impressions arising during the interviews. The discussions involving the research team that took place after the interviews allowed for an initial understanding of the empirical evidence. The meeting notes are included in the final dataset.

3.4 | Data analysis

The data analysis aimed to generate a process model to explain how older adults build digital capabilities through social activities. Following prior process studies in the IS literature (Berends & Deken, 2021), the *first step* was to pull together the chronologically recounted narratives to form the backbone of the process findings. We synthesised the interview and field notes to construct a comprehensive history of each patient. We identified and chronologically structured key events (Langley, 1999; Newman & Robey, 1992) that marked the development of each informant's digital capabilities. This was followed by a detailed description of how each event took place and how social networks affected those events. Eventually, we created a rich narrative for each informant, in which the data were tied to specific moments in the unfolding timeline (Berends & Deken, 2021) (see Appendix A for examples of timelines).

In the *second step*, we compared digital capability levels and digital capability development timelines across informants. To classify the interviewees, we took the digital capabilities in the JISC digital capability framework as a reference and considered ICT proficiency, information literacy, digital research and problem-solving, digital communication, digital learning, and digital wellbeing (JISC, 2018). These elements were chosen because they are the ones most relevant to the capabilities of older patients. Moreover, building on our understanding of the interview transcripts, we tailored the elements to form our own evaluation criteria that fit the research setting and participants. The criteria included familiarity with HIT, accuracy in defining HIT, number of HIT used, range of HIT used, and level of independence when using HIT. The comparison resulted in four groups of informants whose digital capability ranged from incapable to advanced. For the group classified as incapable of using HIT, we analysed whether and why they had no access to HIT or did not use it. For the other three groups, we compared how they had developed their digital capabilities, focusing in particular on their social activities. We used the pattern-matching method to identify and distinguish patterns across individuals, which generated first-order codes and second-order categories for each informant group (Figures 1-3 present the codes; Appendix B provides illustrative quotes). Three pathways emerged from the data analysis, revealing that older adults might develop digital capabilities at different levels through social activities in the core social network, the expanded social network, and wider public networks.

The *third step* focused on generating the process model. We formed an abstract understanding of the phases in the three pathways and analysed the inter-relationships among these pathways. Regardless of their level of engagement in HIT, informants' development of digital capabilities generally involved four phases. The second-order categories, including sourcing information from family, sourcing information from peripheral networks, and actively searching for information from public sources, were grouped at the aggregate level as phase 1 (*information sensing*). In phase 2, the informants *evaluated information* by filtering information by the family, making comparisons with life and work experience, and cross-checking information from multiple sources. Phase 3 involved *learning by doing*, in which informants with different digital capability levels practiced using HIT with the family's support, experimented and learned from close relations, and/or built self-confidence in using HIT. Finally, abstracting experience, creating a learning method, forming a common language, and sharing knowledge were categorised as phase four (*technology intuition building*). These phases were aligned with events in the data to form the basic theoretical constructs of the process model (Newman & Robey, 1992). Moreover, by fleshing out how the informants moved among the pathways and what drove these movements, we were able to theorise the interconnections among the pathways. This led to a model that provided a faithful account of the informants' actual experience (Newman & Robey, 1992), as well as an early theoretical explanation of the process involved in developing older adults' digital capability through interactions within and across social networks.

4 | FINDINGS

We found positive attitudes towards HIT use among our interviewees. Despite the variations in the extent of their engagement with HIT, 8 out of the 12 older patients had some experience with using the technology. Four interviewees were not currently using HIT but showed interest in accessing it. For example, the interviewees explained,

> "I would love to make doctor appointments online if I knew how to operate it". (patient 1)

> "I cannot read much due to my low level of literacy. Without this limitation, I would have probably tried to use these technologies [HIT]". (patient 3)

> "I think the new technologies can improve my healthcare experience in general, if I were given the chance to use them". (patient 3)

The interviewees explained that they were interested in using HIT as the technologies offered better access to effective and high-level healthcare services. They also believed that HIT might provide a level of autonomy and independence. In this section, we explain the three pathways along which the informants built different levels of digital capabilities through diversified social activities.

4.1 | Pathway 1: Developing basic digital capability through the core social network

Data analysis revealed that families were often the starting point for older patients to learn HIT. The four patients who had no experience with HIT were similar in that their willingness and autonomy to learn and use HIT were not recognised by their family members. For example, we asked patient 1, who had never used a smartphone, whether she would like to try the technology. Her son immediately replied, "No, she does not want to. She does not know how to use it", but the patient answered the opposite: "I do want to try it". This happened repeatedly in the interviews: the children or grandchildren spoke for the patients, leaping to the conclusion that the patient would not like to use HIT because "these technologies are too complex for my father, he is really old" (son of patient 8); "I don't have time to teach him" (son of patient 3); "She doesn't know whether [medical] information [in healthcare apps] is reliable or not" (daughter of patient 6); and "I worry that my mum may feel frustrated if she finds out she cannot handle the new technologies" (daughter of patient 6).

In general, family members' assumptions that HIT was associated with feelings of loss of control, vulnerability, and frustration acted as barriers, preventing older patients from trying to understand and explore HIT. The direct outcome could be a loss of confidence and change of attitude towards HIT among older adults. For example, patient 1 said, "On second thought, maybe he [the son] is right. I may not have the ability to use it [mobile doctor appointment]".

By contrast, three older patients in our interviews built their basic level of digital capability by relying on interactions with younger family members such as children, grandchildren, nephews, and nieces. This basic level of digital capability allowed them to use relatively straightforward HIT (e.g., the diagnosis-result collection machine, the appointment scheduling machine at the hospital) and to search for healthcare information on platforms and apps. Family members frequently encouraged and supported these older patients, whereby these patients' intention to use HIT was valued and encouraged (Figure 1).

In pathway 1, the development of digital capability started with information sourcing from family members in various scenarios (e.g., family dinners, picnics, and watching TV). Older patients also looked for information from sources suggested by family members. For instance, patient 11 searched for medical advice on a healthcare platform because his daughter told him, "This platform is good. The information on it is mostly accurate and reliable".

