

***iHealth Screen:  
Empowering Older Adults and Caregivers Through Mobile Health Screening***

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**Abstract**

With the global population ageing, the health challenges faced by older adults are increasing. Mobile applications provide a cost-effective and accessible solution to help them maintain independence and promote healthy ageing. This study focuses on iHealth Screen, a mobile health app specifically designed to provide older adults with preliminary self-help health screening without limitations of time and location in Hong Kong. It takes a comprehensive approach to healthy ageing, incorporating 11 common geriatric assessments, test results, educational videos, community resources, and a comprehensive health report. The efficacy of the app was evaluated using both quantitative and qualitative methods, gathering feedback from older adults and caregivers. In face-to-face iHealth Screen workshops with 225 participants, 96% expressed their intent to continue using the app, and 95% would recommend it to others. Over 90% reported improved understanding of their health condition through the app. Nine focus groups with 45 participants revealed that iHealth Screen enhanced older adults' health literacy and facilitated healthy ageing through its resources and interactive videos. Caregivers found it helpful in initiating discussions, reducing stress, and increasing confidence in providing care. The reporting feature enabled caregivers to monitor health conditions and seek professional advice. iHealth Screen has served as a cost-effective and empowering tool for older adults and caregivers in healthcare monitoring and enhances health literacy. District-based implementation in elderly centers could further leverage its potential for understanding older adults' conditions and resource allocation.

Keywords: Mobile Health, App, Healthy Ageing, Older Adults, Caregivers, Geriatric Health Screening

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## Introduction

The health of older populations in developed countries has not kept pace with the increase in life expectancy, placing a burden on healthcare systems (Marmot et al., 2022). In Hong Kong, for instance, individuals aged 65 or older accounted for 20.5% of the total population in 2021, and this proportion is projected to nearly double, reaching 36% by 2046 (Hong Kong Census and Statistics Department, 2023b). Research indicates that among older adults aged 60 and above, 75.3% experience geriatric syndromes (such as frailty and sarcopenia), 41.8% have multimorbidity (defined as having two or more chronic medical conditions), and 22.5% live with disability, leading to greater utilization of primary care services and hospital admissions (Cheng et al., 2018).

Addressing the needs of the ageing population requires innovative approaches beyond traditional hospital and institutional care. The World Health Organization (WHO) (2020) advocates for a healthy ageing approach that emphasizes maintaining the independence and well-being of older individuals within their communities. Simultaneously, efforts should focus on preventing functional decline commonly associated with advancing age. While chronological age is a universal factor, the associated decline can be mitigated through targeted health intervention programs that modify unhealthy lifestyle habits such as poor nutrition, lack of regular physical activity, and sedentary behaviour (Feng et al, 2019; Yeung et al., 2021). This requires a shift in focus from treating diseases to preventing age-related diseases, as well as the development of strategies that empower older adults to proactively care for their own health and function (Woo, 2024).

The advent of mobile health (mHealth) technologies has opened up new avenues for supporting ageing populations in maintaining independence and fostering healthier lifestyles (WHO, 2011). Unlike traditional face-to-face public health interventions, mHealth leverages mobile devices to offering cost-effective and accessible solution on public health intervention (Free et al., 2013). These interventions include mHealth apps, which run on platforms like mobile phones and tablets, empowering users to monitor their health and access health education resources (Yerrakalva et al., 2019).

Notably, older adults constitute the fastest-growing demographic embracing technology, making the implementation of mHealth interventions feasible even within this population. In 2022, a total of 82% of older adults use the internet in Hong Kong, and smart phone ownership is rapidly growing in the past decade (6.9% in 2012 and 90.7% in 2022) (Hong Kong Census and Statistics Department, 2023a). Recent research underscores the effectiveness of mHealth app interventions in promoting healthy ageing and driving behaviour change among older adults (Changizi & Kaveh, 2017). These interventions span various domains, including enhancing balance and strength (Boulton et al., 2019), optimizing nutrition (Farsjø et al., 2019), managing obesity (Batsis et al., 2019), and preventing falls (Hsieh et al., 2018).

