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Older adult stroke survivors' needs and perspectives of a stroke app: a qualitative study

Wenjing Cao[1], Afang Li[1], Azidah Abdul Kadir[2], Juan Chen[3], Lanying Chen[3], Qing Li[1] and Intan Idiana Hassan[4*]

Abstract

Background Stroke continues to be the second leading cause of death and a significant contributor to disability globally, with a more pronounced impact on older adults compared to other age groups. Along with evidence that mobile health (mHealth) apps have promising possibilities for supporting individuals pursuing health and wellness goals, the development of stroke apps is increasing. However, there remains a notable lack of research investigating the needs and perspectives of stroke survivors during the development of such apps.

Objective We aimed to describe the needs and perspectives of older adult stroke survivors regarding a stroke app.

Methods We employed an empirical phenomenological approach for a qualitative study. Using purposive and snowball sampling, older adult stroke survivors were recruited from three tertiary hospitals in Hunan province. Face-to-face semi-structured interviews were conducted between August and October 2024. Data were transcribed verbatim and analysed using Haase's adaptation of Colaizzi's phenomenological method.

Findings Thirteen older adult stroke survivors (eight men and five women aged 63–84 years) participated in the study in China. Three main categories and ten subcategories were extracted. The themes were the following: (1) optimism about the app (a good thing and eager to use); (2) desire for an app tailored to the unique (particular to older adults, information at fingertips, and reminding); and (3) concern (privacy issues, more depersonalized interactions with their doctors, the validity of the information provided on the app, cost, and having problems in using the app).

Conclusion This study pinpointed crucial factors from users' needs and perspectives that should be considered in developing a mobile app for older adult stroke survivors. Future research on app development should gather users' needs and preferences to enhance acceptability and increase the likelihood of successful implementation.

Keywords Stroke survivors, Needs, Perception, Mobile health, Qualitative research

*Correspondence:
Intan Idiana Hassan
intanidiana@usm.my; intanidiana@yahoo.com
Full list of author information is available at the end of the article

Introduction

Globally, stroke is a leading cause of death and disability. It has conclusively been shown that older adults are disproportionately affected by stroke [1–4]. Evidence suggests that with the aging of our population and the lengthening of life expectancies, prevention of stroke in older adults will be an important target to relieve the future global burden of stroke [5–7]. However, the current enormous and continuously growing burden of stroke indicates that prevention strategies for stroke have been relatively ineffective [8, 9]. Overall, there seems to be some evidence to indicate that novel stroke prevention strategies should be encouraged, specifically in older adult stroke survivors.

mHealth interventions like smartphone apps may improve stroke patients' medication adherence and clinical indicators [10]. A promising area that warrants further research is using digital technologies for primary stroke prevention in older adults [11]. However, there are few culturally appropriate and sustainable stroke-specific apps despite the rapid growth of mobile health apps [12]. Furthermore, most apps are designed for target groups without involving them in the development process [13, 14], and significant limitations hinder the incorporation of stroke-specific apps into clinical practice [15]. In addition, existing apps for stroke survivors and caregivers focus primarily on language and communication difficulties [16], leaving substantial room for improvement in addressing a broader range of needs.

While existing research has explored the development of mHealth apps for stroke survivors, there remains a significant gap in addressing the specific needs and preferences of older adults within this population. Many current apps are not tailored to the unique challenges faced by older adult stroke survivors, leading to usability issues and limited adoption. For instance, a study highlighted that despite the potential benefits of mHealth interventions, their clinical effectiveness remains uncertain, particularly due to a lack of focus on older adults [17]. Additionally, while some apps aim to improve medication adherence among older stroke survivors, comprehensive solutions that encompass a broader range of needs are scarce [18]. Zhang et al. [19] revealed a severe deficiency in the downloads of stroke-related apps on the Android platform. It is worth noting that users have cited various reasons for discontinuing the use of mHealth apps, including the apps not meeting their needs, lacking a direct positive impact on their health, and being excessively confusing and time-consuming to log in [20, 21]. Furthermore, a study conducted by Son et al. [22] underscores the importance for healthcare professionals and mobile health app developers to carefully consider patients' needs and preferences while designing mobile health technologies. Therefore, to guide the development of further apps among older adult stroke survivors, it is essential to gain insight into the expectations of current or potential users of available apps.