In the second phase, family members, as the dominant information source, were responsible for ensuring the credibility of information and information channels. When older patients discovered new HIT themselves, they asked family members to evaluate the technologies. Older patients trusted the filtered information provided by family members because

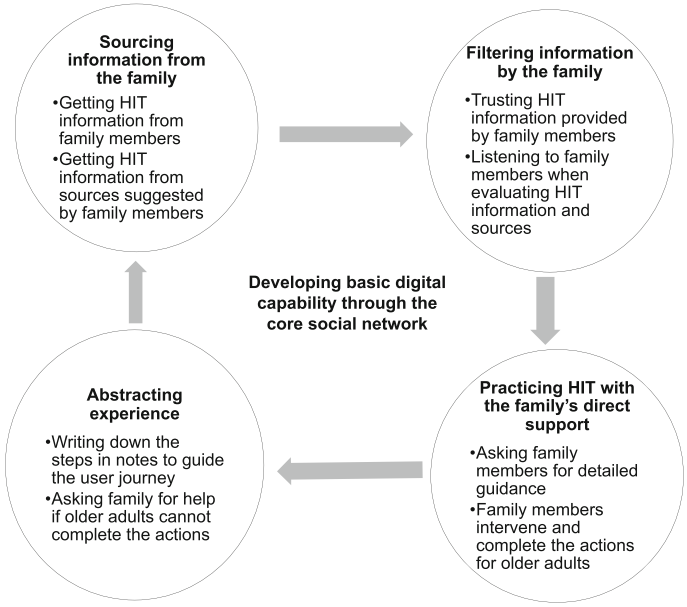

FIGURE 1 Pathway 1: Developing basic digital capability through the core social network

> "Young people [family members] understand new technologies better than me. They are surrounded by lots of new technologies [HIT] and information. They are used to identifying useful and reliable ones". (patient 12)

Moreover, older patients believed that family members could select HIT that best suited their needs:

> "My children understand what I need. They explain the latest technologies to me in a way that I can understand". (patient 11)

In the third phase of pathway 1, family members provided hands-on support for older patients in actual HIT use. Children and grandchildren often supported the interviewees by guiding them through the user journey, step by step. For example, one patient explained that his son stood beside him and told him which button to click when collecting his MRI result in the auto diagnosis results collection machine. "He [the son] said, 'Dad, this machine can print your MRI result automatically.... You can click on start. It's a touch screen, just like your mobile'" (patient 11). Families also intervened and completed some of the actions for older patients when they struggled with the HIT.

Older patients abstracted their experience of using HIT in the fourth phase. The interviewees made detailed and thorough notes on their user journey or asked family members to write down the steps for them. For example, the granddaughter of patient 12 not only wrote down the specifics of using a health-information platform for her but also drew icons to guide her user journey. Older patients could consult these notes until they became familiar with the specific HIT. For example, patient 7 said,

> "I wrote down the steps of using the mobile app in my diary. I had to revisit the diary a couple of times. However, once I remembered the steps, I knew which button to click and what I should do next. I no longer need the diary now".

Having gained experience using a specific HIT, older patients were able to draw on their experience when adopting a new HIT. However, they often needed help from family members to complete certain actions. For example, patient

7 always had a problem with user registration and needed her daughter or son-in-law to complete her registration whenever she used a new platform/app.

4.2 | Pathway 2: Developing intermediate digital capability though expanded social networks

In pathway 2, three older patients in the sample developed intermediate digital capability by expanding their social networks from family members to close contacts such as friends, former colleagues, former classmates, and neighbours (Figure 2). In contrast to interviewees with only a basic level of digital capability, having an intermediate level of digital capability provided these patients with access to HIT with more functions and benefits (e.g., online doctor appointments and mobile medical payments). These individuals showed a relatively high level of familiarity and a good understanding of HIT. For instance, when we asked about the function of patients' wristbands, older patients with a basic level of digital capability described the key function as "showing my personal information" (patient 7) and "helping nurses to make sure I got the correct medicine" (patient 12). In contrast, older patients with an intermediate level of digital capability were able to associate the wristbands with a "patient information database" (patient 2), "patient management system" (patient 2), and "doctors' electronic medical records" (patient 9). While families still played a crucial role in triggering and encouraging HIT use among this group, the older patients were able to absorb HIT information, knowledge, and skills from their extended networks.

The older patients started by obtaining HIT information from friends, former colleagues, former classmates, and neighbours. Patient 9 had joined an interest group and was a member of clubs for photography and card games in which participants shared healthcare information. Patient 4 elaborated that

> "I have a WeChat [a social media tool] group with former classmates. We are of a similar age, and people of this age have common health problems like heart disease and diabetes. Thus, we frequently communicate about healthcare services… including useful healthcare technologies".

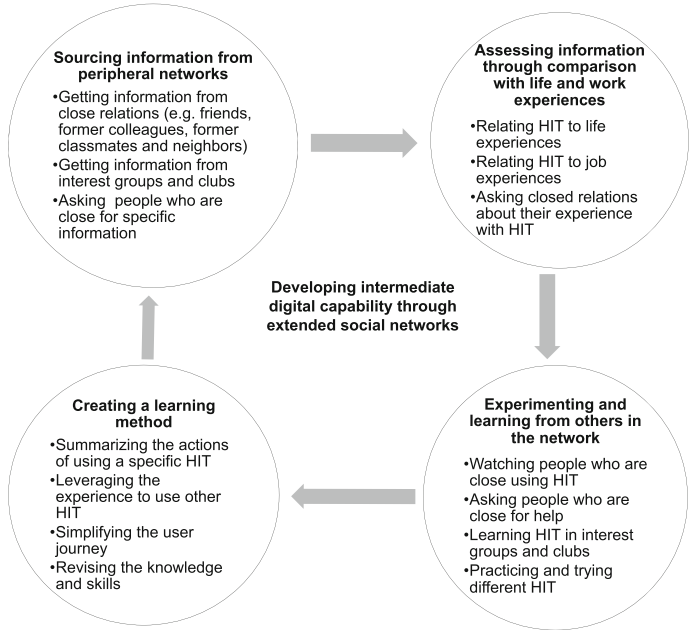

FIGURE 2 Pathway 2: Developing intermediate digital capability through extended social networks

In the second phase, interviewees made the decision to use HIT by associating the decision with prior life and work experience to generate context-aware predictions of HIT outcomes. Patient 2 provided an example:

> "I have lived long enough to know whether the information is true or not. I once received a call that promoted a wearable device. They explained so many functions of the device. Something like it can treat high blood pressure. I knew from my experience that this must be a spam call".

Patient 2 had experience using ICTs at his work. He explained that

> "There was a government program that taught farmers to use computers [digital technologies and tools] in agriculture. The government collaborated with some leading companies [platforms] like Alibaba, organizing us [farmers] to learn about computers and mobiles that can, for example, forecast the weather.... I am not an expert in these technologies, but I know the basics of computers [digital technologies] through this program. I know what a computer is, what a mobile is, what a mobile app is.... The general understanding of [information] technologies helped me figure out how some of the HIT work".