Despite the successes achieved by mHealth interventions in specific domains, a critical gap persists in their current landscape when it comes to promoting healthy ageing. While many mHealth apps have demonstrated effectiveness in specific areas, they often lack a comprehensive approach that addresses the multifaceted dimensions of the ageing process. Recent reviews conducted by Kankanhalli et al. (2019) and Zheng et al. (2023) highlight this limitation, revealing a disproportionate emphasis on physical exercise and dietary aspects in the design of most mHealth apps, and other crucial geriatric syndromes such as sleep

behaviour and mental health often receive insufficient attention, hampering the overall functionality of these apps and potentially deterring their usage among older adults due to perceived limitations.

In order to explore the full potential of mHealth in promoting healthy ageing, our study seeks to rigorously evaluate the efficacy of an mHealth app that adopts a holistic approach. Specifically, our focus is on the iHealth Screen app, developed by the "Jockey Club CADENZA e-Tools for Elder Care" Programme since August 2021. To our knowledge, this app represents Hong Kong's first publicly available and free resource dedicated to supporting older adults and caregivers in their pursuit of healthy ageing. By incorporating a gerontological perspective, the iHealth Screen app encompasses 11 geriatric health topics, offering preliminary health screenings, relevant health education information, and access to community resources. Through our study, we aim to thoroughly examine the user experience of older adults and caregivers, providing robust evidence to inform the development of mHealth apps tailored for healthy ageing with comprehensive approach.

## **Methodology**

### ***Study Design***

This paper presents a case study to examine the feasibility of a mobile application for older adults and caregivers to achieve healthy ageing. A mixed-method approach, including both quantitative and qualitative methods, is employed to investigate the adoption and efficacy of the iHealth Screen app with holistic approach on healthy ageing by older adults and caregivers. The development of this app was undertaken as a component of the Jockey Club CADENZA e-Tools for elder care project, which received funding from a charitable organization. The primary objectives of the project were to enhance elder care knowledge among older adults and caregivers and to promote public awareness of healthy ageing through online platforms.

### ***iHealth Screen Mobile Application***

The iHealth Screen app is designed and developed to offer convenient and accessible preliminary self-help health screening for older adults and caregivers in the home setting. The app has been launched on both Android and iOS platforms since August 2021. It can be easily accessed through smartphones or tablets and provides versions in both Chinese and English to cater to a diverse range of users.

Compared to most mobile health assessment tools that focus on specific diseases, iHealth Screen takes a holistic approach by addressing common issues encountered during the ageing process. With 11 geriatric health topics (Figure 1), the app allows users to perform free health screening tests and receive instant results using their own mobile devices. To cater to older adults and enhance user engagement, iHealth Screen incorporates a chatbot conversation feature, resembling familiar messaging applications. This feature offers clear options and minimizes the need for text entry, ensuring an interactive and user-friendly interface. Additionally, the app utilizes a combination of text, images, and voice-over instructions (Figure 2) to ensure thorough understanding of the health screening tests.

