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Exploring observed and instructed mHealth use in the middle-aged and elderly people (MAEP): A social learning perspective

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Abstract

Objective: Based on social learning theory, this study aimed to explore the intention of middle-aged and elderly people (MAEP) to engage with mobile health (mHealth) and the underlying effects of usability and utility. The goal was to garner insights that could enhance the advancement of mHealth and improve the scope of benefits of mHealth use among MAEP in the future.

Methods: We employed a survey-based approach to delve into the mHealth use intentions among MAEP individuals aged 45 and above. A total of 371 valid survey responses were collected and analyzed using SmartPLS 3.0 for statistical examination and model verification.

Results: Our hypotheses tests revealed that vicarious utility fully mediated the relationship between observed use and direct use intention and both indirect use intentions. Instructed usability and instructed utility were found to fully and partially mediate the relationship between instructed use and indirect use intention, respectively.

Conclusions: This study demonstrates that the observed and instructed use behaviors of MAEP can promote their eventual intention to adopt mHealth through processes of observational and reinforcement learning. These findings underscore the importance of understanding the underlying effects of MAEP's intention to use mHealth is critical to increasing their adoption of mHealth, and thereby potentially improving their health outcomes.

Keywords

mHealth, middle-aged and elderly people, observed use, instructed use, social learning theory

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Introduction

Background

The escalating desire for a healthy lifestyle among the public has significantly increased the demand for healthcare resources, leading to a notable imbalance between the supply and demand for medical services.[1] This trend is particularly pronounced among the middle-aged and elderly people (MAEP), a demographic that is not only growing in number and represents a significant portion of the population but also faces unique challenges in accessing and utilizing healthcare services. The advent of mobile health (mHealth) technologies offers a promising solution to address these challenges.[2–4] Defined as the use of mobile communication and networking technologies for healthcare, mHealth has the potential to revolutionize the traditional healthcare delivery system by improving both the efficiency and quality of medical resources.[5,6] However, the MAEP, those most in need of healthcare services, are currently underrepresented in the utilization of mHealth technologies.[7] This demographic has been identified as facing substantial barriers to adopting mHealth services.[5,8,9]

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This is mainly due to the fact that many MAEP experience gradual cognitive challenges,[10,11] which can sometimes affect their proficiency in embracing and utilizing mHealth. In addition, as digital immigrants, MAEP have many barriers to adapting to mHealth services,[8,9] such as lack of familiarity with digital interfaces and poor design of mHealth applications for MAEP.[12–14]

Addressing the barriers to mHealth adoption among the MAEP is paramount to unlocking the full spectrum of benefits that these technologies can offer.[15] The integration of mHealth has the transformative potential to enhance the longevity and quality of life for the MAEP by digitizing healthcare services and clinical interventions tailored to their needs.[16] Such digitization is not only beneficial in itself but also leads to a cascade of positive outcomes, including reduced healthcare costs, access to personalized health information and services, and an overall more efficient healthcare service delivery process.[17,18] Consequently, mHealth emerges as a pivotal strategy for augmenting traditional (offline) health services and meeting the escalating medical demands of our aging society.[19] The imperative question, therefore, is how to ensure that the MAEP can reap the benefits of improved quality of life through mHealth technologies. Scholars have proposed the Technology Acceptance Model to gain insight into the factors that influence MAEP adoption of mHealth, which underscores the importance of perceived usefulness and ease of use.[1] Furthermore, according to the Unified Theory of Acceptance and Use of Technology (UTAUT),[20] facilitating the adoption of mHealth among the MAEP is not just about increasing their intention to use the technology but it is more important to understand how they are influenced and where they learn to use mHealth services. In fact, the MAEP often learn about mHealth through others, indicating that their learning process is inherently social.[21]

Social learning theory (SLT) offers a framework for understanding this phenomenon. According to SLT, learning can be bifurcated into two primary modes: observational learning and reinforcement learning. Observational learning is a powerful mechanism by which individuals learn new behaviors by observing the actions of others.[22] In the context of MAEP, this process is particularly relevant as they witness the practical applications and benefits of mHealth, which may inspire their own intention to use these services. Reinforcement learning, which stems from the direct and experiential learning of past behaviors, is particularly impactful when MAEP are actively instructed in the use of mHealth.[23] As individuals age, their reliance on family for support increases, with family members often becoming central figures in their lives.[24] This close familial bond makes family members instrumental in introducing and assisting MAEP with mHealth. Given the physical and cognitive challenges that come with aging, MAEP are often dependent on their children,[25] making them more receptive to learning about mHealth through their offspring. We define "observed use" as the MAEP's active observation of their children's use of mHealth, while we define "instructed use" as the children's proactive teaching of mHealth to the MAEP. Moreover, "direct use intention" refers to the MAEP's immediate intention to engage with mHealth, while "indirect use intention" refers to the MAEP's intention to interact with the mHealth system through one or more intermediaries (e.g., their children).[26,27] In light of these insights, it is essential to further explore the factors influencing the intention of MAEP to use mHealth. This exploration should be grounded in the principles of SLT, which highlights the role of observation and reinforcement in shaping the usage of mHealth among MAEP.