The interviewees also asked friends and former colleagues about their experience with HIT to ensure the reliability of certain HIT. Social media groups and interest clubs facilitated such information-sharing and validation.

The third phase was concerned with learning from close contacts and adopting different types of HIT. In contrast to pathway 1, older patients who followed pathway 2 showed a higher level of autonomy, which allowed for more active observation of how friends and peers used HIT, and they replicated the behaviours. The older adults made great efforts to improve their capabilities even if they were considered part of a disadvantaged group. For example, patient 4's low level of education did not allow him to fully use Pinyin (the official romanisation system that is used to spell Chinese characters according to Mandarin pronunciation). This made it difficult for him to type on a smartphone or a computer. To overcome this, he learned from friends and developed the ability to use voice input on a smartphone.

This group of older patients demonstrated a high level of enthusiasm for adopting various HIT. For example, patient 9 joined an interest group to improve his ICT skills and experimented with using healthcare apps with peers:

> "The interest group focuses on mobile-based skills, teaching us how to use some mobile apps...including healthcare apps. I learned, for example, how to send voice messages and how to make mobile payments. I mostly use three or four mobile apps currently. However, when my classmates [who are in the same interest group] tell me about new apps, I always feel curious, and I would love to try them". (patient 9)

In the fourth phase, based on learning and practicing, older patients may create their own learning methods. Similar to pathway 1, older patients in pathway 2 summarised their actions related to using specific HIT by taking notes and revisiting them. However, they were able to leverage their experience of using a particular HIT to another one without detailed guidance from others. Moreover, they often simplified the user journey by skipping certain actions. For example, most older adults struggled with user registration. While interviewees with basic digital capabilities asked family members to complete registrations for them, interviewees with intermediate digital capability chose to skip this step. According to patient 2,

> "I skip user registration when I can. It asks too much personal information [when registering]. Some [apps] ask to connect to other [social media] accounts. I sometimes got confused. Ever since I found out that I don't need to register, I started to skip this.... My friends explain to me that I will need to register if I need premium services, but I think the basic functions are enough for me".

This showed a relatively comprehensive understanding of what specific benefits the HIT might provide and what the interviewees needed from the HIT. Also, interviewees who used several different HIT applied the skills developed from using one HIT to other ones. In this process, older patients were constantly fine-tuning their HIT knowledge and skills. As indicated by patient 4,

> "When I used my mobile to pay the medical bill for the first time, I did not know how to create an account in the app. I kept clicking on the wrong buttons. It looked complicated to me. However, when I used it the second time, it was much easier. Now I understand that the account can be stored on my mobile. I don't need to type in all my personal information every single time. I did the same thing [allowing the mobile device to remember user information] when using another app".

4.3 | Pathway 3: Developing advanced digital capability through wide public networks

In pathway 3, two older patients in the sample built advanced digital capability through a wide range of social activities on public networks (Figure 3), exploring a number of computer- and mobile-based HIT. They were familiar with the latest HIT, such as e-consultation, telemedicine, and wearable devices. They also recognised leading healthcare platforms such as AliHealth, Dingxiang Healthcare, and Chuyu Doctor. In contrast to other patients, they extended their information sources and learning networks from family and close relations to public sources.

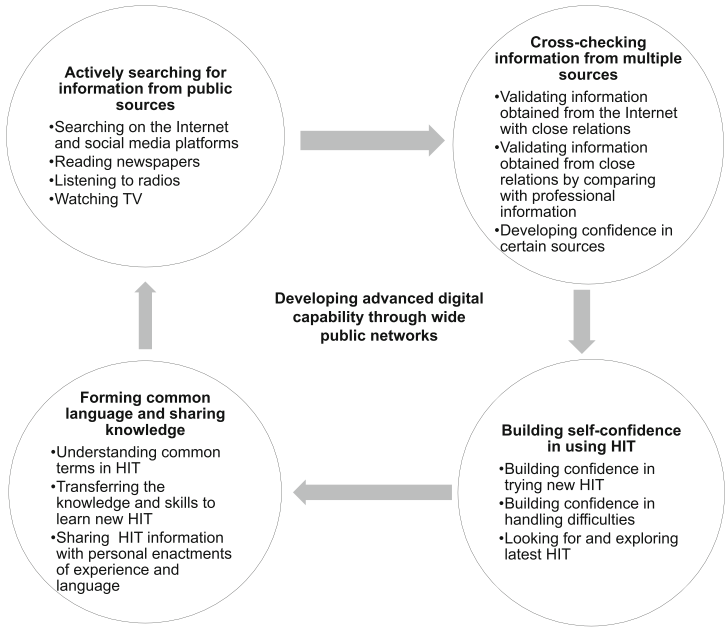

FIGURE 3 Pathway 3: Developing advanced digital capability through wide public networks

In the first phase, developing digital capability started with searching for HIT information using public sources. This included not only traditional sources such as newspapers, TV, and radio but also online sources such as healthcare platforms, apps, and news portals. These activities might be spontaneous and triggered by a specific need or difficulty related to traditional access to healthcare services. For instance, patient 5 struggled to queue at the hospital to make a doctor's appointment, and this motivated him to explore alternatives by searching on the Internet:

> "I always look for new ways of doing things, especially when the old ways no longer work. I couldn't wait in the queue [for making a doctor's appointment] for too long now. I couldn't ask my children to get up at 5 am and wait in the queue for me either.... I started to look for alternative ways on the Internet". (patient 5)

In other cases, information about HIT was pushed to the interviewees. For instance, patient 5 saw a newspaper advertisement for an app that would allow booking doctors' appointments. He remembered the advertisement, which encouraged him to look for the app online. Some interviewees had asked healthcare professionals or fellow patients for information. For example, patient 10 overheard a doctor explaining why he had recommended telemedicine to another patient on the ward, and this prompted patient 10 to ask this patient about her experience with using telemedicine.

In the second phase, older patients cross-checked information from different sources to verify and validate it. They searched online for more official information after hearing about specific HIT from family and friends. They read the reviews and comments made by others on healthcare platforms and news portals. If their information came from public sources, they asked family and friends for their experience and evaluations of the HIT. Moreover, the interviewees had asked healthcare professionals (i.e., doctors and nurses working in the hospital and in care homes) for professional advice on certain HIT. Patient 10 provided an example:

> "I've heard about a few wearable devices in recent years. These are hot topics.... I know some of them, like the watch that can track the heartbeat.... I read in the newspaper about wearable devices. I am not an expert.... A supplier of the device came to our care home, introducing their products and services. I asked them to compare their offerings with the ones I have heard about".