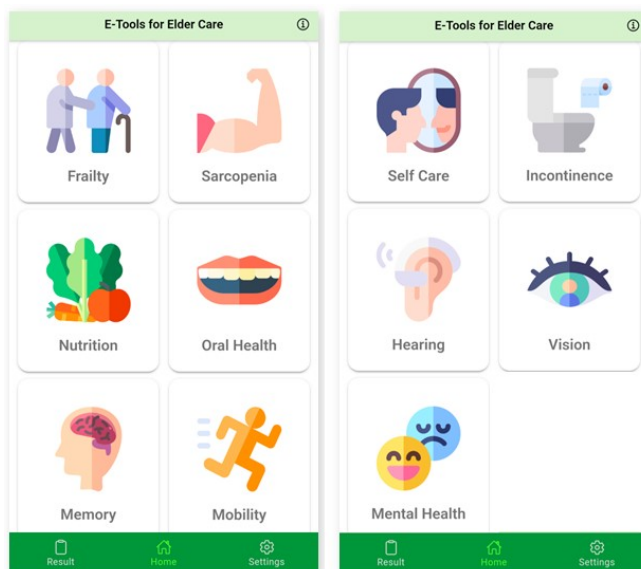


Figure 1: 11 geriatric health topics

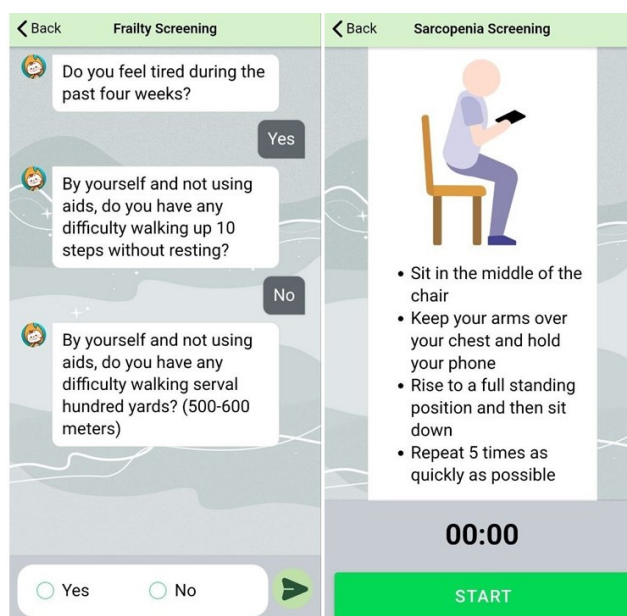


Figure 2: Friendly chatbot feature and voice-over instructions

Following each health test, iHealth Screen provides users with guidance and online educational materials to promote continuous learning about age-related health topics and facilitate self-care (Figure 3). Additionally, community resources are available for users seeking additional professional consultation or social and medical support. The app generates comprehensive health reports that allow users to compare their three most recent results (Figure 4). The reports highlight any items that require follow-up, ensuring users are informed about necessary actions. Retrieving the results and related information for each screening test is effortless, and users can conveniently print or share the report with family members and friends via messaging applications. This feature enables users to bring the report when consulting healthcare professionals, facilitating effective communication.

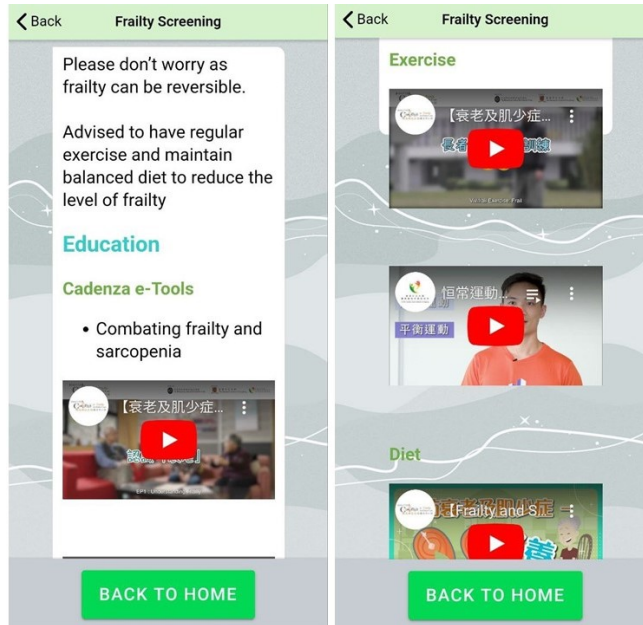


Figure 3: Results, advice & education videos



Figure 4: Retrieve comprehensive health report

### Participants

This study included community-dwelling older adults and caregivers. Participants were recruited from elderly centers and health services units. The eligibility criteria for older adults were as follows: age  $\geq 60$  years, living in the community, ownership of a smartphone or tablet with internet access, ability to read and speak Chinese language.

A caregiver was defined broadly as a family member or nonfamily informal caregiver providing assistance to the older adult. There were no specific inclusion or exclusion criteria for caregivers. They were identified by the collaborative centers and needed to have access to a mobile phone or tablet to use the app.

## ***Data Collection***

To promote the utilization of the iHealth Screen app and familiarize participants with its functionalities, the project team arranged workshops to introduce older adults and caregivers to the app. A total of 36 workshops were held between July 2021 and December 2021, attracting a total of 225 participants. Each workshop had a duration of one hour. At the end of every session, participants were given a questionnaire comprising of eight items to gather their feedback and user experiences. Among these items, five scaling questions were presented to assess the app's ease of use and perceived usefulness. The remaining three questions addressed the participants' future intention to use the app, reasons for discontinuing its usage, and their willingness to recommend it to others.