To our knowledge, few studies are available assessing what older adult stroke survivors needs and perspectives regarding a stroke app. Therefore, in this exploratory, descriptive study, we aimed to explore the unique requirements and viewpoints of older adult stroke survivors to inform the design of a mobile app to fit their needs.

Methods

Study design and participants

This qualitative study utilised semi-structured face-to-face interviews. Thirteen older adult stroke survivors in three tertiary hospitals in Chenzhou, Hunan province, from August 2024 to October 2024. Detailed descriptions of needs and perspectives of older adult stroke survivors regarding a stroke app were obtained by using an empirical phenomenological approach.

Participants were recruited through purposive and snowball sampling. Potential participants were identified and approached by healthcare professionals in neurology and rehabilitation departments of the three hospitals. Clinicians provided initial information about the study to eligible individuals during routine follow-ups or outpatient visits. Interested participants were then contacted by the research team to further explain the study objectives, voluntary nature, and confidentiality measures before obtaining informed consent. Additionally, enrolled participants were encouraged to refer other eligible individuals. Participants were included in the study based on the following criteria: (a) age exceeding 60 years, (b) proficiency in communication in Mandarin Chinese or the local Chenzhou dialect, (c) a confirmed history of strokes through neuroimaging during the episode, and (d) possession and regular use of a mobile phone. Excluded from the study were individuals with psychiatric illness, deafness, aphasia, or other language barriers, as well as those with cognitive impairment (determined by a Mini-Mental State Examination score of ≤ 17 for illiterate individuals, ≤ 20 for those with 1–6 years of education, or ≤ 24 for those with seven or more years of education). Data saturation —i.e., no further data were obtained on the topics of interest, was used to determine sample size. Ten participants were approached through snowball sampling, and the rest were already known by one of the two interviewers. Variations in age, duration of stroke, educational level, occupation status, and types of strokes were considered to enrich diversity in the expectations of older adult stroke survivors regarding a stroke app.

The study objectives and voluntary nature were explained to the participants, and all participants gave written consent that included permission to publish deidentified quotations before each interview. Numbers (e.g., Survivors S1, S2, etc.) were used instead of names to assure confidentiality. In addition, identifying information from the transcripts was removed. A password-protected computer was used to save all audio recordings and transcripts.

Procedures

Semi-structured, face-to-face interviews were done at a time convenient for participants, either in their homes or at an outpatient clinic in three hospitals (see supplementary material). All interviews were recorded with a voice recorder with the participant's permission. For the first step of the interview, participants' gender, age, duration of disease, educational level, occupation status, and types of strokes were obtained. Afterward, a broad data-generating question was used: "What are your attitudes toward using the apps for stroke management? Please tell me about your needs and perspectives regarding a stroke app."

Open-ended follow-up questions were used to obtain detailed descriptions, and examples were: "Please tell me about your expectations regarding a stroke app,"; "What would you ideally like a stroke app to have? "; "Which feature do you think is most important in the stroke app?"; "What do you want from a stroke mobile app?"; and "What do you believe would be challenging about using mobile app for stroke management?".

To acquire more data, the interview continued with probing questions such as, "Please explain more about this." and "What do you mean by that?". At the end of the interview, the participants were asked if they had anything to add. The length of the interview varied between 45 to 55 min.