In the third phase, the interviewees built self-confidence in using HIT. This required the interviewees to build trust in HIT and develop confidence in their ability to organise and execute the actions required to use HIT. The two interviewees showed great trust in HIT, enabling them to recognise feasible opportunities for HIT engagement. This level of confidence had allowed them to explore a wide range of HIT and manage the difficulties. For example, patient 5 explained, "I can always go back a step to correct information I have typed in wrongly. I can re-start the app in the worst case". Once these older patients had used certain HIT successfully and had benefitted from them, they tended to keep learning other HIT due to their increased self-confidence. As patient 5 noted, "If young people can use these technologies, why can't I?"

The fourth and final phase involved the ability to construct a common language to allow older patients to understand HIT in a broad context and share their knowledge, skills, and methods with others. For instance, the interviewees were able to define a mobile app. When they tried out a new healthcare mobile app, although the app functions might have varied, they were familiar with terms such as *account*, *password*, *registration*, *login*, and *mobile payment*. In another example, when patient 5 was asked how he learned to use the diagnosis-result collection machine, he said,

> "I just watched how the person in front of me used the machine. It was simple. The buttons were easy to understand. These machines [diagnosis-result collection machine and the doctor's appointment machine] are all similar".

Taking this further, the interviewees communicated complex HIT information drawing on their personal experience and understanding of various terms, which they translated into understandable language. For instance, patient 10 was one of the most active users of HIT in her care home, and she educated others about telemedicine and wearable devices by "using language that was easier for older adults to understand":

> "Some businesses [suppliers of HIT] visit us [at the care home] and promote their products [and services] to us. When they try to educate us about the latest technologies, they often forget that we are not familiar with technological language.... For example, they kept saying 'big data'. My friends were like, what data? I explained to them [the friends] that the mattress [a health monitoring device] can record our temperature and heart rate". (patient 10)

5 | PROCESS MODEL OF DIGITAL CAPABILITY DEVELOPMENT

Comparing the steps in the three pathways, our sample of older adults generally went through four phases to develop digital capabilities. These four phases formed the backbone of the process model (Figure 4).

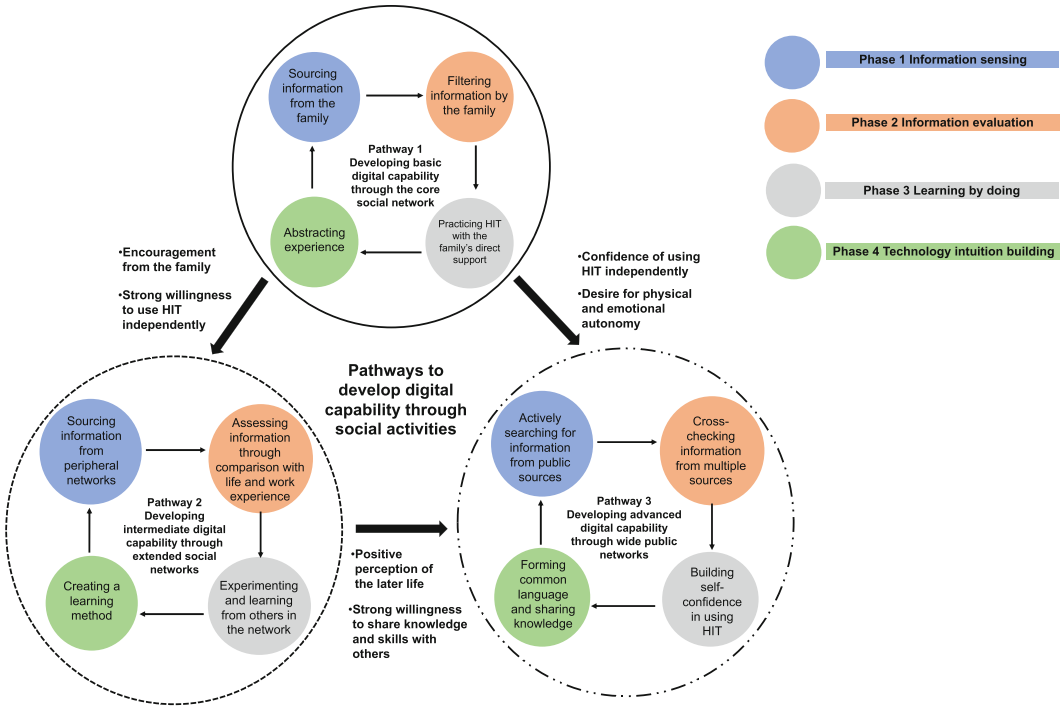

FIGURE 4 Process model of digital capability development

The process started with the first phase of information sensing (blue circles in Figure 4). This capability was developed when older adults frequently collected information on HIT from diverse data sources (e.g., family, friends, ex-classmates, ex-colleagues, newspapers, TV, radio, search engines, social media platforms, healthcare portals, and healthcare professionals). This phase involved various data sources, a volume of data, and frequent information-searching actions.

The second phase required older adults to evaluate information (orange circles in Figure 4). They sorted and filtered information to generate a comprehensive view of HIT that supported their decisions and choices regarding HIT. This information evaluation process relied largely on cross-checking communication and information within social networks.

The third phase emphasises learning-by-doing (grey circles in Figure 4). Older adults capable of using HIT often experimented with different HIT in a discovery-driven approach involving trial-and-error learning. When older adults decide to adopt several different HIT, the skills developed from using one HIT can be transferred to the use of others. Engaging in a series of related experiments can eventually yield the most effective ways of using HIT. The more HIT older adults experimented with, the more their confidence grew.

This increased confidence led to the fourth phase of technology intuition building (green circles in Figure 4), involving the ability to leverage the skills and knowledge acquired in other contexts and share them with others. Technology intuition building, in turn, helped older patients expand their sources of valuable information, improve their ability to evaluate information, and enhance their operating skills. This led to a positive loop in which the digital capabilities of older adults were formed, fine-tuned, and accumulated.