In addition to collecting quantitative feedback, a qualitative methodology was adopted to gather in-depth opinions regarding the usage of iHealth Screen app. Following the introductory workshops, participants were invited to take part in focus groups one month later. Participants were encouraged to use the app's features at home, including conducting self-help health tests. A total of nine focus groups were conducted, involving 45 participants in total. Each focus group lasted approximately one hour and consisted of four to eight individuals. A moderator facilitated the discussions, while an observer recorded non-verbal expressions. All discussions were recorded and transcribed for further analysis.

## ***Data Analysis***

We employed a triangulation approach, integrating quantitative and qualitative data (Creswell et al., 2004). Quantitative feedback was collected through scaling questions, while qualitative insights were obtained from focus group discussions. Our inductive approach enhances our understanding of how mHealth app could support health management and health behaviour change among older adults and caregivers.

## **Results**

### ***Quantitative Result***

A total of 225 quantitative surveys were recorded from older adults and caregivers. The majority of participants, over 80%, were older adults, while the remaining respondents were caregivers. Figure 5 illustrates the participants' feedback on five scaling questions. For the usefulness of iHealth Screen, more than 90% of the participants agreed that the app was useful to them and enhanced their understanding of health conditions. For the ease of use, over 85% of the participants found the app easy to use. More than 90% of the participants expressed their intention to continue using the app, and they would recommend the app to others.

While the majority of respondents had positive feedback, a small number of participants mentioned that they would not continue using the app. Their reasons varied and included factors such as not perceiving a need for the app, finding the question sets too simple, and facing challenges with navigation and complexity.

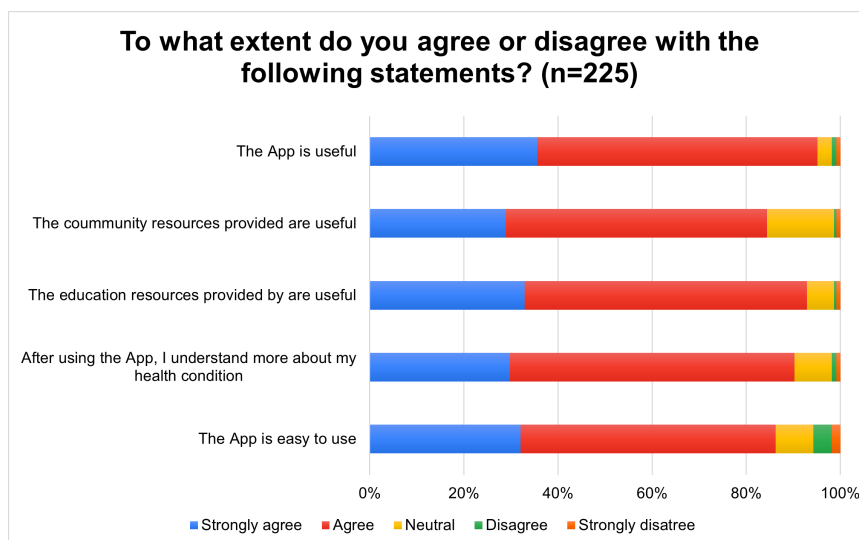


Figure 5: Participant’s satisfaction of iHealth Screen

**Qualitative Result**

The focus group interview involved a total of 45 participants, predominantly older adults, with approximately one-third being caregivers. Among the age group, 64% were aged 70 or over. Regarding educational background, about 65% of the participants had completed secondary education or higher, while one-third had received primary education only. When asked to rate their app literacy on a 5-point scale, 40% of participants considered their ability to use mobile apps as average, 35% rated themselves as below average, and the remaining 25% rated themselves as above average. Additionally, more than half of the participants had prior experience using other health-related apps (see Table 1 for further details).

	n	(%)
Gender		
Female	34	(76)
Male	11	(24)
Age		
< 60	1	(2)
60 – 64	3	(7)
65 – 69	12	(27)
70 +	29	(64)
Identity		
Older adults	30	(67)
Carers	15	(33)
Highest education received		
Primary education or below	16	(35)
Secondary education	26	(58)
Tertiary Education	3	(7)
App literacy (5: highest, 1: lowest)		
1	4	(9)
2	12	(26)
3	18	(40)
4	8	(18)
5	3	(7)
Ever used other health-related mobile applications		
Yes	27	(60)
No	18	(40)

Table 1: Participant's characteristics (n= 45)

The qualitative responses were then analyzed and organized into two main categories: perceived usefulness of the app and concerns and suggestions expressed by the participants. The key themes identified are summarized in Table 2 below and illustrated in the following sections.