Data analysis was performed concurrently with data collection. Within 24 h of each interview, the audio records were transcribed verbatim and rechecked by the research team for accuracy. The interviews, original transcriptions, and data analysis were in Chinese. All quotations were translated into English, and a subsample of the transcripts was then back-translated to ensure that meaning was retained. Referring to data analysis, there is an overall agreement in the results among all authors and highlighted quotations were chosen.

Data analysis

We used Haase's adaptation of Colaizzi's method to analyse transcripts [23, 24]. The first step of the analysis included reading the transcripts several times to understand the meanings conveyed. Second, the significant phrases from each transcript were identified and restated in general terms. The next step is formulating and validating meanings through research team discussions to reach a consensus. Next, themes were identified and organised into clusters and categories. Finally, a complete description of the themes was developed. Several strategies listed below were used to ensure trustworthiness and credibility. In-depth interviews followed by peer debriefing were utilized to attain credibility. Two researchers independently analysed the transcripts by bracketing data with preconceived ideas and strictly using the adapted Colaizzi's method described above. Subsequently, the findings were reviewed and compared. It was then discussed by the team until a consensus on themes, theme clusters, and categories was achieved among all authors. Variations of participant characteristics and adequate quotations collected through in-depth interviews were considered to establish transferability. An audit trail was maintained to ensure all analysis steps could be traced back to the original interviews.

Rigor

To ensure the rationality of the interview outline and the representativeness of the objects, we conducted pre-interviews before the formal interviews. Two researchers analyzed the transcribed data and non-verbal information repeatedly to increase the reliability. A group discussion was used to compare and examine themes and sub-themes until consensus was reached when their opinions differed.

To ensure the validity of this study, we applied the criteria of credibility, transferability, dependability, and confirmability, as suggested by Lincoln & Guba [25]. Firstly, for credibility, member checking was conducted by presenting a summary of key findings to three participants. They were asked whether the themes accurately reflected their experiences and if they had any additional insights. All three confirmed that the results aligned with their perspectives, and no major changes were suggested. Secondly, detailed information on the data collection method, period, and participants was meticulously documented to ensure transferability. Thirdly, to establish the dependability of post-data analysis, the researcher sought confirmation on the analysis process, and results from fellow researchers experienced in qualitative research. After receiving feedback, necessary corrections were implemented. Finally, to achieve confirmability, researchers implemented bracketing to prevent their views on mHealth from influencing their comprehension of participants' experiences. In other words, the researchers distinguished their viewpoints from participants'

experiences by addressing and managing any biases and assumptions held by the researchers throughout the data collection and analysis phase.

Results

Our sample consisted of 13 older adult stroke survivors recruited from three hospitals in Hunan province. Among them, five were female, and eight were male—participants aged from 63 to 84 years. Most participants were married (8 [61.5%]) and had more than one year duration of stroke disease before the interviews (9 [69.2%]). Those living alone represented 3.8% of the sample. Table 1 outlines the baseline characteristics of the participants.

Based on the results of the analysis, three themes and ten categories with two subcategories were revealed, which are provided in Table 2.

Theme 1: optimism about the app

Participants expressed that designing the app through multicenter efforts and enabling stroke management post-discharge would be ideal. The findings highlighted two main themes: positive aspects and a keen interest in usage.

Category 1: a good thing

One of the participants described this topic as follows (S1):

> *"I think that (stroke app) is a perfect thing. For example, the app provides us low-key means of getting in touch with knowledge and a health care professional sometimes."*

Another participant said (S3):

> *"I think it's a brilliant idea. Easy to access, you've got the information there, so it's something you can discreetly look at on your phone."*

