

Facilitators and Barriers to Home Use of Wearable Devices Among Older Adults With Ischemic Stroke: An Exploratory Qualitative Study

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Abstract

Background

Long-term management of modifiable risk factors is essential for secondary stroke prevention, yet home-based health management among older adults with ischemic stroke remains suboptimal. Wearable devices may support continuous monitoring and personalized health feedback; however, little is known about how this population perceives their use at home or the factors shaping their adoption and continued engagement. This study aimed to explore older adults' perceptions and experiences regarding the use of wearable devices for home-based health management after ischemic stroke and to identify perceived facilitators and barriers to their adoption and continued use.

Methods

The Health Belief Model and the Technology Acceptance Model were integrated to guide the conceptual framework of this study. Using purposive sampling, 26 older adults with ischemic stroke who had prior knowledge of or experience with wearable devices were recruited from the neurology department of a Grade A tertiary hospital and a community health service center in Xuzhou, China, between November 2025 and January 2026. Data were collected through focus groups and individual semistructured interviews and analyzed using qualitative content analysis that incorporated both deductive and inductive approaches.

Results

The analysis identified 6 themes: (1) practical challenges in home health management; (2) perceived technological value and health benefits; (3) barriers to technology use and challenges concerning trust; (4) multilevel social support and empowerment through technology; (5) preferences for age-friendly design; and (6) needs for functions specific to stroke and expectations for health care integration. Continuous health monitoring, real-time feedback, behavioral reminders, and support from family members, peers, communities, and healthcare professionals emerged as key facilitators of wearable device adoption. Major barriers included limited digital literacy, complex operation, concerns regarding monitoring data accuracy, privacy and data security, and affordability. Participants also emphasized the need for personalized monitoring, timely risk alerts, and integration with primary healthcare services.

Conclusions

Wearable devices have potential to support home-based health management among older adults with ischemic stroke, but successful adoption requires attention to patients' perceptions, technology-related challenges, social support, and stroke-specific needs. Future interventions should incorporate user-centered and age-friendly design principles, strengthen support from families, communities, and healthcare professionals, and integrate wearable technologies into stroke self-management and preventive care pathways. These findings highlight the importance of developing patient-centered approaches to support sustainable use of wearable technologies in post-stroke home health management.

1. Introduction

Stroke has become a major public health problem in China [1]. Ischemic stroke (IS) is the most common subtype of stroke, accounting for 86.8% of all stroke cases among people aged 40 years or older in China [2]. As the population continues to age and the number of people aged 60 years or older increases substantially, the burden of IS is expected to grow [3]. Chronic comorbidities are common among older patients with IS. Approximately 90% have at least one

additional chronic condition, and nearly half have four or more concurrent chronic conditions [4]. Such multimorbidity further increases the complexity of home-based health management and places greater demands on patients' ability to sustain long-term disease management.

The occurrence and recurrence of IS are closely associated with multiple modifiable behavioral risk factors [5]. Standardized secondary prevention is a key strategy for reducing the risk of stroke recurrence and improving patient outcomes [6]. Evidence suggests that comprehensive lifestyle interventions can effectively reduce the risk of stroke recurrence and improve patients' functional independence and health-related quality of life [7]. Population aging, multimorbidity, and the need for ongoing risk-factor management make home health management a central component of long-term care for older patients with IS. However, adherence to recommended self-management practices among older adults with IS in China remains generally low, with self-management levels in this population reported to be lower than those among individuals with other chronic conditions [8]. Moreover, the coverage, implementation, and sustained delivery of secondary stroke prevention remain inadequate [9]. These challenges are particularly pronounced in rural and resource-limited areas, where insufficient primary healthcare capacity, limited patient health literacy, and a lack of ongoing management support further hinder the effective implementation of secondary prevention strategies [10, 11].

Because of limitations in healthcare personnel, service availability, and geographic coverage, traditional out-of-hospital care models often cannot continuously meet the long-term health management needs of individuals with stroke. Digital health technologies offer a promising approach to addressing these limitations [12]. In recent years, wearable devices have been increasingly used for the home health management of chronic conditions because of their capacity for noninvasive, continuous monitoring and remote data transmission. Wrist-worn devices, such as smart bands and smartwatches, can continuously collect physiological and behavioral data, such as heart rate, physical activity, and blood oxygen saturation [13]. These capabilities align with the long-term physiological monitoring and health behavior management required for secondary stroke prevention, providing technological support for home-based health management and active aging among older adults with IS [14].

Although wearable devices have shown considerable potential in chronic disease management, the specific needs of older patients with IS remain insufficiently understood and addressed [15]. Most commercially available devices are still designed primarily for younger users, requiring older adults to navigate complex interfaces, operational challenges, and design features that may not adequately accommodate age-related or stroke-related limitations. These issues may restrict the effective use of wearable devices in home-based care. Existing research has largely focused on device detection performance and clinical validation [16] as well as the application and feasibility of wearable devices in stroke care [17]. However, limited attention has been paid to older adults' experiences with wearable devices in real-world home settings, their motivations for adopting such technologies, and the factors that facilitate or hinder their use. This gap is particularly evident in relation to stroke-specific health needs and the lifestyle adjustments required after stroke. Consequently, the perspectives of older adults with IS remain underrepresented in the design and evaluation of wearable technologies, potentially constraining the development of user-centered and age-appropriate devices.