Mhealth use

mHealth is broadly defined as the use of mobile computing and communication technologies in healthcare and public health.[15] Several health-related research topics have captured important findings and contributions of mHealth, such as heart disease, elderly care, and chronic diseases.[28] The use of mobile medical devices can provide remote assistance and data collection, reduce work errors associated with written reports, increase system efficiency, and improve the standard of healthcare.[29] In particular, mHealth can provide support to remote communities and MAEP.[30] As mHealth gains widespread acceptance, a wealth of scientific research has been devoted to exploring various aspects of the field.[1] To date, the majority of these studies have focused on the mHealth adoption,[31] mHealth technology anxiety,[32] and professionals' perceptions of mHealth.[33] However, there is a notable absence of research on the intentions behind mHealth usage within the MAEP framework.[34–36] In addition, few studies have used systematic mechanisms to explain the MAEP's use intentions.[34–36] In fact, we have found that individuals' use behavior is influenced by verbal statements and vicarious experiences,[37] and that the feelings they experience during this process directly affect their intention to use.[38,39] This means that MAEP can be influenced by third parties in the midst of their lives to generate different use intentions. Therefore, we believe it is important to describe the systems-based framework in which MAEP generate intention to use mHealth.

Social learning theory

Social learning theory proposes that users' learning behavior is determined by two structurally distinct social learning processes: observational learning and reinforcement learning.[37] Observational learning implies that users can learn how a behavior is performed before the individual engages in that behavior and also relates to the evaluations of others. When users observe the behavior of others, they are provided with a social reference, which allows them to change their own behavior by observing the behavior of others.[23] In addition, users can reinforce learned behaviors through positive and negative reinforcement learnings, where positive reinforcement learning involves rewarding users and negative reinforcement involves the removal of an unpleasant stimulus to increase the likelihood that a behavior will be repeated.[22] After experiencing the provision of rewards or the absence of something unfavorable, users reinforce behaviors over time. In addition, observational learning usually comes from indirect and vicarious learning experiences in which users observe the behavior of others and seek their opinions.[40] In contrast, reinforcement learning often comes from direct and experiential learning experiences of users' past behaviors.[23]

Previous research has shown that individuals' actual use behavior is driven by self-efficacy.[41] Self-efficacy refers to personal judgments of one's capability to organize and implement behaviors in specific situations.[42–44] According to SLT, individuals' self-efficacy can be influenced by verbal persuasion and vicarious experiences.[37] Since the MAEP have a shrinking social circle, and their experiences and social relationships are dependent on family,[24] they are vulnerable to the influence of their children to use mHealth. On this basis, we suggest that both verbal persuasion and vicarious experiences from children affect the MAEP's intentions to use mHealth.[17,45] During observed use, the MAEP observe their children's successful use of mHealth gives them confidence to use mHealth themselves and further generates intentions to use mHealth.[3] During instructed use, the MAEP are verbally encouraged and persuaded by their children,[17,45] and their own sense of efficacy increases, resulting in intentions to use mHealth.[37,39] Therefore, we believe that the SLT can serve as an insightful perspective to understand the underlying mechanisms of MAEP's intentions to use mHealth. In summary, the study model based on SLT is shown in Figure 1.

Hypotheses

According to SLT, observing the successful performance of others can give individuals confidence in their own ability to complete similar tasks.[37] MAEP who observed their children using mHealth developed confidence and perceived that using mHealth was feasible.[39,46] We conceptualize the extent to which MAEP indirectly perceived the ease of mHealth use through observing their children's mHealth use as vicarious usability. Research indicates that the MAEP demands a high degree of system usability, and this usability significantly influences their willingness to engage with mHealth applications.[47] As MAEP observe their children's successful use of mHealth, their perceptions of the difficulty of using healthcare technologies are influenced by the vicarious usability to increase the sense that they can use mHealth easily.[21,37] This vicarious sense of usability increases their self-efficacy in using mHealth, causing them to generate direct intention to use.

> H1: Vicarious usability mediates between observed use and direct use intention.