Table 1 Characteristics of participants

ID	age	gender	Time since stroke	Marital status	Living situation	Employment
S1	65	Male	Within one year	married	With spouse	Employed
S2	63	Male	Between 2 and 5 years ago	married	With children	Unemployed
S3	74	Female	Over 10 years	divorced or widowed	Lived alone	Retired
S4	76	Male	Over 10 years	unmarried	Lived alone	Working part time
S5	80	Male	Between 6 and 10 years ago	divorced or widowed	Lived alone	Retired
S6	68	Female	Between 6 and 10 years ago	married	With spouse	Retired
S7	72	Male	Between 2 and 5 years ago	married	Lived alone	Working part time
S8	69	Female	Within one year	married	With spouse	Working part time
S9	70	Male	Within one year	divorced or widowed	Lived alone	Retired
S10	75	Male	Between 6 and 10 years ago	married	With spouse	Retired
S11	81	Male	Between 2 and 5 years ago	married	With children	Unemployed
S12	84	Female	Between 6 and 10 years ago	married	With children	Retired
S13	77	Female	Within one year	divorced or widowed	With children	Unemployed

Table 2 Summary of themes and subthemes

Themes	Main category	Subcategory
Optimism about the app	A good thing	
	Eager to use	
Desire for an app tailored to the unique	Special to older adults	
	Information at fingertips	educational informational
		personal medical data
	Reminding	
Concern	Privacy issues	
	More depersonalized interactions with their doctors	
	Validity of the information provided on the app	
	Cost	
	Having problems in using the app	

"Apps may effectively promote healthy aging, very good, I think." (S6).

Category 2: eager to use

One participant said (S5):

"I was affected by stroke for seven years; with the growing availability of a range of health-related apps on the market, I really want to use one of the apps to manage my disease, like stroke."

Another interviewee said (S7):

"The app could be complementary [to traditional nursing], yes. We live in the online world, and although we are old, we still want to come into contact with new things."

Theme 2: desire for an app tailored to the unique

The participants suggested that the app should tailored to the unique. They were classified into three subcategories: particular to older adults, information at fingertips, and reminding.

Category 1: particular to older adult

One participant said (S7):

I find that a lot of…apps are generally limited to the public and not particular to older adults.

Another interviewee said (S11):

"We have poor vision and hearing problems; the app should consider them."

Category 2: information at fingertips

Subcategory 1: educational information Most of the interviewees mentioned they appreciated educational information.

"I hope the app can include educational information about stroke." (S8).

"Sometimes I'll [wonder] want to know more about stroke. The app can make this information accessible to us." (S9).

"Educational information specific to stroke was highly valued." (S10).

Subcategory 2: personal medical data "It's really nice to have an app to keep personal medical data." (S6).

"I want easy access to my medical data, such as current prescriptions, recent lung function values, and hospitalization history." (S7).

"I'm interested in my blood test results, including hemoglobin levels, HDL, HbA1c, etc. Having access to these levels would allow me to take better care of myself at home. It's frustrating that the hospital doesn't share the results unless specifically requested, even after the tests. I wish I could freely access and view my information." (S4).

Category 3: reminding

"I have poor memory, often forget to take medicine. I need reminders." (S2).

"The biggest challenge for me would be taking medicine as doctors suggesting…Sometimes I forgot and do not know when I need to refill their prescription. If the app can remind me about this." (S5).

Theme 3: concern

Category 1: privacy issues

"I am concerned about the privacy issues because I have no control over who will see it." (S11).

"Usually, the app asks us for sensitive information; I wonder if a data breach will happen." (S1).

"It's my data. Does anyone protect my data in the app? If everyone could see my data, I would not use it." (S6).

Category 2: more depersonalized interactions with their doctors

"I am afraid that the app to be used as an excuse to see us less by doctors. I prefer to use it simply as a tool for facilitating the relationships between us and doctors instead of replacing it." (S5).

"I found electronic communication just seems to be replacing talk and conversation; I don't want it to replace human contact with my doctors or nurses." (S10).

"Interactions with doctors are like any other human relationships. I believe talking through a smartphone differs from having a face-to-face conversation. It's not just about exchanging information; the personal connection matters and I think it's best done face to face." (S13).