The three pathways in the model are not mutually exclusive. Older adults who achieved a high level of capability could advance from pathway 1 or 2 to pathway 3. The data analysis revealed that family was the starting point for most older patients' engagement with HIT, and they relied on family members to guide their HIT use. However, family members could also be a barrier to progressing from pathways 1 to 2. Some older adults were over-reliant on their families to source and evaluate HIT information and complete certain actions. In other cases, the family controlled information sources because they did not have confidence in the older adult's ability to use HIT independently. In one extreme case, the children of patient 11 bought him a smartphone but later took it away because the patient's son "does not want me to read too much information online. He thinks there is too much false and fake information there. He worries that I might follow the wrong advice without his help". In addition, older patients who lived with their children/grandchildren often stopped at pathway 1 because the older adults believed their family members could always help them, and family members believed they were responsible for taking care of them:

> "I don't want my mother to bother with too many HIT, especially when she is ill. It's enough for her to understand some basics. Knowing too much may result in further stress. It's my responsibility to make doctor's appointments and collect diagnosis results for her". (son of patient 7)

By contrast, the family members of older adults who moved from pathways 1 to 2 supported them in expanding their learning networks. Moreover, these older adults were highly motivated to use HIT independently because they were afraid of being a "burden" on their children. For example, patient 4 asked his granddaughter to teach him how to use a healthcare app because he "would like to use the app even when the young kids are not around".

The key driver for older adults to move from pathways 2 to 3 was having a positive perception of their later life. The two older patients in pathway 3 challenged the assumption that ageing is associated with a decline in learning and social abilities. They remained active participants in society and in a wide range of offline and online groups. Patient 10 explained that

> "I should be able to use the new technologies if others can.... Aside from healthcare-related technologies, I plan to learn online flight booking this year. Older adults can also have wonderful life".

The older patients were motivated also by their passion to share their knowledge and skills with others. They acted as opinion leaders in their networks (e.g., interest groups at care homes and groups of former classmates and colleagues), where the feeling of "leading and influencing" others encouraged them to keep exploring new technologies and educating others about the latest HIT.

Some older adults moved from pathways 1 to 3, skipping pathway 2. These individuals were those most confident about using HIT independently with a desire for autonomy. For example, although patient 5 learned about WeChat by watching his daughter use it, he did not rely on his daughter when he began to use it. He felt confident about learning how to use it using online resources. During the interview, patient 5 highlighted the importance of autonomy in learning, practicing, and sharing HIT knowledge and skills. This included both physical and emotional autonomy, which empowered older patients to control their lives.

6 | DISCUSSION

This research was motivated by an awareness of an age-based digital divide and an interest in finding ways to narrow it. We were interested in particular in how social networks shape the development of digital capability among older adults, which is not systematically investigated in the current literature. To address this gap, we collected empirical evidence to demonstrate how older patients can develop the ability to use HIT through social activities within and across networks.

6.1 | Theoretical contributions

Our research makes four major contributions to the IS literature. First, we argue theoretically and demonstrate empirically that digital capability can provide a valuable conceptual lens for understanding individuals' ICT use, which can complement the existing literature on digital literacy, mindfulness, and effective IS use. Those three lines of discussion have provided a comprehensive understanding of the skill sets, psychological rationales, and user actions related to people's engagement with ICTs. By contrast, digital capability highlights the fact that people develop their knowledge, skills, and mindsets in the digital world through ongoing actions in the social environment. It provides an opportunity to analyse 'the big picture'—that is, the diversity of individual lives and how different roles, relationships, social networks, and personal interactions come together to shape digital capability.

Second, we highlight the social context for the development of digital capability by systematically analysing the processes of social interactions at multiple levels. Extending existing studies that reveal the potential of social interaction in affecting ICT choices (Agarwal et al., 2009; Czaja & Sharit, 2012; Goolsbee & Klenow, 2002; Munshi, 2004; Selwyn, 2004; Tsai et al., 2017), we show that older adults can learn to use HIT by communicating with people within and across social networks, participating in social groups, and playing leadership roles in peer groups. Studies of mindfulness and the effective use of IS tend to focus on organisational settings, suggesting that peer effects and the collective organisational mind are influential factors in ICT adoption (Langer, 1997; Nevo & Nevo, 2012; Sun, 2011; Weick & Roberts, 1993). Further, sharing representations in organisations can stimulate individuals' learning behaviours (Burton-Jones & Grange, 2013; Dendere et al., 2019; Lin et al., 2019). By contrast, we investigate the wider social contexts that matter in individuals' lives. Our findings indicate that social networks drive learning and adaption behaviour, so that older adults can take informed actions to access healthcare services. Older adults can construct their own language and share their knowledge and skills with others, which feeds back to the society and improves the overall understanding of HIT within their social networks. Older adults' perception of being significant in their social networks is a crucial psychological factor in their willingness to experiment with HIT and share HIT experiences. While using HIT provides older adults with physical and emotional autonomy, supporting others gives meaning to their lives (Langer, 2014). Thus, this study extends the literature by providing a fine-grained picture of how social activities at multiple levels can create opportunities for learning, adaptation, and capability development. We focus on the micro-foundations that uncover the power of social interactions for building digital capabilities at different levels and classify these interactions as the core social network (family members), expanded social networks (close friends and former classmates), and wider public networks. Our findings thus offer a comprehensive explanation of how social interactions can drive, support, or hinder older adults' efforts to build digital capabilities.

Third, our model emphasises the dynamic nature of digital capability by approaching the development of digital capability from a process perspective. This developmental view is important because it allows older adults to adjust and improve their digital capabilities until they find the best way to facilitate their HIT use. Rather than taking HIT adoption for granted or as the status quo, this study showed that older adults found their way into technology use. Our process model provided a detailed account of how the digital capabilities of older adults were built and changed over time and how this evolution could be triggered, promoted, and shaped by social activities. Our findings extend the literature by revealing how the micro-elements that enable older adults to sense and evaluate information, learn by doing, and build technological intuition are structured chronologically. Process models cover within- and cross-social network dynamics that unfold over time (Langley, 1999; Newman & Robey, 1992) and generate theoretical insights from rich contextual details (Berends & Deken, 2021). Thus, this study responded to the need to examine ICT adoption as a dynamic process, avoiding the dangers of over-simplifying ICT adoption as merely a one-off decision.

Fourth, and finally, we contribute to research on the age-based digital divide by showing how it can be narrowed by promoting individual-level autonomy and action. We extend the current discussion around inequalities in digital skills among older adults (de Veer et al., 2015; Fox & Connolly, 2018; Francis et al., 2019; Hill et al., 2015; Lam & Lee, 2006; Niehaves & Plattfaut, 2014; Oderanti et al., 2021) by bridging the digital divide literature with research on individuals' ICT use and digital capability development. We reveal that building and enhancing older adults' ability to exploit HIT can be a way for this group to obtain more affordable and more effective healthcare services.