User-centered design (UCD) emphasizes understanding users' needs, task characteristics, and contexts of use throughout the technology development process, positioning user experience as a central consideration in design decision-making [18]. Older adults with IS have distinct disease-related characteristics, varying levels of digital literacy, and specific home-based health management needs. Therefore, exploring their experiences and perspectives on wearable device use is essential to identify facilitators and barriers to home use and inform age- and stroke-appropriate technology development.

1.1 Conceptual Framework

To systematically examine factors influencing wearable device use among older patients with IS, our research team developed a conceptual framework by integrating the Health Belief Model (HBM) and the Technology Acceptance Model (TAM). The HBM explains health-related behaviors through individuals' perceptions of disease susceptibility and severity, perceived benefits and barriers, self-efficacy, and cues to action [19]. In recent years, the HBM has been extended to digital health contexts, including mobile health applications and wearable technologies, to explain technology-related behaviors motivated by perceived health risks and health management needs [20].

The TAM explains individuals' acceptance and use of technology, emphasizing perceived usefulness and perceived ease of use as key determinants of attitudes and behavioral intentions [21]. In the context of digital health technologies, including wearable devices, the TAM can help explain how patients form intentions to adopt and continue using a technology based on its perceived usefulness, ease of operation, and their experiences with its use [22].

Wearable device use among older adults with IS involves both health-related perceptions and evaluations of technological value and usability. Therefore, neither the HBM nor the TAM alone may fully explain the adoption process. In the integrated conceptual framework, the HBM was used to explain why older adults perceived a need for home-based health management and sought support from wearable devices, whereas the TAM was used to explain how device functionality, ease of use, and user experience shaped their attitudes toward and intentions to use these technologies. Together, the models guided exploration of older adults' perspectives and the facilitators and barriers influencing wearable device use.

2. Methods

2.1 Study Design

This study employed an exploratory qualitative design and a user-centered approach to examine the use of wearable devices for home-based health management among older adults with IS. The study aimed to explore their perspectives on using wearable devices for health management and to identify facilitators of and barriers to their adoption and use [23]. Data on older patients' subjective perceptions of and experiences with wearable device use were collected through one-on-one semi-structured interviews and focus group discussions.

2.2 Setting and Participants

This study was conducted between November 2025 and January 2026. Using purposive sampling, older adults with ischemic stroke (IS) were recruited from the neurology department of a Grade A tertiary hospital and a community health service center in Xuzhou, Jiangsu Province, China. The research team collaborated with community health workers and healthcare professionals in the neurology department to identify and recruit potentially eligible participants. Some participants in the focus group discussions were recruited from a previous study conducted by the research team in Xuzhou, titled "Intervention Study of Smart Wearable Devices Combined with a Platform on Intrinsic Capacity in Older Adults." The protocol for that study has been published [24].

The inclusion criteria were as follows: (1) age 60 years or older; (2) a diagnosis of ischemic stroke (IS) based on the Chinese Guidelines for the Diagnosis and Treatment of Acute Ischemic Stroke 2023; (3) being in the recovery phase of stroke; (4) the ability to use a smartphone and some prior knowledge of or experience with smart wearable devices; and (5) clinical stability, the ability to communicate effectively, and willingness and capacity to participate in an interview.

The exclusion criteria were as follows: (1) severe cognitive impairment preventing effective communication; and (2) severe comorbid physical illness or an unstable medical condition.

Participants were given the option of taking part in either a focus group discussion or an individual semi-structured interview. Data collection and preliminary analysis were conducted concurrently and continued until data saturation was achieved, defined as the point at which no new codes, categories, or themes emerged from subsequent interviews or focus group discussions. After data had been collected from 26 participants, the research team made a preliminary determination that saturation had been reached. To confirm this assessment, two additional eligible participants were interviewed. As these interviews yielded no new codes, categories, or themes, data saturation was considered confirmed [25]. Consequently, only data from the first 26 participants were included in the formal analysis, and recruitment was subsequently discontinued. Among the 26 participants included in the formal analysis, 18 took part in one-on-one semi-structured interviews, and eight participated in two focus group discussions, with 4 participants in each group.

2.3 Data Collection

The research team developed a semi-structured interview guide informed by the HBM and TAM (Appendix 1). The guide addressed perceived health risks in the home setting, wearable technology acceptance, expectations for device functions, and barriers to use. The interview guide was pilot tested with two older adults to improve the clarity and relevance of the questions. Data from the pilot interviews were not included in the final analysis.

All individual interviews and focus group discussions were conducted between November 2025 and January 2026. Individual interviews were conducted by NC and TH. NC served as the primary moderator for the focus group discussions, and RS served as the assistant moderator. Individual interviews were conducted in a quiet, private room with only the participant and the two interviewers present. Focus group discussions were held in a quiet meeting room and were attended only by the participants, NC, and RS.

TH had participated in a previous wearable device intervention from which some focus group participants were recruited. To minimize the potential influence of this preexisting relationship on participants' responses, TH did not participate in the focus group discussions. Before each interview or focus group discussion, researchers collected participants' sociodemographic and clinical information. Sessions were conducted in Chinese and audio-recorded with participants' written informed consent. Individual interviews and focus group discussions lasted between 20 and 50 minutes.

Data collection and preliminary analysis were conducted concurrently. Within 24 hours of each session, NC, the first author, transcribed the audio recordings verbatim and removed all personally identifying information from the transcripts. NC was a graduate nursing student who had received formal training in qualitative research methods. Ultimately, 26 Chinese-language transcripts were generated, comprising approximately 45,000 Chinese characters and 73 single-spaced pages in 12-point Times New Roman font.