Category 3: validity of the information provided on the app

"I am sometimes rather skeptical of apps, especially the information they provided without the recommendation of doctors." (S13).

"In all honesty, I am worried about how reliable the information may be in the app because there is no proof that the information provided is evidence-based or obtained from a reliable source." (S7).

"We get access to a lot of information, sometimes we can't tell whether the information is true or not. How to make sure the app provides evidence-based information." (S9).

"I think that stroke can be kind of overwhelming, and we need true information at our fingertips." (S5).

Category 4: cost

"I wouldn't give [the app] a chance if I have to pay for it." (S9).

"I am sure I will feel anxious when the app is not free." (S5).

Category 5: having problems in using the app

"I am not good at using a mobile phone, and I have poor eyesight; I may meet a lot of difficulties (when using the app)." (S4).

"I have a lower level of digital literacy; it is not easy for me to use the app. I need somebody to help me." (S3).

"I think everything will be difficult at first. There are many things to learn to cope with all the problems". (S9).

"Using smartphones and installing apps is quite challenging for me. I find it difficult to navigate without assistance from my grandchildren, and it feels a bit overwhelming for me." (S12).

Discussion

Principal findings

This paper sheds light on the views of older adult stroke survivors regarding their needs and perspectives on the stroke app, giving a voice to the user and informing the development of a stroke app for older adult stroke survivors. We believe this will help to develop tailor-made designs and helpful features of mobile apps for facilitating long-lasting self-care among older adult stroke survivors.

The study results indicate that older adult stroke survivors are optimistic about the app. This result coincides with the findings of Puebla et al. [26], who states that seniors are open to investing time and effort in learning technology, provided it enhances their lives or fulfills specific needs. Individuals grappling with the aftermath of a stroke express a sense of abandonment and marginalization from healthcare services [27]. In fact, close to 40% of individuals affected by stroke are not provided with the necessary services to meet their long-term needs [28]. Nonetheless, a consensus is that addressing the population's needs requires services beyond the current healthcare delivery systems [29]. Given the widespread use and popularity of apps, they hold the potential to provide innovative, scalable solutions, reaching populations with limited access to post-stroke services, regardless of geographical location [30]. Therefore, this finding has important implications for developing more tailored and personalized apps to meet the needs of older adults who are surviving and living with the long-term effects of stroke.

The results of this study show that older adult stroke survivors desire an app tailored specifically to older adults, featuring accessible information and reminder functionalities. Firstly, the older adult stroke survivors clearly expressed their preference for the app special to older adults. A possible explanation for these results may be that many are not designed for older users [14, 31]. With the aging of the population and the increasing reliance on mobile apps for services, it is crucial to develop mobile interfaces that are easily accessible and consider the specific needs of senior citizens. These needs are associated with cognitive, perceptual, and psychomotor changes accompanying aging, influencing how older individuals interact with smartphones [31]. Drawing from our study's findings, we suggest incorporating features such as user-friendly interfaces with larger text and intuitive navigation to make the app fit the needs of older adult stroke survivors. Secondly, as suggested by participants, educational information and personal medical data should be considered in the app. Pindus et al. [27] found there is a deficiency in knowledge and skills to address their enduring needs among stroke survivors. In adapting to the swiftly evolving modern digital landscape, it is imperative to use mobile engagement opportunities to deliver knowledge directly to users, ensuring that information is at their fingertips [32]. Overall, there seems to be some evidence to indicate that when developing stroke apps among this population, some

educational information elements should be considered. We suggest that developers ensure easy access to reliable educational resources within the app. A high data entry burden is a significant factor that stops users from using some health apps [33]. In the context of stroke app development, it is essential to implement features that allow users to access their data quickly and securely. Thirdly, the reminding function of the app is also mentioned among older adult stroke survivors in our study. Managing chronic conditions like stroke necessitates consistent adherence to medication. Secondary prevention medication after stroke reduces the risk of all-cause mortality by 48% [34]. Apps with a reminder function boosted medication adherence and improved the management of complex medication regimens in patients [35]. These studies underscore the importance of incorporating a reminder function in app development among older adult stroke survivors. Incorporating customizable reminders can support medication adherence and the management of complex regimens.