Although vicarious usability has been shown to correlate with MAEPs' intentions to use mHealth, mHealth is a healthcare product with diverse and complex functional designs, and not all MAEP are comfortable using mHealth. Some MAEP have visual and other limitations that prevent them from successfully using mHealth

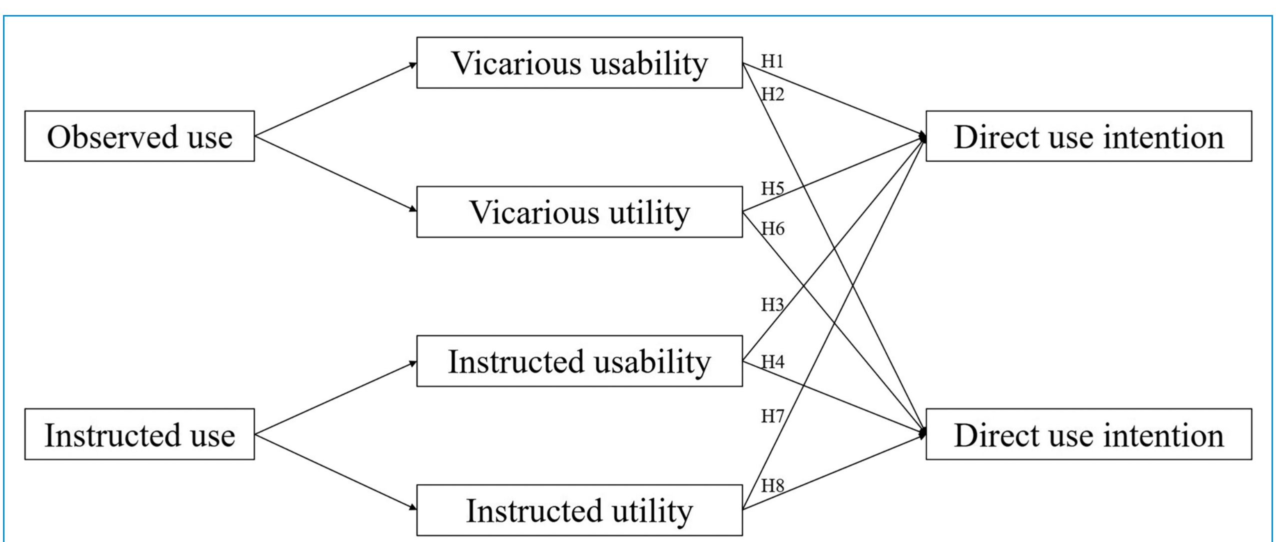

Figure 1. Research model.

software.[48] Moreover, the efficiency of MAEP utilizing mHealth independently is markedly inferior to the efficiency achieved when they enlist the help of their children to navigate the technology.[5] In this context, MAEP who have lower technology adoption than younger people[49] are reluctant to use mHealth directly and tend to use mHealth with the help of their children. Therefore, the MAEP with a high degree of vicarious availability are more likely to have an indirect use intention.[47]

H2: Vicarious usability mediates between observed use and indirect use intention.

The attitude of family members is an important factor influencing the acceptability of mHealth among MAEP.[50] In the process of instructed use, children tell MAEP that mHealth is easy to use. We refer to the extent to which children suggest that mHealth is easy to use during mHealth use among MAEP as instructed usability. Instructed usability is a key component of technology adoption and use behavior, and the higher the level of instructed usability, the easier MAEP find it to use mHealth.[51] Research has shown that the current lack of formal technology training makes it difficult for the MAEP to use and learn how to use the mHealth technology.[16,38,52] If MAEP successfully use mHealth with instructions from their children, their technology frustration will decrease and their intention to use will increase. Therefore, we believe that the instructed usability felt through instructed use will lead to direct intention to use mHealth among MAEP.

H3: Instructed usability mediates between instructed use and direct use intention.

mHealth technology has two basic characteristics: high convenience and low cost,[53] which makes it easier for MAEP to manage their health status online and can replace traditional medicine to some extent.[29] Middle-aged and elderly people are more likely to use mHealth for reasons of convenience, but they face limitations due to their cognitive ability, operational efficiency, and limited understanding of mHealth.[5] As a result, MAEP may experience a certain degree of powerlessness and dependence on others. Children, as the closest family members of the MAEP, will have a greater influence on the MAEP.[3] With the guidance of their children, MAEP perceive that using mHealth through their children is easy to use, and subsequently desire to use mHealth through their children, creating indirect use intention.

H4: Instructed usability mediates between instructed use and indirect use intention.

While mHealth services have reduced time and space constraints, they also pose usage behavior challenges for MAEP. Studies have shown that the intention to use mHealth among MAEP is related to the degree of usefulness of mHealth.[5,6] We refer to the extent to which MAEP indirectly perceive mHealth as useful for health management by observing their children's use of mHealth as vicarious utility. Previous studies have shown that MAEP tend to have a higher level of control to alleviate their own fear of death as well as health problems due to the existential fear of death.[54] That is, the higher the vicarious utility of mHealth use among MAEP, the more they feel in control of their health status through mHealth.[29,55] Knowing their own health condition will allow MAEP to experience a higher level of control, which will substantially increase the use of mHealth among MAEP. Therefore, we believe that when MAEP perceive vicarious utility from observing their children's use of mHealth, their direct use will increase.[56,57]

H5: Vicarious utility mediates between observed use and direct use intention.