2.4 Data Analysis

The interview transcripts were analyzed using qualitative content analysis, combining deductive and inductive approaches. Deductive content analysis was guided by the conceptual framework integrating the HBM and TAM. An initial analysis matrix was developed from the framework's core constructs to guide coding and categorization [26] (Fig. 1). Data outside the predefined framework were analyzed inductively using open coding to identify additional categories and themes [27].

RS and TH verified each transcript against its audio recording. Verified transcripts were imported into NVivo 15 for data management and analysis. Sentences or paragraphs conveying a distinct meaning relevant to the research questions were treated as units of analysis. Before formal analysis, the two coders completed 8 hours of standardized training. The training included instruction on the theoretical constructs of the HBM and TAM, discussion of the definitions and scope of each category in the initial analytical matrix, and pilot coding of the pilot interview data. Pilot coding informed refinement of coding definitions and decision rules.

The formal analysis involved three interconnected steps: deductive coding, inductive coding, and theme integration. First, two coders independently coded the units of analysis using the initial analytical matrix and assigned data to the relevant constructs in the HBM and TAM. Second, data outside the predefined constructs were analyzed through inductive open coding. The coders used constant comparison to examine similarities and differences among codes and subsequently grouped and abstracted them into newly developed categories. Third, the codes and categories generated through deductive and inductive analyses were iteratively compared to identify relationships and patterns across the data. Codes with conceptually similar meanings were grouped into higher-order categories and subsequently integrated into the final themes and subthemes.

Disagreements regarding coding, category assignment, or theme naming were resolved through discussion between the two coders. When consensus could not be reached, an experienced qualitative researcher (XT) was consulted.

2.5 Rigor

This qualitative study followed the Consolidated Criteria for Reporting Qualitative Research (COREQ) guidelines [28]. Methodological rigor was guided by Lincoln and Guba's trustworthiness framework, encompassing credibility, dependability, confirmability, and transferability [29]. To enhance credibility, pilot interviews informed refinement of the interview guide before data collection. Transcripts were verified against the original recordings to ensure accuracy. During analysis, researchers returned to the original data to ensure that codes, categories, and themes reflected participants' accounts. Representative quotations were included in the findings to preserve participants' voices and support the credibility of the interpretations. To enhance dependability, two researchers independently coded the data after completing standardized training and pilot coding. The research team also maintained an audit trail documenting revisions to the interview guide, refinements to coding definitions and decision rules, and the development and integration of categories and themes. To enhance confirmability, the researchers engaged in reflexivity throughout data collection and analysis. Reflexive memos and team discussions were used to examine how the researchers' prior experiences, professional backgrounds, and theoretical assumptions might have influenced data collection, interpretation, and theme development. To enhance transferability, detailed descriptions of the study setting, participant characteristics, eligibility criteria, and data collection and analysis procedures were provided. These contextual details enable readers to assess the potential applicability of the findings to other populations and settings.

2.6 Ethical Considerations

This study was approved by the Ethics Committee of Xuzhou Medical University (approval number: XZHMU-25S1118). All participants provided written informed consent before data collection. They were informed that participation was entirely voluntary and that they could decline to answer any question or withdraw from the study at any time without penalty or adverse consequences. Participants received no financial compensation. To protect confidentiality, all interview transcripts and personal information were deidentified, and each participant was assigned a unique study identification number. Identifying information was removed from the transcripts before analysis. Selected verbatim quotations were included in the results section to illustrate the findings while preserving participants' anonymity.

3. Results

3.1 Characteristics of the Participants

A total of 26 older patients with IS enrolled in this study. Their demographic and disease-related characteristics are presented in Table 1. Participants' ages ranged from 62 to 80 years, with a mean age of 69.96 years (SD = 4.95). Of these participants, 15 (57.7%) were men and 11 (42.3%) were women. All participants had received some formal education. Most had at least one comorbid chronic condition, including hypertension, diabetes mellitus, coronary heart disease, or

hyperlipidemia; only 2 participants reported no additional chronic conditions. Regarding prior experience with wearable devices, 12 (46.2%) had used a smartwatch or smart wristband.

Table 1
Sociodemographic Characteristics of the Participants (N = 26)

ID	Sex	Age	Occupation	Education Level	Marital Status	Living Arrangement	Experience With Wearable Devices	Other Chronic Conditions
S1	Female	74	Worker	Junior high school	Married	With spouse	Had heard of wearable devices	Hypertension
S2	Female	62	Worker	Junior high school	Married	With spouse	Had heard of wearable devices	Hypertension
S3	Male	64	Administrative staff	Technical secondary school	Married	With spouse	Had heard of wearable devices	Hypertension and diabetes
S4	Male	65	Worker	Junior high school	Married	With spouse	Had heard of wearable devices	Hypertension and coronary heart disease
S5	Female	72	Worker	Junior high school	Married	With spouse	Had heard of wearable devices	Hypertension
S6	Male	74	Teacher	Junior college	Married	With spouse	Had heard of wearable devices	Hypertension and diabetes
S7	Male	74	Scientific and technical professional	Senior high school	Married	With spouse	Owned a smartwatch	Diabetes
S8	Male	76	Worker	Junior high school	Married	With spouse	Had heard of wearable devices	Hypertension
S9	Female	63	Farmer	Junior high school	Married	With spouse	Had heard of wearable devices	None
S10	Male	63	Administrative staff	Bachelor's degree	Married	With spouse and children	Owned a smartwatch	Hypertension
S11	Male	80	Worker	Junior high school	Married	With children	Owned a smartwatch	Diabetes
S12	Male	72	Worker	Junior high school	Married	With spouse	Had heard of wearable devices	Hypertension
S13	Male	63	Self-employed	Senior high school	Married	With spouse	Owned a smartwatch	Hypertension
S14	Female	73	Worker	Junior high school	Married	With spouse	Had heard of wearable devices	Hypertension and diabetes
S15	Male	66	Farmer	Junior high school	Married	With spouse	Had heard of wearable devices	Hypertension