6.2 | Strategies for promoting HIT use among older adults

Based on the process model, we suggest two strategies that might encourage older adults to engage with HIT. First, more social interaction between older adults and the outside world could promote HIT adoption and facilitate digital capability development. Our findings indicate that the extent of social interaction (e.g., frequent contact with family, friends, neighbours, former classmates, and the public) was associated with a high level of digital capability. Older adults often rely on social interaction as a significant source of information. They also frequently receive support from people in their social networks to complete learning processes. Technological intuition allows older adults to share their HIT knowledge and skills with others, which can help elderly communities construct a common understanding of HIT. Thus, activities that boost communication among elderly communities and strengthen the links between older adults and the wider society are important.

Second, encouraging trial-and-error learning may lead to the emergence of new users and encourage older adults to explore new HIT. Trial-and-error learning can help older adults to build trust in HIT and develop self-confidence. This could be crucial for promoting HIT adoption and encouraging first HIT use among older adults. Interviewees with less HIT experience were often constrained by self-doubt, a lack of confidence, and perceived costs in terms of time, effort, and money, and they worried that they would not understand the technology or would make mistakes. When these older adults began to use HIT, they realised the sunk costs were trivial and they could accumulate the skills required to use HIT. Experiential learning approaches emphasise the dynamic nature of capability development (Gavetti & Levinthal, 2000; Prather, 1971), in which knowledge and skills are constantly revised and improved (Nelson, 2008). Progress through the process allows participants to develop the most effective ways of using HIT, which eventually enabled them to exploit all the opportunities offered by HIT. We propose, therefore, a developmental model that allows older adults to refine their capabilities and use HIT applications in a way that suits their needs.

6.3 | Managerial implications

This study has managerial implications for both governments and managers in the private sector. It is important for policy makers to recognise that the digital divide is more than a question of limited access resulting from

demographic variation. It also involves differences in end users' capabilities. Thus, valuing and stimulating older adults' willingness and autonomy in using HIT may complement current efforts to narrow the digital divide. Unfortunately, overlooking older adults' HIT needs may be common in society because these individuals are perceived as not interested in or incapable of using the technologies. Governments should implement policies to create opportunities for older adults to experiment with HIT.

For firms that introduce HIT, our findings should be informative for strategizing along several dimensions, such as value proposition, user acquisition, user engagement, and product and service promotions. Given the rapid ageing of today's societies, it is critical for firms to understand older adults' needs and develop attractive value propositions for this customer segment. Instead of taking HIT adoption for granted, firms may embed digital capability development in their business model designs. Following a strategy of stimulating social interactions among older adults, firms could consider how they could facilitate knowledge transfer from family members to older adults, involving both the family and older adults in a user journey and promoting active sharing behaviour between older adults. In relation to trial-and-error learning, firms could explore ways to create feedback loops to improve older adults' digital capability. Firms could innovate business models that allow older adults to experience products and services and do not include high failure costs, which might eventually expand their user base and product usage.

7 | CONCLUSION

Our exploration of older adults' actual experiences with accessing and using HIT offers a systematic explanation of how the age-based digital divide can be narrowed by building digital capability. One finding of particular interest was the critical role played by social activities in encouraging older adults to join the digital society. This suggests that governments and other relevant parties should look for ways to enhance older adults' social connections with the outside world that facilitate the development of their digital capabilities.

These recommendations are made in the context of the recent phenomenon in which older adults in ageing societies experience difficulty obtaining access to healthcare services through HIT. This study focuses on a specific hospital in China because of its embracing of digital healthcare and its early experiments with smartphone-based HIT. We originally focused on the interactions between healthcare professionals and HIT but soon recognised the importance of encouraging older patients' engagement with HIT, and social activity emerged as a new dimension from the initial research. We argue that this small study, which represents early stage theorising regarding a new phenomenon, has crucial importance for promoting the welfare of older adults. We hope this nascent research will stimulate future studies using larger samples.

This study opens opportunities for future research from three perspectives. First, future studies could explore the interdependencies and outcomes of the three pathways we identified, assessing and comparing their effectiveness individually and in combination to enable access to healthcare services for older adults. Moreover, our data revealed how older patients engaged in HIT with support from their social networks and developed their digital capability from a basic to an advanced level. It is possible, however, that the move between pathways might signal deterioration. Although our data and analysis did not reveal a move from an advanced to an intermediate/basic level, the model would logically suggest that digital capability could deteriorate as older adults change over time. For example, the ability to learn could deteriorate as a result of illness, and keenness to use HIT might be reduced if friends and peers began to use it less. Future research could explore the complex interdependencies among the pathways and investigate the dynamics among pathways as older peoples' physical and mental states and networks change.

Second, this study could be extended to other contexts related to ICT use to enrich the quality of older adults' lives, especially those who might be liberated from mobility problems through digital engagement. During COVID-19, older adults have been excluded from in-person social interaction because of isolation restrictions (Seifert, 2020; Seifert et al., 2021). Digital capability has been shown to be vitally important, perhaps more than ever, for enabling access to information, services, and social involvement (Xie et al., 2020). Future research could study social networks

under this unusual circumstance, investigating any emerging patterns of social interaction, how the pathways to digital capability development have changed, and how digital capability can enhance social connectedness between older adults and others.

Third, digital capability can be both individual and collective, making it essentially a multi-level concept spanning individuals, groups, organisations, and communities. Future research can extend our findings and transfer the theoretical approach to organisational settings, since organisations are not simple rational systems but social systems that are embedded in institutional contexts (Scott, 2013). Research can also explore digital capability at varying levels of analysis, linking the individual-level micro-foundational stream of digital capability research with work at the organisational level in relation to organisational processes, routines, resources, and performance in digital transformation.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

ORCID


Tao Zhang https://orcid.org/0000-0003-1329-598X

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AUTHOR BIOGRAPHIES

Yang Zhao is Senior Lecturer in Digital Transformation and Business Intelligence at Aston University. Previously, she was a Lecturer at the University of Glasgow and Loughborough University. In her research, she focuses on two broad questions: How do firms design, innovate, grow, and transform their business models in the digital economy? What are the economic, organisational, and societal implications of digital innovations? She has published in journals like *Long Range Planning*, *Technovation, and Technological Forecasting & Social Change, among others*.