As a large group of people with chronic diseases, MAEP lack professional healthcare knowledge and skills and usually rely on traditional medical care such as doctors and nurses for their own health. They learn that they can solve their health problems through mHealth by observing their children's use of mHealth, thus generating vicarious utility. However, MAEP are challenged in learning how to use mHealth.[48] For this reason, they may turn to third parties for help. For MAEP, they mostly rely on their families for physical, social, and financial support, as the family is one of their most important external links.[24] Children, as the closest people to the MAEP, become the MAEP's help seekers. Therefore, we believe that if MAEP perceive vicarious utility from observing their children's use of mHealth, it will increase their indirect use intention.[57]

H6: Vicarious utility mediates between observed use and indirect use intention.

In the use of mHealth among MAEP, the extent to which children suggest that mHealth is beneficial for health management is referred to as instructed utility. Instructed utility is a type of extrinsic motivation and is a strong driver of daily development.[58] The higher the level of instructed utility, the more likely an individual is to be convinced that a technology is useful to the user.[59,60] For MAEP, their social circles are limited, their experiences and social relationships are dependent on the family, and they are vulnerable to the influence of their children. The MAEP use mHealth under the guidance of their children, are influenced by their children's verbal persuasion,[17,45] perceive the instructed utility, and believe that mHealth can meet their needs. Studies have shown that one of the main challenges to mHealth use among MAEP is a lack of e-literacy,[61] and when children supplement their e-literacy, it will increase their intention to use mHealth directly.[45] Therefore, the higher the perceived instructed utility of mHealth, the more likely it is to increase direct use intention.[59,60]

H7: Instructed utility mediates between instructed use and direct use intention.

There are challenges and barriers to the use of mHealth among MAEP.[8,9] Studies have shown that the MAEP fear the negative consequences of misuse and therefore refuse to use new technologies.[5,6,62] Thus, despite the MAEP recognizing the instructed utility of mHealth and developing an intention to use it after being guided through its use,[59,60] they often refrain from engaging with mHealth independently.[26,27] This hesitation stems from a fear of potential misuse and the possibility of operational errors.[62] As a result, they are more inclined to use mHealth through the hands of their children and rely on their children to facilitate their interaction with mHealth. Therefore, we suggest that the concept of instructed utility serves as an underlying mechanism that links the instructed use and the indirect use intention of mHealth among MAEP.

H8: Instructed utility mediates between instructed use and indirect use intention.

Methods

Data collection

To investigate the factors influencing the intention to use mHealth care among MAEP, we used a survey method and the survey was distributed and filled out by the respondents themselves at one time. The survey was designed drawing on established scales from scholars,[5,51,58] and appropriately modified according to the situation of MAEP. Specifically, drawing from Hoque et al.'s research, the use behavior scale was adapted from the observer's perspective to measure observed use and from the instructee's perspective to measure instructed use; the scales of behavioral intention to use mHealth were modified from the perspectives of direct and indirect users to measure direct use intention and indirect use intention, respectively.[5] The scale by Ozturk et al. was modified from the observer's and instructee's perspectives to measure vicarious and instructed usability,[51] and the scale by Liu et al. was modified from the same perspectives to measure vicarious and instructed utility.[58]

The survey was created on a website dedicated to data collection, Questionnaire Star. Since the research context of this study was to investigate the smartphone usage of MAEPs, the survey was randomly distributed to MAEPs over the age of 45 living in China to ensure the appropriateness of the respondents.[63–65] Ultimately, a total of 408 responses were received. After meticulously excluding participants under the age of 45, a robust sample of 371 valid surveys remained. Among the final valid surveys, there were relatively more males ($n = 206$, 55.53%); the age of the respondents was 45 years and older, with the majority of participants aged between 50 and 54 ($n = 146$, 39.35%); and most respondents had been using mobile phones for more than six years ($n = 214$, 56.68%), as shown in Table 1 for the descriptive statistics.

Measures

The study utilized scales that have been rigorously validated by academic research. Recognizing the need for linguistic and cultural adaptation, we employed a forward-backward translation method to ensure the questionnaire's relevance for our MAEP participants in China. This meticulous process began with two native Chinese graduate students translating the original English items into Chinese. Subsequently, two seasoned researchers translated these Chinese items back into English to identify and rectify any discrepancies against the source material. To guarantee comprehensibility, the scale was then piloted with several MAEP, and their feedback was instrumental in making final adjustments to the scale. The resulting survey, consisting of 26 items within eight constructs, was measured using a 5-point Likert scale, ranging from "strongly disagree" (1) to "strongly agree" (5).