ID	Sex	Age	Occupation	Education Level	Marital Status	Living Arrangement	Experience With Wearable Devices	Other Chronic Conditions
S16	Female	69	Administrative staff	Senior high school	Married	With spouse	Had heard of wearable devices	Hypertension
S17	Female	72	Worker	Junior high school	Widowed	Alone	Had heard of wearable devices	Hypertension, diabetes, and hyperlipidemia
S18	Male	75	Teacher	Technical secondary school	Widowed	Alone	Had heard of wearable devices	Hypertension
Fg1	Male	72	Worker	Junior high school	Married	With spouse	Owned a smartwatch	Coronary heart disease
Fg2	Male	68	Worker	Junior high school	Married	With spouse	Owned a smartwatch	Hypertension and diabetes
Fg3	Female	69	Worker	Junior high school	Married	With spouse	Owned a smartwatch	Diabetes
FG4	Female	70	Scientific and technical professional	Technical Secondary School	Married	With spouse	Owned a smartwatch	Hypertension and diabetes
FG5	Female	74	Worker	Junior High School	Married	With spouse	Owned a smartwatch	Hypertension
FG6	Male	72	Scientific and technical professional	Senior high school	Married	With spouse	Owned a smartwatch	Hypertension
FG7	Male	74	Administrative Staff	Junior High School	Married	With spouse	Owned a smartwatch	Hypertension
FG8	Female	63	Administrative Staff	Technical Secondary School	Married	With spouse and children	Owned a smartwatch	None

3.2 Qualitative Results

Guided by the HBM and TAM and informed by the inductive analysis, this study identified 6 themes and 19 subthemes. The themes were as follows: (1) practical challenges in home health management; (2) perceived technological value and health benefits; (3) barriers to technology use and challenges concerning trust; (4) multilevel social support and empowerment through technology; (5) preferences for age-friendly design; (6) needs for stroke-specific functions and expectations for health care integration. The themes and subthemes are presented in Fig. 2.

3.3 Qualitative Findings

3.3.1 Theme 1: Practical Challenges in Home Health Management

Participants encountered multiple challenges in managing their conditions at home. As symptoms improved, some became less vigilant and engaged less consistently in self-management. Existing health care services also did not fully meet their needs for continuous monitoring and professional guidance during home rehabilitation.

Reduced Self-Management After Symptom Improvement

Some participants reported that as their symptoms gradually improved, their vigilance regarding the disease declined, and they engaged less frequently in daily monitoring and self-management.

S16 (female, 69 years): *"Sometimes I feel better and stop taking my medication. But as soon as I stop, I feel unwell again, almost as if one side of my body is paralyzed."*

S17 (female, 72 years): *"I used to check my blood pressure regularly, but later I felt fine and stopped checking it. By the time symptoms appeared, it was too late. Look, now I am back in the hospital. Not checking blood pressure or blood sugar is dangerous."*

Insufficient Support for Continuous Health Management

Participants reported limited access to continuous professional monitoring and guidance at home and concerns about the reliability of health measurements obtained through informal channels, such as pharmacies.

S14 (female, 73 years): *"The community cannot really provide much health-related help. They only call occasionally and give a few simple reminders."*

S18 (male, 75 years) reflected: *"I was hospitalized three times in one year. It seems that only hospital doctors provide me with health information."*

3.3.2 Theme 2: Perceived Technological Value and Health Benefits

Participants generally recognized the potential value of wearable devices for disease monitoring and health behavior management at home.

Data Visualization Enhances Perceived Personal Control

Participants recognized that wearable devices could visually present health and activity data, helping them understand their health status and adjust daily health behaviors accordingly.

S10 (male, 63 years): *"It counts my steps, so I can clearly see how many steps I have taken and plan my exercise."*

Device Reminder–Driven Adjustments to Proactive Health Behaviors

Participants reported that wearable device reminders increased health awareness and encouraged healthier behaviors, including reducing prolonged sitting and maintaining regular sleep schedules.

S3 (male, 64 years): *"If I sit too long, it reminds me to get up and move around. After a stroke, I need to stay active to prevent poor circulation."*

FG8 (female, 63 years): *"It helps me make myself go to bed early. If I did not sleep well the night before, seeing the record on the wristband makes me anxious, so I go to bed early the next night. It reminds me to live healthily."*

Real-Time Monitoring of Stroke Risk Factors

Participants with prior experience reported that wearable devices could provide health-related data, including heart rate, blood pressure, and blood glucose measurements, while those without prior experience expected similar monitoring capabilities. Participants viewed these data as a useful reference for daily health management but emphasized that their usefulness depended on monitoring accuracy and reliability.