Tao Zhang is Senior Lecturer in Innovation and Entrepreneurship at Loughborough University London. Tao's research focuses on technology policy, innovation management and energy, standing at the intersection of innovation and sustainability. He primarily examines technology user behaviour, technological change and innovation management in relation to energy, for example, consumers' adoption of innovative energy technologies, post-adoption user learning, and national/international environment and climate policies for promoting innovative energy technologies. He has published in the *Journal of Product Innovation Management*, *Annals of Tourism Research*, *Technological Forecasting and Social Change*, *Business Strategy and the Environment*, *International Business Review*, the *Journal of Environmental Management*, *Applied Energy*, *Energy Economics*, etc.

Rohit K. Dasgupta is Senior Lecturer in Cultural Industries at University of Glasgow. Prior to this he was Senior Lecturer at Loughborough University where he remains as Visiting Fellow. He is the author of *Digital Queer Cultures in India* (Routledge, 2017); *Social Media, Sexuality and Sexual Health in Kolkata, India* (Bloomsbury, 2017). He is currently working on a new book *COVID-19 Assemblages* forthcoming from Routledge.

Renpin Xia is the head of the Organ Transplantation Department at First Affiliated Hospital of Kunming Medical University in China. After receiving his PhD at Tongji Medical College, Huazhong University of Science & Technology in China, he worked at Hokkaido University in Japan and Harvard University in the U.S. He is specialised in hepatic and pancreas transplantation. He has actively promoted the adoption and use of healthcare information technologies in the department of Organ Transplantation. He is also interested in the use and diffusion of healthcare information technologies among patients.

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APPENDIX A: EXAMPLES OF TIMELINE OF KEY EVENTS

Timeline of key events – Patient 11 (Basic level of digital capability)

Started using a computer because he would like to have video calls with his grandson	Developed basic computer skills by learning from his family	His son brought him a smart phone	Learnt to use a smart phone to communicate with his family and friends	Read news and information on mobile with help from his family	Used HIT facilities at the hospital with his son's support	Understood online doctor appointment by watching his son making the appointment	Did not use online medical payment due to the security concerns	Searched for healthcare information online	Constantly communicated the false and inaccurate medical information obtained online with his family and friends	His son worried that the false medical information misled him	His son replaced the smart phone with a simple mobile designed for older people

Timeline of key events – Patient 9 (Intermediate level of digital capability)

Started using a mobile due to the need to communicate with his family and friends	Used mobile apps to discuss health problems with friends at similar age	Learnt to use mobile for reading and searching for information	A former colleague recommended an online doctor appointment app	Learnt to use the online doctor appointment app by talking to the colleague	Asked his family for help when using the online doctor appointment app	Shared the experience of using the online doctor appointment app with a neighbor	Practiced healthcare mobile apps with peers in an interest group	Observed his family making medical payment using mobile for the first time	Asked his family to get an online banking account for himself	Practiced mobile payment in his daily life

Timeline of key events – Patient 5 (Advanced level of digital capability)

Got to know computers at work before the retirement	Watched his daughter using WeChat	Started using WeChat by watching introductory videos online	Communicated with former colleagues and friends in WeChat groups	Learnt to use mobile payment in local shops	Knew about online doctor appointment by reading newspapers	Used the doctor appointment app independently because he did not want his daughter to worry about his health conditions	Used HIT facilities at the hospital by asking volunteers* and watching others	Learnt to use medical payment app from doctors and other patients	Shared the experience of using apps with former colleagues and friends	Understood and started using healthcare platforms	Recommended healthcare platforms to former colleagues and friends, and taught them how to use the platforms

* There were volunteers that guided and helped people use HIT facilities at the hospital as a part of its digitalization efforts.

APPENDIX B: ILLUSTRATIVE QUOTES FOR THE PATHWAYS TO DIGITAL CAPABILITY DEVELOPMENT

Second-order categories	Representative first-order data
Pathway 1: Developing basic digital capability through the core network	
Sourcing information from the family	• "My daughter said to me, the outside world is now very different, you do not need to know everything, but it's better if you know a little about these changes. The mobile phone can do this, and I can help you if you would like to learn". (patient 7) • "My daughter told me about the website Health Commission of Yunnan Province". (patient 7) • "Two of my grandsons are studying in the UK…they sometimes tell me about new healthcare technologies when we have video calls". (patient 11) • "We have a big family…the children all live close to me. We regularly get together for dinner, and they share (healthcare) information with me in these family gatherings". (patient 11) • "My children and my granddaughter work for Huawei [a Chinese telecommunication corporation]. They brought me the mobile [device]". (patient 12) • "I tell my children about my health condition most of time. They care about me very much. They will look for healthcare information and new technologies". (patient 12)
Filtering information by the family	• "Especially when it comes to healthcare-related news and products, they [the children] are very cautious". (patient 7) • "When I tell my children about new healthcare technologies, they always double check by themselves". (patient 11) • "My son is a public servant. He believes there is too much fake information online. He does not think I can assess the reliability of this information by myself". (patient 11) • "[When looking for HIT], I trust the younger generation [in the family]. They will look up information online and see which is the best". (patient 12)
Practicing with the family's direct support	• "My daughter showed me how to use WeChat for doctors' appointments…. She showed it to me step by step, which department to select, who the doctors are, how to view the doctor information…. When I could not understand, she took the mobile [device] over and told me what to do…she spent about half an hour teaching me". (patient 7) • "I collected my MRI result in the auto diagnosis results collection machine…. My son guided me". (patient 11) • "I provide reviews for doctors online whenever I am hospitalised. I have been in this hospital four times. My children help me do this". (patient 11) • "My children are very patient with me. I easily forget things because I am too old…. For example, when I said I would like to learn the doctor appointment machine in the waiting hall, they were very encouraging. They explained the buttons and their functions. They watched me using the machine. My eyesight is poor, so they read some instructions for me". (patient 12)
Abstracting experience	• "Writing down the steps required is definitely helpful. I still cannot use the app by myself; for example, I get confused with the registration, but I am learning from this experience and hope I can learn more". (patient 7)