Observed use, instructed use, direct use intention, and indirect use intention. Specifically, observed use, instructed use, direct use intention, and indirect use intention were assessed using Hoque et al.'s scale,[5] which contains three items, and the items measuring observed use specifically included "I spend a lot of time observing my children's use of mobile medical software" and "I have recently been observing my children's use of mobile medical software." The questions measuring instructed use included "My children spend a lot of time teaching me how to use mobile medical apps" and "My children have recently been teaching me how to use mobile medical apps." Questions measuring direct use intention included "I plan to switch to mobile health services if needed in the future" and "I think I will use mobile health services if needed in the future." Questions measuring indirect use intention included "I plan to ask my children to help me switch to mobile health services if needed in the future" and "I think I will ask my children to help me use mobile health services if needed in the future."

Vicarious usability and instructed usability. The vicarious usability and instructed usability scales were adapted from Ozturk et al.[51] and both contained three items, with the vicarious usability items specifically including "By observing my children using mobile health software, I feel it is easy to learn to use mobile health software" and

Table 1. Descriptive statistics of respondents' characteristics.

Demographics	Category	N	Percentage (%)
Gender	Male	206	55.53
	Female	165	44.47
Age	45–49	119	32.06
	50–54	146	39.35
	55–59	72	19.41
	60–64	23	6.20
	Over64	11	2.96
Education	Primary school and below	7	1.89
	Middle school	27	7.23
	High school (or junior college, etc.)	85	22.91
	Bachelor's degree (or college, etc.)	239	64.42
	Graduate students	13	3.50
Smartphone use time	Less than 1 year	6	1.62
	1–2 years	25	6.74
	2–4 years	51	13.75
	4–6 years	75	20.22
	More than 6 years	214	57.68

Note. Age, education and smartphone use time are given in years.

"By observing my children using mobile medical apps, I find it easy to become proficient in using mobile medical apps." The instructed usability items included "My children repeatedly tell me that it is easy to learn to use mobile medical software" and "My children repeatedly tell me that it is easy to become proficient in using mobile medical software.

Vicarious utility and instructed utility. The vicarious and instructed utilities scales were adapted from Liu et al.'s scale[58] and both contained four items, with the vicarious utilities items specifically including "By observing my children using mobile health apps, I feel that using mobile health apps will help me manage my health" and "By observing my children's use of mobile medical apps, I feel that using mobile medical apps would make my health management easier." Specific questions for instructed utility included "My children repeatedly tell me that mobile medical apps help me manage my health" and "My children repeatedly tell me that mobile medical apps make it easier to manage my health."

Results

Measurement model

In this study, Harman's single factor method was used to include all the variables in the study model in the factor analysis, and the results showed that the maximum explanation rate of a single factor was 37.65%, which is lower than the 40% criterion,[66] indicating that the issue of common method bias did not significantly affect this study.

Cronbach's alpha (CA) and composite reliability (CR) are commonly used in research to test the consistency and stability of scales. The results of the reliability test for this study were obtained by running a partial least squares (PLS) analysis in SmartPLS 3.0,[67] as shown in Table 2. The values of CA for all variables ranged from 0.77 to 0.87, and the values of CR ranged from 0.85 to 0.92, meeting the criterion of 0.70.[68] Table 2 indicates that this study has good reliability.

Content validity. In the present study, the items for all variables were drawn from previously established scales, and each variable had a minimum of three measurement items, thus providing good content validity.[69]

Convergent validity. In this study, the convergent validity was assessed using indicator loadings and average variance extracted (AVE), as shown in Table 2. Values of AVE for all variables were above 0.50.[68] Therefore, this study has good convergent validity.

Discriminant validity. The Fornell–Larcker criterion was used to measure the discriminant validity in this study. As shown in Table 3, the square root of AVE for all variables was greater than the correlation with other variables, indicating good discriminant validity.[68]

Structural model

The SmartPLS 3.0 software was utilized with a robust Bootstrapping procedure executed 5000 times to ensure a comprehensive assessment of the statistical significance of the identified pathways. As detailed in Table 4, the results demonstrated support for Hypotheses H4, H5, H6, and H8. The support for H4 indicates that instructed usability serves as a mediating role in the relationship between instructed use and indirect use intention, suggesting that instructed use can influence indirect use intention through instructed usability. The support for H5, with variance accounted for (VAF) values exceeding 80%, signifies that vicarious utility acts as a full mediator, and the impact of observed use on direct use intention is predominantly channeled through vicarious utility. Similarly, the support for H6, with VAF values also surpassing 80%, indicates that vicarious utility fully mediates the relationship, with the influence of observed use on indirect use intention being mainly conveyed through vicarious utility. Thus, the results of H5 and H6 tests suggest that vicarious utility plays a significant part in the overall model. The support for H8 implies that instructed utility mediates the relationship between instructed use and indirect use intention, where instructed use can affect indirect use intention via instructed utility. Furthermore, the nonsignificance of H1, H2, H3, and H7 indicates that the corresponding pathways do not exert a notable influence within the model. The results of the hypotheses tests are shown in Figure 2.