Participants also raised concerns regarding privacy, the potential for depersonalized interactions with healthcare providers, the reliability of information provided by the app, cost, and usability challenges. These concerns are consistent with findings by Vo et al. [36], who asserted that while many patients view mHealth apps as valuable complementary tools, significant issues hinder their optimal use. These issues encompass the requirement for more tailored designs, the cost associated with these apps, the reliability of the delivered information, and concerns about security and privacy. Maseeh et al. [37] highlighted that app users' three primary privacy concerns include credibility issues, unauthorized secondary use, and worries about vulnerability. These results suggest that ensuring that the app furnishes patients with precise, evidence-based information is vital during development. In addition, there is an urgent need to develop and implement standards that address the security and privacy issues many patients are concerned about. Moreover, to assist patients in becoming acquainted with mobile app usage, diverse educational programs on mHealth utilization can be developed and offered to patients upon discharge from the hospital.

Limitations

Although our study provided some interesting insights it was not without limitations. The study was conducted in Chenzhou, Hunan Province, which may introduce geographical limitations. The perspectives of older adult stroke survivors in other regions may differ due to variations in healthcare access, digital literacy, and cultural influences. Additionally, expanding the participant pool across diverse settings in future research could provide a broader understanding of older adult stroke survivors' expectations of a stroke app.

Implications for clinical practice and research

This study underscores the significance of healthcare professionals considering the needs and preferences of older adult stroke survivors to boost the acceptance of mobile health technology within this demographic. The insights gleaned from this study can play a crucial role in shaping the future design and implementation of mobile health interventions dedicated to improving stroke management for older adult stroke survivors.

Conclusions

This study provided a comprehensive and in-depth understanding of the older adult stroke survivors' needs and perspectives of a stroke app through a phenomenological approach. We found that older adult stroke survivors are optimistic about the stroke app; they desire an app tailored to the unique and have concerns about the app. This study provided fundamental data for further app development for older adult stroke survivors. These findings suggest valuable insights into the preferences and needs of older adult stroke survivors regarding stroke apps. They should be regarded as crucial aspects to consider in the development process of stroke apps for this demographic. Future research should also delve into the perspectives of experts with diverse backgrounds during the app development process to guarantee its widespread acceptance and effectiveness.

Supplementary Information

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Supplementary Material 1

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Authors' contributions

All authors had full access to all the data in this study and took responsibility for the integrity of the data and the accuracy of the data analysis. Wenjing Cao conceived of and designed the study. Juan Chen supervised data collection and analysis. Qing Li and Lanying Chen collected the data. Wenjing Cao wrote the original draft of the manuscript. Intan Idiana Hassan and Azidah Abdul Kadir revise the manuscript. All authors contributed to reviewing and editing the manuscript.

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Data availability
The data sets used and analyzed during this study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate
Ethics approval for this research was received from the ethical committees of the Affiliated Hospital of Xiangnan University (Linyan K2022—003—01), Chenzhou No. 1 People's Hospital (Yu2022033) and Third People's Hospital (Lunshen 2022—10). The study adhered to the ethical guidelines, protocol, and regulations outlined in the Declaration of Helsinki. All participants provided informed consent.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Author details
[1]Xiangnan University, Hunan Province, Chenzhou, China. [2]Department of Family Medicine, School of Medical Sciences, Health Campus, Universiti Sains Malaysia, Kubang Kerian, Kelantan 16150, Malaysia. [3]Affiliated Hospital of Xiangnan University, Hunan Province, Chenzhou, China. [4]School of Health Sciences, Health Campus, Universiti Sains Malaysia, Kelantan, Malaysia.

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