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Second-order categories	Representative first-order data
	• "The first time [collecting diagnosis results from the machine], the result did not print out. My son explained that I had not pressed the 'confirm' button. He showed me a second time, and on my third try, I was able to get the result myself. When older people do not understand new technologies, we learn from young people". (patient 11) • "My children put in the first comment for me. I told them what I felt about the hospital and the doctors. They typed these and posted them online. I watched them doing this. The second time, I clicked the post button myself. I knew the process by the third time". (patient 11)
Pathway 2: Developing intermediate digital capability through extended social networks	
Sourcing information from peripheral networks	• "We often see our neighbours when going for a walk after dinner. We sometimes talk about healthcare technologies. They also recommended Dianyi Tong [a healthcare platform introduced by healthcare organisations in Yunnan Province] to me". (patient 2) • "We [friends] talk about our health conditions in the WeChat group. For example, when I was in the hospital this time, they asked me what happened. They looked for [healthcare] information and shared the information with me". (patient 4) • "There are a few people using healthcare mobile apps in the interest clubs". (patient 9)
Assessing information through comparison with life and work experience	• "I hesitated when the hospital suggested that I pay my medical bills through the app. I have used the mobile [device] to pay small amounts, like for vegetables and other food in the market. I also use the mobile [device] to receive payments for foods sold…because everybody pays through mobile nowadays. If you ask people to pay by cash, most of them simply do not have cash with them. I think mobile payment generally is safe, but when it comes to the large amounts, I am more careful. In addition, I was not sure about how the healthcare insurance worked in this process…. I asked my friends if they had used the app to pay medical bills. The son of a friend had experience with it and explained how the healthcare insurance worked. That was very helpful". (patient 2) • "I use the mobile [device] a lot in my life. It's not like I know nothing about the [digital] technologies. Therefore, when I use the machines at the hospital, my experience with using the mobile [device] helps me understand the machines". (patient 4) • "I asked my friends if they knew about Dianyi Tong and if they had used it". (patient 4) • "Most people in the interest club are retired colleagues because it [the club] is organised by our [government] department. We know each other quite well. I trust them, so I trust the things [technologies] they recommend. In addition, I compare the new products [technologies] with what I have used, and this gives me a good understanding of the new products". (patient 9)
Experimenting and learning from others in the network	• "I use different healthcare platforms…because I like to try new things. Moreover, the information on one platform is not necessarily correct". (patient 2) • "My friends are more patient than my children. They can sit down and teach me step by step, and sometimes we figure it [healthcare app] out together". (patient 2) • I noticed a friend using WeChat by speaking into the mobile [device] but not typing. I was interested because my Mandarin is poor. For a long time, I could not use the mobile [device] well because of the language issue. I asked him to teach me, and he did. And then I found

Second-order categories	Representative first-order data
	that not only WeChat but also many other apps can use voice input [the input method in mobile devices allowing users to speak rather than type]. They can even recognise local dialects". (patient 4) • "I started to practice the voice input in different apps…like the heartbeat examination app. Some apps come from the mobile [device] itself. Some are recommended by friends". (patient 4) • "I watched them [people in the interest club] using the apps and got interested…. I like to communicate with them". (patient 9)
Creating a learning method	• "The first one [healthcare platform] was a struggle. The rest are fine [easy to use]. They are more or less the same…. For example, you open the platform by clicking the icon; the menus are usually on the left side, [and] you can click on the next one when finishing reading one article". (patient 2) • "I tried to shop online once. I think these apps have common steps—register, get an account, select what you want, and pay for it. This process is not a big problem; the problem is there are too many products online, and I do not know which one is the best". (patient 4) • "I have used WeChat payment. I actually started using it when I was hospitalised the last time. The doctors told my children to pay [medical bills] using their mobile [devices]. I watched them do this [use online payment]. I got an online account myself after this…. I use it for shopping, mostly shopping for food, in supermarkets too. I will use mobile payment if they [doctors] ask me to. I think it will be the same as the WeChat payment". (patient 9)
Pathway 3: Developing digital capability through wide public networks	
Actively searching for information from public sources	• "I first got to know about it [telemedicine] from TV news. This time when in hospital, I noticed a digital screen, like an advertising screen, in front of the hospital building, talking about the telemedicine technologies". (patient 5) • "There is a lot of news about new healthcare technologies online. I remember I read a piece about a robot that can do surgery. Amazing". (patient 5) • "I read in the newspaper about wearable devices". (patient 10) • "A volunteer at the hospital told me about the appointment-booking machine". (patient 10)
Cross-checking information from multiple sources	• "I like to browse news and information online, including the healthcare platforms. When I hear about a new technology, I go online and check what people say about it". (patient 5) • "I ask doctors what they think about the wearable devices". (patient 10) • "A doctor explained telemedicine to her [another patient in the ward]. I looked for information on this new technology on my mobile after that. We [patients in the ward] discussed it". (patient 10)
Building self-confidence in using HIT	• "It's not difficult. You just download the app [Chunyu Doctor] and register". (patient 5) "Did anyone tell or show you how to use the app?" (the interviewer) "No, I learned this myself. I looked for instructions online. It's very straightforward". (patient 5) • "The appointment-booking machine is so intelligent and convenient to use—which department you want, which doctor you would like to make an appointment with, and what time you would like to have the appointment. It's very convenient. I can plan in advance and come to the hospital near to the appointment time. I no longer need to wait in a long queue". (patient 5) • "Yes, if necessary, I would like to use telemedicine…because I trust the doctors and I trust technologies". (patient 5)

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Second-order categories	Representative first-order data
	• "Did you worry about using the diagnosis-results collection machine for the first time?" (the interviewer). "No, I did not. Other people always help me. We help each other". (patient 5) • "Usually, I just follow the instructions on the screen. These instructions are user friendly. At least I can understand them. If there is anything I really cannot understand, I simply ask the volunteers to help". (patient 10) • "I cannot entirely rely on my children. I need to be able to use the technologies if they are busy and they cannot be with me. I know I can use them [HIT]" (patient 10)
Forming common language and sharing knowledge	• I like sharing my opinion of new technologies and my experience of using new technologies with my wife, friends, and former colleagues.... From the technology point of view, the whole society is now digitised, including the library, e-books, [and] digital management tools for engineering; digital healthcare technologies may be even more advanced. This is how society is developing. What we must do is embrace this development". (patient 5) • We [older adults] should support each other in learning new technologies. For example, my friend who is 70 uses Xiao Niangao [a mobile app that makes digital photo albums] very well. He teaches me how to make the albums. I know how to buy medicine online. I teach him [how to do so]". (patient 5) • "A young guy once came to our care home, demonstrating a mattress that tracks your temperature, pulse rate, and blood pressure. I told him that older people easily get lost if your app has more than five steps.... This is based on my observation of my friends at the care home". (patient 10) • "I also notice that if passwords have to include more than six digits, older adults start to struggle. If it [the app] asks for a combination of letters and numbers as the password, it's over—most older adults would not be able to remember complex passwords. I share my ways of setting passwords with my friends, but this does not mean everyone knows how to use it. Sometimes, they still forget". (patient 10)