Table 2. The CA and CR of the measurement model.

Factor	Item	Loading	Ave	CA	CR
OU	OU1 OU2 OU3	0.88 0.86 0.82	0.73	0.82	0.89
VUA	VUA1 VUA2 VUA3	0.90 0.85 0.87	0.77	0.85	0.91
VUT	VU1 VU2 VU3 VU4	0.78 0.75 0.75 0.80	0.59	0.77	0.85
DUI	DUI1 DUI2 DUI3	0.82 0.85 0.83	0.69	0.78	0.87
IU	IU1 IU2 IU3	0.87 0.88 0.81	0.73	0.82	0.89
IUA	IUA1 IUA2 IUA3	0.89 0.87 0.85	0.75	0.84	0.90
IUT	IU1 IU2 IU3 IU4	0.85 0.85 0.84 0.86	0.75	0.87	0.91
IUI	IUI1 IUI2 IUI3	0.90 0.89 0.89	0.80	0.87	0.92

OU: observed use; VUA: vicarious usability; VUT: vicarious utility; DUI: direct use intention; IU: instructed use; IUA: instructed usability; IUT: instructed utility; IUI: indirect use intention.

Discussion

Discussion of results

Based on the MAEP's own circumstances[70] and the literature on mHealth use,[45,71] this study developed and examined the social learning functions performed by MAEP in the use of mHealth. This study posits that MAEP may view mHealth as feasible and may feel confident in their ability to adeptly utilize it through observing their children's engagement with the technology. However, H1 and H2 indicate that vicarious usability does not serve as a mediator between direct and indirect use intentions. A potential rationale for this finding could be that MAEP's smartphone usage is predominantly functional and utilitarian in nature;[72–74] thus, observing the usability of mHealth applications, although it provides a sense of the technology's ease of use, it lacks utility which does not necessarily

Table 3. Correlations.

	OU	VUA	VUT	DUI	IU	IUA	IUT	IUI
OU	*0.86*							
VUA	0.11	*0.88*						
VUT	0.38	0.37	*0.77*					
DUI	0.30	0.37	0.66	*0.83*				
IU	0.74	0.09	0.39	0.35	*0.85*			
IUA	0.51	0.13	0.42	0.35	0.74	*0.87*		
IUT	0.50	0.14	0.62	0.46	0.56	0.60	*0.86*	
IU	0.45	0.05	0.43	0.48	0.59	0.55	0.60	*0.89*

Note. Italics are the square root of AVE.
OU: observed use; VUA: vicarious usability; VUT: vicarious utility; DUI: direct use intention; IU: instructed use; IUA: instructed usability; IUT: instructed utility; IUI: indirect use intention; AVE: average variance extracted.

compel them to engage with mHealth.[51,75] For instance, witnessing a child at play with a toy may instill a perception of ease in using the toy, yet it does not incite the MAEP to partake in the play themselves.

In addition to observing others' use of mHealth indirectly, the MAEP also engage with mHealth under the guidance of their children. Middle-aged and elderly people perceive the usability imparted by their children's instructions and may come to believe that their use of mHealth is contingent on assistance from others, potentially overlooking their own capacity for independent use. This perception is supported by the outcomes of H3 and H4. When guided by their children, MAEP recognize the ease of using mHealth and form an intention to use it indirectly rather than directly. Despite the possibility of using mHealth with assistance, MAEP may still lack the conviction in their ability to use it independently.[3] This finding slightly deviates from previous research that suggests a sense of power promotes indirect use.[26,27] In our study, the guided MAEP, who may not feel a strong sense of power, are more inclined toward indirect use. The reason behind this could be that in the context of mHealth usage, perceived self-efficacy and confidence play a dominant role.[76–78] The guided MAEP, lacking confidence in their ability to use mHealth independently, opt for indirect use instead.

H5 and H6 illustrate that vicarious utility serves as a mediator between the observed use of mHealth and both direct and indirect use intentions. When MAEP perceive utility in the use of mHealth by observing others, this recognition incites their desire to engage with mHealth, whether through direct interaction or with the aid of others. This finding aligns with the results of our hypotheses tests, indicating that in the context of mHealth use among MAEP, the instrumentality of the technology is a more significant mechanism driving adoption.[76–78] Moreover, these results are congruent with previous research on direct and indirect use, suggesting that both forms of utilization are viable pathways for users to engage with technology.[79,80] These results highlight the importance of understanding the multifaceted

Table 4. Results of mediating effect test.