Categories	Main themes
Perceived usefulness	<ul style="list-style-type: none"> <li>• Provide accessible and effective tool for health monitoring</li> <li>• Enhance health literacy on age-related health topics</li> <li>• Learn and practice self-care skills and behaviours</li> <li>• Strengthen communication between caregivers and older adults</li> </ul>
Concerns & suggestions	<ul style="list-style-type: none"> <li>• Lack of direct access to educational materials without having to take screening tests</li> <li>• Incorporating push notifications would help remind users to revisit the app regularly</li> <li>• Adding fun and gaming elements to enhance sustained use of the app</li> <li>• Users with lower app literacy would benefit from on-site technology workshops</li> </ul>

Table 2: Main themes of focus group

### ***Perceived Usefulness.***

The iHealth Screen offers 11 screening tests that are adapted from commonly used geriatric assessments. Most participants revealed that the app serves as an accessible tool for monitoring their own health or regularly assisting in the monitoring of care recipients. They highlighted the importance of the app's record features to enable them to manage changes in health conditions associated with age-related decline.

*“Performing the tests regularly, like once a month or every few weeks, is important for managing our health effectively. It's not a one-time thing.” (Older adult, female, aged 65-69)*

*“I find the app quite good, and it's not necessary to perform health tests every day. Doing them once every one or two months is sufficient.” (Caregiver, female, aged 70+)*

Participants also appreciated the app's feature that provides suggestions and self-caring tips based on the results of health tests. They found it valuable in enhancing their health literacy on age-related health topics and gaining a better understanding of their own health conditions. This feature plays a crucial role in promoting healthy ageing by facilitating early identification and prevention of potential health issues.

*“Even if the sarcopenia test shows that I don't have that issue, I appreciate the exercise recommendations for prevention. It's quite helpful.” (Older adult, female, aged 70+)*

*“When I discover a health issue, I can seek medical advice early or take preventive measures. The app's online information helps us learn and practice self-care, slowing down the progression of certain conditions.” (Caregiver, female, aged 65-69)*

Besides the self-health assessment tools, the iHealth Screen app is perceived by most participants as a comprehensive health information hub. It organizes a broad spectrum of information across 11 age-related health topics. Participants find it highly beneficial to have the ability to select specific topics of interest for further learning and exploration. This not only enhances their motivation to use the app on a daily basis but also encourages them to engage beyond performing health tests. The availability of valuable health information contributes to a more holistic user experience and empowers individuals to take proactive steps towards their overall well-being.

*“The app provides targeted advice and information based on specific health issues of older adults. For example, if you want to learn about vision problems in older adults, you can easily find relevant information within that category.” (Caregiver, female, aged 65-69)*

Furthermore, some participants highlighted the educational videos provided by the app as valuable resources for learning new caregiving methods and reinforcing self-care behaviours. They found the interactive demonstrations particularly useful in acquiring and practicing various skills, including physical exercise, maintaining a healthy diet and nutrition, managing emotions, and improving communication with older adults. These videos not only imparted knowledge on healthy lifestyle but also facilitated hands-on learning, enabling participants to apply the acquired skills in their daily lives.

*“The mindfulness video for emotional well-being is appealing and makes it easier for us to absorb the information.” (Caregiver, female, aged 60-64)*

*“The cooking demonstrations in the videos are engaging. I remember a segment that taught how to use oil and calculate portion sizes, along with cooking nutritious meals. These types of videos are very helpful for older adults who may not know how to cook healthy.” (Caregiver, female, aged 60-64)*

*“I watched the section on hearing, which focuses on effective communication with older adults who have hearing difficulties. It emphasized adjusting our attitude and tone rather than speaking loudly.” (Older adult, male, aged 65-69)*

Additionally, some participants recognized the iHealth Screen app as a valuable tool for fostering mutual understanding and communication between caregivers and care recipients. They highlighted that caregivers can utilize the app to engage in interactive health tests with older adults, leading to a deeper comprehension of their functional decline associated with ageing. This enhanced understanding allows caregivers to provide more targeted and personalized support, promoting a better quality of care for the older adults they assist. As one informant said:

*“When caregivers perform health tests with their care recipients using the app, they gain insights into their needs. They may not be aware of certain issues their care recipients are facing, but the interactive tests in the app can help them understand, such as memory problems or issues with incontinence. It serves as a valuable communication channel.” (Caregiver, female, aged 60-64)*

### ***Concerns & Suggestions.***

Most of the participants expressed satisfaction with the video teaching resources provided in the app after completing the health test. However, they frequently encountered difficulties when trying to access health information again. A common issue identified by participants was the absence of a direct link on the iHealth Screen app's main page, which would allow them to access health information without having to go through the screening tests. They suggested the inclusion of an option to directly revisit the educational videos without the need for screening tests. This enhancement would greatly enhance the app's value by giving users the choice between taking tests or watching videos.

*“I find the education video inside the app to be valuable. It should be made easily accessible to everyone. It is not convenient now, as it requires me perform the screening test for accessing that information each time.” (Older adult, female, aged 65-69)*

*“Sometimes, I prefer to read health information without taking the tests, but I can't simply choose specific topics or information to read right from the beginning. I may not have the time to take the tests always but want to revisit those information for learning. It is better if the app can provide an additional pathway for me to directly access the information.” (Caregiver, female, aged 70+)*

Some participants expressed their concerns regarding the sustained use of the iHealth Screen for health monitoring. They emphasized that older adults may lack the motivation to perform the tests on their own or easily forget to do them regularly without reminders or assistance. It would be beneficial to incorporate a push notification feature within the app to remind users to revisit the app and conduct health tests on a monthly basis.

*“Having a reminder function, like an alarm clock, to remind me when to do the tests would be great. As people reach a certain age, memory decline becomes inevitable. And some older adults may engage in various activities and might not remember to use the app also.” (Older adult, female, aged 65-69)*

Some participants suggested that incorporating fun and gaming elements into the iHealth Screen app could increase its usefulness for older adults and caregivers, thereby promoting its continued usage. For instance, one participant highlighted the usefulness of the memory screening test but suggested that incorporating interactive mini-games would be even better. These games could serve as training activities to help delay memory loss.

*“It will be better to add new functions to train the memory of older adults, such as some mini-games of matching pictures and words to enhance the memory.” (Caregiver, female, aged 60-64)*

The perceived usefulness of the iHealth Screen app varied based on the participants' technical proficiency. Participants with lower app literacy reported more usability issues with the iHealth Screen app. For example, they encountered difficulties in returning to the app after visiting external links for additional information or experienced challenges in remembering how to use the app's functions due to declining working memory. These participants suggested that more on-site technology workshops would be beneficial in helping them become more familiar with using the app.

*“I want to use the iHealth app to access health information, such as osteoporosis, but I don't know how to find it to read. Even if someone teaches me, I quickly forget once I get back home.” (Caregiver, female, aged 70+)*

*“We may need to attend a few more classes to learn how to use it (iHealth Screen) properly because last time we only had one hour more at the center, and it felt rushed for us to learn.” (Caregiver, female, aged 65-69)*

## **Discussion**

### ***Principal Findings***

This case study provides evidence regarding the adoption of mHealth app by older adults and caregivers to foster healthy ageing and independent living in the community. Both groups expressed positive views towards the iHealth Screen app, recognizing its potential in health monitoring and education with a comprehensive approach to multidimensional healthy ageing. The app effectively raises awareness about individual health conditions and assists in health management. By offering a wide range of information on age-related health topics, it enhances health literacy and motivates behavioural changes aimed at preventing functional decline.

These findings are consistent with previous research, which emphasizes the empowering potential of mHealth apps for older adults in terms of health monitoring, information access, and self-care enhancement (Changizi & Kaveh, 2017; Matthew-Maich et al., 2016). Helbostad et al. (2017) further highlight the crucial role of mHealth apps in promoting active and healthy ageing. However, prior studies on mHealth intervention (Kankanhalli et al., 2019; Zheng et al., 2023) have often focused on specific facets of healthy ageing, neglecting a comprehensive approach that encompasses early identification of geriatric syndromes and the prevention of functional decline. Addressing this gap, our case study centered around the iHealth Screen app offers accessible health screening tests and educational resources covering 11 common health topics relevant to ageing. Participants in our study found the app valuable for addressing multiple dimensions of health, enhancing their motivation for frequent app usage. By integrating these features, the iHealth Screen app contributes to the expanding body of evidence supporting mHealth interventions for healthy ageing (Marcussen & Marinus, 2021).