S10 (male, 63 years): *"I used to measure my blood pressure at home with an electronic blood pressure monitor, but now I use this watch. I can measure it at any time, which is very convenient."*

FG5 (female, 74 years): *"The blood glucose value displayed on the device provides an approximate range and is not completely accurate. I compared it with a blood glucose meter and found that there were indeed some discrepancies. However, it is still useful as a reference in daily life and can reduce the frequency of blood glucose testing, because pricking my finger every day is quite painful."*

Intergenerational Remote Support and Health Data Sharing

Participants reported that location-tracking and health data-sharing functions enabled family members to remotely monitor their physical condition and activities.

S13 (male, 63 years): *"I previously had an ischemic stroke and fainted, so my children have always been concerned about my safety. This device can track my location, allowing them to find me wherever I go."*

3.3.3 Theme 3: Barriers to Technology Use and Challenges Concerning Trust

Although participants generally recognized the potential value of wearable devices, they encountered multiple barriers to adoption. Those with device experience primarily reported usability problems, whereas those without such experience more often expressed concerns about operational complexity, data accuracy and privacy, and financial costs.

Insufficient Digital Literacy

Some participants, regardless of whether they had experience with wearable devices, considered their digital skills limited. Participants with device experience primarily described difficulties with device setup, charging, and finding specific functions, whereas those without such experience were concerned that complex operations might exceed their capabilities.

S2 (female, 62 years) admitted: *"I only know how to make phone calls and use WeChat on my phone. I cannot manage anything too complicated."*

FG6 (male, 72 years): *"If no one had told me that I had placed the watch on the charger the wrong way around, I would have kept thinking that it was broken. I later realized that I had not positioned it correctly on the charger."*

Device Usability and Barriers to Feature Use

Some participants reported problems with device responsiveness, interface displays, and data synchronization, which hindered device use.

FG1 (male, 72 years): *"Sometimes I keep tapping the screen, but nothing appears. The device is not responsive enough, and the data are sometimes delayed. No matter how many functions it has, if it is difficult to operate or the display is unclear, it is of no practical use to older adults like us."*

Concerns About Data Reliability and Privacy

Some participants were concerned about the accuracy of device-generated data and the security of their personal information. These concerns reduced their trust in device functions and monitoring results.

S3 (male, 64 years) expressed concern about the accuracy of blood pressure monitoring based on his firsthand experience: *"Is this blood pressure measurement really accurate? I use an electronic blood pressure monitor at home, and I have noticed that when I measure my blood pressure twice, the readings are different each time."*

FG3 (female, 69 years): *"This device is linked to my phone, so I simply do not use the functions that I do not know how to operate, and I do not ask anyone to teach me because I am worried that my private information on the phone may be disclosed."*

Constraints on Economic Accessibility

For participants with limited financial resources, high device costs could hinder adoption despite recognition of their practical value.

S14 (female, 73 years) explicitly decided against purchasing the device because of its price: *"I know that a watch that can measure blood pressure costs more than 3,000 yuan and works very well, but it is too expensive. I would rather measure my blood pressure with my blood pressure monitor."*

3.3.4 Theme 4: Multilevel Social Support and Empowerment Through Technology

Participants generally believed that social support played a key role in facilitating wearable device use. Family members, peers, and community organizations provided practical assistance and strengthened participants' confidence in using these devices.

Intergenerational Digital Support Within Families

Participants stated that when they needed technical support, they primarily relied on their children for assistance and viewed this intergenerational support to build confidence in using wearable devices.

S13 (male, 63 years) similarly attributed his confidence in using the device to family support: *"As I have gotten older, I have had limited exposure to new technologies, so I definitely need to learn. My children will teach me, and once I have learned how to use it, I will feel confident operating it on my own."*

Peer Experience Sharing and Demonstration

Peer sharing and demonstrations helped participants understand wearable device functions and their practical role in daily health management.

S10 (male, 63 years): *"Many of my friends wear smartwatches with multiple functions. When we get together, we exchange our experiences of using these smart devices."*

Community-Based Digital Education Support

Participants in communities with well-established grassroots support systems reported receiving digital technology guidance from community workers.

FG8 (female, 63 years): *"Our community health workers arranged classes for us and taught us how to use smartphones and smartwatches, including how to operate them and what functions they have."*

3.3.5 Theme 5: Preferences for Age-Friendly Design

Participants believed that existing wearable devices did not fully meet older users' needs regarding functional design, information presentation, and learning support. They emphasized age-friendly design to reduce the burden of device use and support independent use.

Improving Device Usability and Interaction Friendliness

Participants emphasized that physical and interface features, such as large-font displays, long battery life, water resistance, and durability, influenced everyday device usability.

S5 (female, 72 years): *"I hope it is water resistant... does not need to be charged frequently, and that the display font is larger. My eyesight is not very good, so small text is difficult for me to read."*

FG3 (female, 69 years): *"I cannot understand what these icons represent. There are no text labels on the screen, so I do not know which function each icon corresponds to."*

Simplifying Unnecessary Features

Some participants believed that more device features did not necessarily increase practical value and could instead increase learning and operational demands. They preferred to retain core functions closely related to their health management to improve device-use efficiency and their confidence in operating the device.

S13 (male, 63 years): *"This watch has many functions, but I have not even looked at many of them because I do not need them."*

Multichannel Operational Guidance

Participants preferred multichannel operational guidance, including voice prompts, illustrated instructions, and step-by-step manuals. They believed that such support could facilitate understanding and independent device use.

S11: *"It would be best if it also had voice prompts. When I select a function, it could tell me by voice what that function is. It would also be helpful to have a simple, easy-to-understand instruction manual, preferably with pictures that teach me step by step how to operate it."*

3.3.6 Theme 6: Needs for Stroke Specific Functions and Expectations for Health Care Integration

Participants expected wearable devices to extend beyond basic data collection and health monitoring. They emphasized risk alerts, proactive health support, and closer integration with the health care system.