	Indirect effect (IE)	Total effect (TE)	VAF
H1 OU → UA → DUI	0.02	0.22***	0.34%
H5 OU → VUT → DUI	0.21***		92.34%
H2 OU → VUA → IUI	−0.01	0.05*	−18.87%
H6 OU → VUT → IUI	0.06*		118.87%−
H3 IU → IUA → DUI	0.03	0.07*	50.77%
H7 IU → IUT → DUI	0.03		50.76%
H4 IU → IUA → IUI	0.16**	0.33	47.85%
H8 IU → IUT → IUI	0.17**		52.13%

Note. *, **, *** indicate statistical significance at the levels of $p < 0.05$, $p < 0.01$, and $p < 0.001$, respectively.
OU: observed use; VUA: vicarious usability; DUI: direct use intention; VUT: vicarious utility; IUI: indirect use intention; IU: instructed use; IUA: instructed usability; IUT: instructed utility; VAF: variance accounted for.

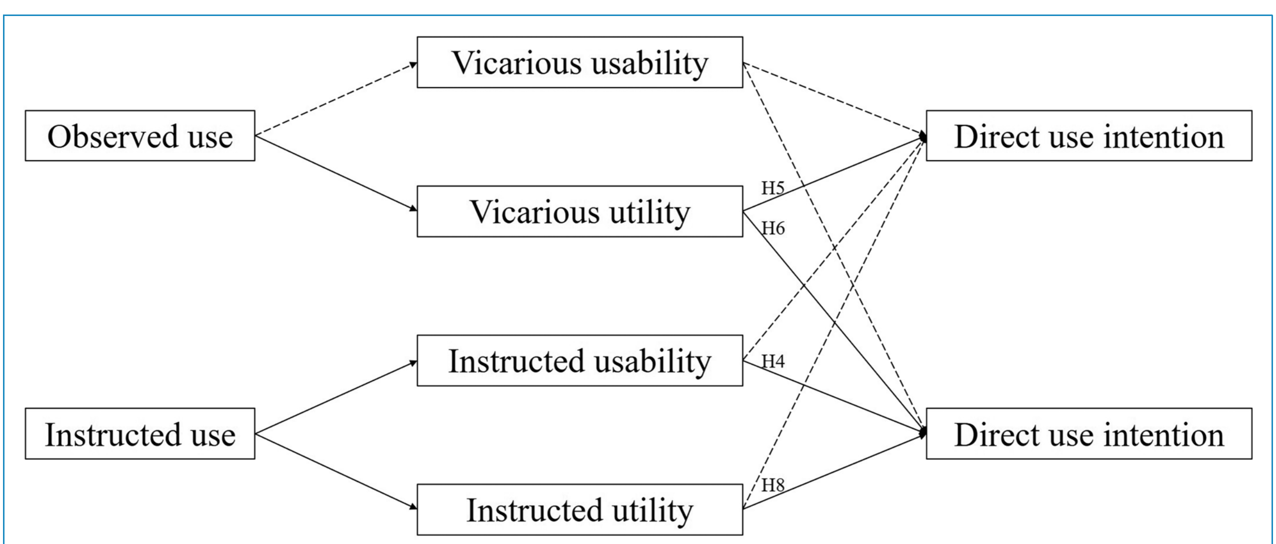

Figure 2. The results of the hypotheses tests.
Note. In the figure, solid lines represent pathways that are supported by the data analysis results, while dashed lines indicate pathways that are not supported.

nature of technology adoption behaviors in this demographic.

Furthermore, instructed utility, as confirmed by H7 and H8, mediates not the direct but the indirect use intention from instructed use. This indicates that when guided by their children, the MAEP form an intention to use mHealth indirectly, not directly. This result indicates that MAEP are more likely to adopt an indirect approach to using mHealth rather than direct use, which is consistent with the aforementioned explanation of their lack of self-efficacy and confidence when guided.[3,78] In summary, compared to direct use, MAEP are more inclined to utilize mHealth in an indirect manner.