Our case study also sheds light on the perspectives of older adults and caregivers regarding the sustained usage of mHealth apps. The perceived usefulness of the app in their daily lives is vital for its continued usage. If the app does not prove helpful, they may not continue using it, even if it is user-friendly. In our study, participants expressed appreciation for the health tests and the provision of health education information, which encouraged them to revisit the app to gain further knowledge about their health conditions and to remember self-care tips. Older adults and caregivers valued multiple app functions, which contributed to sustained usage. Specific features, such as push notifications for timely reminders and gamification elements, were suggested to enhance user engagement with the mobile health app. These insights highlight the importance of incorporating interactive and engaging elements to ensure continued user involvement and maximize the app's impact on promoting healthy behaviours and ageing.

Our findings also offer valuable insights for the design of mHealth apps aimed at the ageing community. Participants in our study strongly expressed a preference for mHealth apps that offer a flexible interface. They desired the ability to customize their experience based on their specific needs, rather than being restricted to rigid and predetermined sequences. For example, older adults wanted direct access to health information without the requirement of performing a health test beforehand. This desire for flexibility aligns with the principles of user empowerment and personalization that are central to the design of mHealth technology (Zhou et al., 2023). The findings highlight the active role of older adults in the development of human-centered design for mobile health apps, moving away from being passive consumers to active participants in shaping their own healthcare journey (Nimmanterdwong et al., 2022).

The iHealth Screen app was specifically designed to cater to the needs of older adults, and the majority of our participants found it to be user-friendly. However, a subset of participants with lower app literacy faced usability challenges when using the app independently. These challenges included concerns about navigation complexity and occasional forgetfulness regarding the app's functions. These findings align with existing literature on the ageing barriers influencing the adoption of mHealth apps among older individuals (Wang et al., 2022; Wildenbos et al., 2018), as well as the anxiety experienced by older adults when facing new technologies (Cheung et al., 2023; Kim et al., 2023). Previous studies (Liu and Joines, 2020) have shown that older adults with less technology experience encounter more barriers when learning new technology, and different training methods can address their diverse needs. In our study, participants with lower app literacy recognized the usefulness of the mHealth app and expressed a desire for more on-site technology workshops, rather than just one introductory session, to improve their familiarity with the app and enhance their ability to use it at home. This underscores the significance of community promotion with appropriate training programs in encouraging the adoption of mHealth apps among older adults and caregivers, while also addressing any potential technological anxiety they may have.

### ***Limitations and Future Research***

The findings from this evaluation pertain specifically to the target study population. Participants who willingly enrolled in the research project and took part in the study were required to possess a mobile phone, tablet, or internet-accessible device. However, it is essential to recognize that this cohort may not fully represent the broader population of older adults who do not utilize digital resources. The recruitment primarily occurred through elderly centers and healthcare units, potentially excluding a diverse range of older adults within the community from the study.

The present study relies solely on self-report measures, employing quantitative surveys and focus groups, to assess the user experience of the iHealth Screen app. However, to establish a comprehensive understanding, it is crucial for future research to concentrate on evaluating the app's long-term effectiveness on well-being and health behaviour change. Randomized controlled trials and longitudinal studies would offer more substantial evidence regarding its impact on health outcomes.

### **Conclusion**

The iHealth Screen app transcends traditional healthcare boundaries, placing health management directly in the hands of older adults and caregivers. Its holistic approach, user-

friendly interface, and educational resources position it as a valuable tool for healthy ageing. Addressing user feedback, enhancing usability, and incorporating more interactive features such as push notification and gamification elements will contribute to its effectiveness and sustained use. The app also holds broader potential for the further application in primary care service for elderly centers and district health units to integrate into health intervention program and help assess older adults' conditions and allocate resources effectively. As older adults increasingly embrace technology, mHealth apps play a vital role in empowering them to actively manage their health and well-being.

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