Need for Personalized Dynamic Monitoring

Participants expected wearable devices to provide automated monitoring and context-specific reminders tailored to their health conditions, rather than static data records alone.

S7 (male, 74 years) expected the device to provide context-specific intelligent alerts: *"Ideally, it could work like this: while wearing the wristband, I would receive a reminder every morning to take my medication, along with a voice announcement of my blood pressure reading."* He also used an analogy to describe the ideal form of intelligent alerts: *"It could provide reminders based on my heart rate, just as a navigation system reminds you to slow down when approaching a traffic light."*

FG1 (male, 72 years): *"I also have coronary heart disease, so I pay close attention to my heart rate. It would be even better if the device could provide appropriate alerts based on my heart rate, such as reminding me to rest promptly when my heart rate is elevated."*

Intelligent Early Warning for Acute Events

Because they had experienced a stroke or were concerned about another sudden health event, some participants hoped that wearable devices could detect abnormal events, issue risk alerts, and contact emergency services.

S7 (male, 74 years) expected predictive functions: *"For example, it could predict the risk of falling and issue an alert... informing you in advance of what might happen."*

S17 (female, 72 years) recalled that her family had difficulty recognizing her symptoms, noting that their inability to promptly identify stroke symptoms was also an important reason she hoped to receive intelligent alert support: *"At first, my daughter did not believe me at all. She told me not to talk nonsense and said, 'How could it be a stroke?' I am worried that one day I may suddenly feel unwell again and she still will not take it seriously."*

Coordinated Support and Feedback from Family Doctors

Participants also expected wearable devices to be integrated with primary health care services. They expected health data sharing to enable family doctors to provide follow-up and professional feedback.

S15 (male, 66 years) described his ideal mode of interaction: *"I hope I can communicate directly with my family doctor through the platform, just as I do on WeChat. By reviewing the data routinely monitored by my device and communicating with me, the doctor could gain a more comprehensive understanding of my physical condition."*

4. Discussion

4.1 Principal Findings

This study explored the experiences and perspectives of older adults with IS regarding home use of wearable devices and identified key facilitators and barriers influencing their adoption. The findings indicated that the adoption of wearable devices was not determined solely by device functions or technological attributes; rather, it was jointly shaped by patients' perceptions of disease risk, evaluations of potential health benefits, experiences with technology use, and access to external support. Participants recognized the potential value of wearable devices for continuous monitoring, real-time feedback, and risk-related alerts during home health management. Operational complexity, limited digital skills, device costs, and concerns about data credibility also influenced patients' willingness and ability to use wearable devices at home. In contrast, family, peer, and community support could facilitate adoption by addressing limitations in digital skills and confidence in technology use. Participants' expectations regarding stroke recurrence alerts, abnormal event detection, and data linkage between patients and health care professionals suggested that their needs extended beyond general health monitoring toward stroke-specific risk management and healthcare integration.

In the context of home health management, these findings can be interpreted through the HBM and TAM, suggesting that patients' health beliefs and technology-related perceptions jointly influenced wearable device adoption. The study also identified contextual factors beyond classical HBM and TAM constructs, including family support, peer demonstration, community-based digital education, age-friendly design, and linkages to health care services. Although these factors are not established constructs within the HBM or TAM, they may shape device adoption by influencing patients' access to assistance, confidence in technology use, and opportunities for ongoing health management support. Based on the HBM, patients' perceptions of stroke recurrence and its consequences, together with their

recognition of health monitoring benefits, represented important motivations for considering wearable device use. Continuous health monitoring, real-time feedback, and alerts for abnormal events were perceived as potential means of supporting health management after hospital discharge and improving patients' perceived control over their health. When patients believed that the devices could provide clear health benefits, they were more willing to accept some operational challenges associated with device use. Nevertheless, perceived benefits alone could not fully offset technology-related barriers. Professional recommendations from health care providers, reminders from family members, and peers' experiences with device use could also serve as cues to action, encouraging patients to explore and initiate wearable device use.

From the perspective of the TAM, perceived ease of use was an important factor determining whether positive attitudes toward wearable devices could translate into actual home use. Perceived ease of use depends not only on device design but also on patients' digital skills, functional abilities, and access to technical support. Complicated interfaces and complex operating procedures increase the difficulty of device use among older patients[30]. Previous studies have also indicated that operational difficulty and access to technical support influence technology use among older adults[30, 31]. These findings suggest that perceived ease of use is jointly shaped by technological characteristics and the support available in patients' daily environments. Digital skills, learning resources, and access to assistance when problems arise all influence their ability to use wearable devices and confidence in continued use.

In addition, compared with patients with other common chronic diseases, older adults with IS have needs that are more strongly centered on stroke recurrence risk management and maintaining safety during daily life. This population often needs to manage multiple tasks simultaneously, including symptom monitoring, medication management, rehabilitation, and lifestyle modification, resulting in substantial challenges in long-term self-management[32]. Participants in this study recognized not only the value of monitoring routine physiological indicators and activity data but also the importance of stroke-specific functions, including abnormal event detection, risk alerts, and health data sharing. Previous studies have likewise suggested that, compared with patients with chronic diseases such as hypertension and diabetes, patients with stroke are more concerned about recurrence risk and sudden health events[33]. Accordingly, participants expected wearable devices not only to record health data but also to facilitate connections among patients, families, and healthcare professionals to support ongoing risk management.