Theoretical implications

This study provides several theoretical contributions that enhance our understanding of mHealth use among MAEP. Firstly, by integrating perspectives on both direct and indirect use intentions,[26,27] our research introduces a novel framework for analyzing system use intentions among MAEP. This is particularly important given that MAEP often face cognitive challenges[10,11] and difficulties in using mHealth.[8,9] While previous research has focused on motivating MAEP to directly use mHealth[5,31,45,46,52] or converting their desire to use mHealth through others into indirect use,[26,27] few studies have incorporated both the direct and indirect use intentions of mHealth among MAEP. Our study combines these two kinds of use intention of mHealth, expanding the typology of mHealth use. Furthermore, our work advances the discourse on mHealth use intentions by offering a comprehensive analysis that encompasses both direct and indirect engagements, thereby enhancing the theoretical and practical understanding of technology adoption behaviors within the MAEP population.[26,27,79,80]

Secondly, this study establishes a theoretical foundation for both direct and indirect intentions to use mHealth among MAEP by incorporating SLT. Direct and indirect use intentions align with SLT, which elucidates how individuals learn through direct and vicarious experiences.[43,44] By examining the pathways that influence MAEP's intention to use mHealth from the perspective of SLT, this research explores two learning routes that foster the intention to utilize mHealth. Additionally, it investigates the factors that affect mHealth adoption among MAEP, offering a theoretical explanation for their intention to use mHealth and their subsequent use behavior.[21,38] This not only provides a comprehensive understanding of mHealth adoption but also extends the application of SLT.[39]

Finally, this study extends the UTAUT framework.[20] The UTAUT model emphasizes the impact of performance expectancy, effort expectancy, and social influence on behavioral intention. While numerous studies have expanded upon this model,[81,82] there has been a scarcity of research focusing on the role of social influence, particularly in the context of mHealth usage among MAEP. This research focuses on the key social influencer of MAEP (i.e., children), leveraging SLT to elucidate how social influence can foster the adoption of mHealth by the MAEP.[21] Moreover, and more importantly, this study highlights that social influence is not only present in the form of direct interaction but also through observational learning.[43,44] Consequently, our findings enrich and expand the UTAUT model by incorporating these additional dimensions of social influence.

Practical implications

The results of this study provide valuable practical implications for the development and research of mHealth software. First, this study provides new insights for mHealth developers and hospital operators to tap into the market of MAEP. While technology is penetrating into life, traditional medical care is gradually shifting to mobile medical care, which addresses unmet medical needs.[3,76,77,83] The market for mHealth use among the MAEP is huge, yet most MAEP do not use mHealth.[74] Therefore, it is necessary for mobile medical developers to consider the factors influencing the intention of the MAEP to use mobile medical and set up applicable mobile medical software for MAEP.[1,5,31]

Second, the results of our study show that the utility of the device is greater than the usability of the device during the MAEP's observation of mHealth use and being instructed to use mHealth,[84–87] which provides a reference for the design of the interface of mHealth software.[13] In the interface design of mobile medical software, designers should pay more attention to the utility of the software in order to increase the usage rate of MAEP.[14] In addition, the usability of the device needs to be considered.[12] Therefore, we suggest that marketers and software developers concentrate on both the utility and usability of devices when designing mHealth software for MAEP to increase the intention of the MAEP to use mHealth.[88]

Finally, this study makes recommendations for children to teach MAEP how to use mHealth, which can be instructive in improving the quality of life of the MAEP. The findings suggest that MAEP may be willing to use mHealth directly or indirectly as a result of their children's guidance.[26,27] However, most young people believe that the intention of the MAEP to use mHealth only represents direct use intention, ignoring the fact that MAEP may have indirect use intention to use mHealth through their children.[79]

Limitations and future research

Although this study provides some new insights into the intention of MAEP to use mHealth, there are limitations to our results for several reasons. First, the sample in this study was drawn from within China and represents the experiences of only a limited group of people, and future research could explore the intention of the MAEP to use mHealth in different cultural contexts.[14,89]

Second, this study was conducted based on SLT without considering other influences, and future research directions could focus on the effects of different psychological factors on the intention to use among MAEP.[1,5,31,38] In addition, we focused on the process of generating intention to use among MAEP and did not study the effects of moderating variables. Future research can study the moderating effects of other factors based on the proposed model.[1,14,90]

Third, this study takes into account the traits of MAEP and elaborates on the ways in which MAEP generate intention to use based on SLT, which provides a reference for increasing the use of mHealth among MAEP. However, we did not further analyze how the barriers to use brought about by the traits of the MAEP should be eliminated in the course of the study, and future research could explore how to eliminate the barriers caused by the propensity factors of the MAEP.[3,5,7,91]

Conclusions

Drawing on SLT, this study found that MAEP's observed and instructed use of mHealth is instrumental in shaping their intentions to directly and indirectly use such technologies. This is achieved through the mechanisms of observational learning and reinforcement learning. Specifically, vicarious utility mediates the relationship between observed use and direct use, but vicarious usability does not; instructed usability and utility mediate the relationship between instructed use and indirect use, but not direct use. The results underscore the preference for utility and indirect use of mHealth among MAEP, highlighting that such approaches may foster greater acceptance of mHealth practices within this demographic, ultimately leading to improved health outcomes for them.

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