These findings suggest that generic wearable device designs may not adequately meet the individual needs of patients with IS. Future development could incorporate stroke-specific functions that align with patients' health management needs and risk profiles while ensuring clinical relevance and usability. Such approaches may help improve the reliability and interpretation of monitoring information[34]. However, current wearable devices should not be considered capable of accurately predicting or diagnosing stroke. These functions still require rigorous clinical validation, and clear pathways linking risk alerts, professional assessment, and appropriate medical referral should be established to prevent patients from becoming overly reliant on technology.

This study found that intergenerational digital support within families may help compensate for patients' limited digital skills and support wearable device use. When operating the devices exceeded patients' capabilities, their children often became their main source of technical assistance. Family members could not only provide technical support for device setup, troubleshooting, and data viewing but also enhance patients' technology-related self-efficacy and confidence through encouragement and companionship[35]. In addition to family support, peer experience sharing and community-based digital education were important external resources for supporting technology use among older adults with IS. Peer-to-peer experience sharing and behavioral demonstrations could help patients better understand device functions and their practical value, thereby reducing uncertainty about new technologies. Community-based digital education and training could also provide opportunities for repeated learning and practice, compensating for the

limitations of relying solely on family support. Instead, a multilevel support network encompassing families, peers, communities, and health care professionals is needed to provide continuous support for technology use.

Age-friendly design was another important factor influencing patients' acceptance and use of wearable devices. Participants expected simple operating procedures, intuitive information presentation, and interaction designs tailored to older adults with IS. Previous studies have shown that complex interfaces and cumbersome operating procedures can increase the burden of technology use among older users and reduce their willingness to use technology [36]. Therefore, wearable devices for older patients with IS should be designed using a user-centered and age-appropriate approach. In addition to optimizing device interfaces and operational processes, developers should provide appropriate learning resources to support patients with different levels of digital literacy.

The costs associated with device acquisition and continued use were also important barriers to wearable device adoption and access, particularly for older patients with limited financial resources. The costs of purchasing devices, network services, and long-term use could make it difficult for some patients with health management needs to continue using wearable devices [37]. Therefore, policymakers should consider financial support mechanisms, such as reimbursement programs or targeted subsidies, to improve access to wearable devices among low-income older adults with IS [38]. In addition, integration of wearable technologies into secondary stroke prevention requires clear pathways for data review, abnormality feedback, professional assessment, and medical referral.[6].

Regarding privacy perceptions and use-related decision-making, the findings of this study reflected contextual characteristics that differed from some Western studies where privacy concerns were more prominent. Existing Western literature generally identifies privacy concerns as a core factor hindering the adoption of digital health technologies among older adults[39]. However, studies conducted in China suggest that, when weighing health benefits against privacy risks, privacy concerns among older Chinese adults may not significantly diminish their perceived benefits of digital health technologies [40]. Privacy concerns were mentioned by only a small number of participants in this study. Older patients with IS are generally highly concerned about disease recurrence and long-term health management. Under these circumstances, the perceived benefits of continuous monitoring and professional support may carry greater weight in technology use decisions than potential privacy risks. In addition, some participants were recruited through community healthcare settings and maintained contact with primary healthcare providers. Previous studies have shown that trust in health care providers may increase older adults' willingness to participate in digital health programs and to share health information [41]. Therefore, the infrequent mention of privacy concerns in this study may be jointly related to patients' disease-specific health needs, trust in community health care, and the context of participant recruitment. Future research should further examine perceptions of privacy risks across different healthcare settings, technology types, and cultural contexts and explore the interplay among perceived health benefits, healthcare trust, and privacy concerns in technology use decisions.

This population was concerned not only with whether the devices were easy to operate and capable of providing health data but, more importantly, with the roles of these devices in recurrence risk management, abnormal event detection, home safety, and linkages to professional services. Future efforts should therefore focus on developing patient-centered approaches that integrate stroke-specific needs, age-friendly design, and appropriate support systems. At the same time, the boundaries of technological capabilities should be clearly defined to promote the safe and appropriate use of wearable devices in long-term stroke health management.

4.2 Limitations and Future Research

This study has several limitations. First, participants were primarily older adults with ischemic stroke who had mild to moderate functional impairment, basic smartphone skills, and some familiarity with wearable devices. Older adults with severe functional or cognitive impairment or limited digital literacy were therefore underrepresented. The findings may

consequently be most applicable to individuals with relatively favorable recovery outcomes and basic digital competence. Second, consistent with the user-centered focus of the study, wearable device use was examined only from the perspectives of older adults with ischemic stroke. The views of other stakeholders, including family caregivers, healthcare professionals, and technology developers, were not explored. Third, some focus group participants had previously participated in wearable device-related projects conducted by the research team. Their prior experience with the devices and contact with the researchers may have influenced their perceptions of device functions, benefits, and technical support, potentially increasing the prominence of positive experiences and specific functional expectations. Caution is therefore needed when transferring the findings to older adults with ischemic stroke who have no prior experience with wearable devices. Future studies should include participants with diverse functional abilities and levels of digital literacy and incorporate perspectives from multiple stakeholder groups. Such research could provide a more comprehensive understanding of the factors influencing wearable device adoption and sustained use and offer broader guidance for device design and clinical implementation.

5. Conclusions

This study identified facilitators of and barriers to wearable device use for home-based health management among older adults with ischemic stroke. Participants emphasized stroke-specific needs extending beyond routine health monitoring and closer connections with health care services. Adoption was shaped by health-related perceptions, technology-use experiences, social support, and stroke-specific health management needs. Wearable technologies should adopt user-centered, age-friendly designs, incorporate stroke-specific functions, and be integrated with continuity-of-care and home-based chronic disease management to provide more continuous, safe, and individualized support.

Declarations

Ethics approval and consent to participate

This study was approved by the Ethics Committee of Xuzhou Medical University (approval number: XZHMU-25S1118) and was conducted in accordance with the ethical guidelines, protocols, and regulations outlined in the Declaration of Helsinki. All participants provided written informed consent before data collection. Participants were informed that participation was voluntary and that they could decline to answer any question or withdraw from the study at any time without penalty or adverse consequences. To protect confidentiality, all interview transcripts and personal information were de-identified, and each participant was assigned a unique study identification number. Identifying information was removed from the transcripts before analysis. Selected verbatim quotations were included in the Results section while preserving participants' anonymity.

Consent for publication:

Not Applicable.

Clinical trial number:

Not applicable.

Availability of data and materials

The data supporting this study are available upon reasonable request and subject to approval by the corresponding authors. Requests should be directed to XT.

Competing interests

The authors declare no conflict of interest.

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Conceptualization: NC, YW, XT

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Formal analysis: NC, RS, TH, MZ

Funding acquisition: XT, MZ

Investigation: NC, RS, TH, YP

Project administration: NC, GS, YW

Supervision: YW, XT

Validation: GS, XT

Writing – original draft: NC

Writing – review & editing: NC, RS, YW, XT, MZ

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Figures

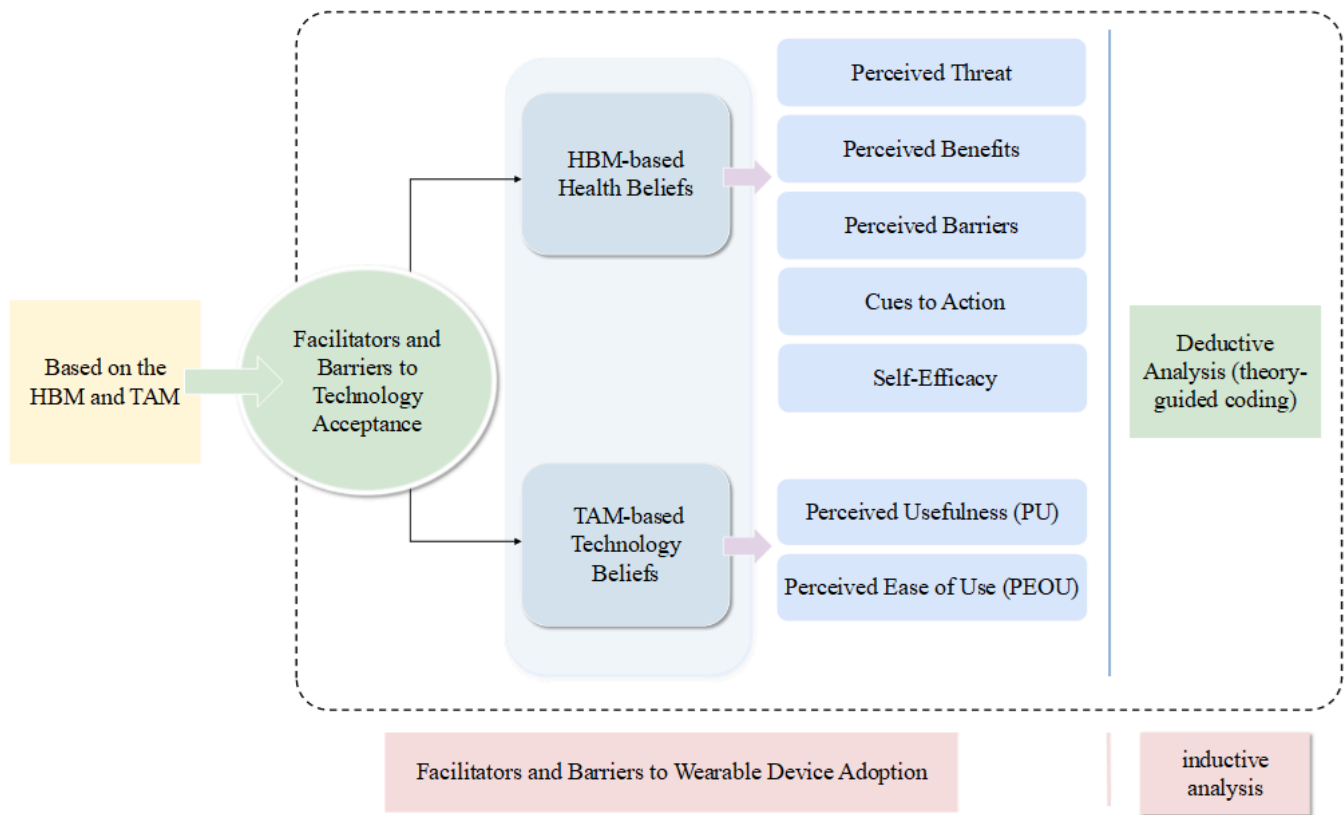


Figure 1

Analysis matrix based on the Health Belief Model and Technology Acceptance Model.



Figure 2

Themes and subthemes identified from interviews regarding wearable device use and adoption.

Supplementary Files

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