

# An Evaluation on Five Dimensions of a Mobile Health Application for Patient Counseling in Ambulatory Care Pharmacy: A Single-center Cross-sectional Survey Based on Pediatric Caregiver's Opinion

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ABSTRACT

**Objective:** Due to high workloads and insufficient counseling time in ambulatory care pharmacy, outpatient pharmacists for pediatric patients in China proposed a mobile health application (mHealth app) that they considered could provide patient counseling more efficiently. To improve it accordingly, we need to design a more specific and multi-dimensional evaluation method to obtain pediatric caregivers' evaluations of a mHealth app. **Methods:** A cross-sectional survey on five dimensions (transmission, accuracy, accessibility, completeness, and experience) of the mHealth app was conducted using a random questionnaire among outpatient caregivers at a children's hospital. **Findings:** We received 478 valid questionnaires from 500 caregivers. The Item-Level Content Validity Index (I-CVI) indicated the content validity of the questions (I-CVI =1.000). The Content Validity Index for Scales (S-CVI) confirmed their content validity (S-CVI =1.000). The intraclass correlation coefficients (ICCs) of test-retest reliability were acceptable ( $0.806 \leq ICC \leq 0.869$ ). The mean scores for transmission, accuracy, accessibility, and completeness were more than 3.5 when the experience was 2.1. Caregivers of different ages agreed that their accuracy was satisfactory; however, their experience was not. Caregivers aged over 50 years did not recognize its transmission and accessibility, whereas caregivers aged under 29 years and over 50 years were not satisfied with its completeness. **Conclusion:** The accuracy of the mHealth app is excellent; the transmission and accessibility need to give the silver generation time to accept and adapt, and experience and completeness should be improved. The five-dimensional assessment model can also be used to evaluate other mHealth apps for patient counseling.

**KEYWORDS:** Ambulatory care, caregiver, mobile health application, patient counseling, pediatric, questionnaire

Received: 26-01-2024.  
Revised: 08-03-2024.  
Accepted: 02-05-2024.  
Published: 23-12-2024.

## INTRODUCTION

The time that the dispenser spends with patients during the drug use process is referred to as dispensing or counseling time, which is an important indicator of the quality of service delivery.<sup>[1]</sup> Studies have shown that a higher workload of dispensers, defined as the number of prescriptions dispensed per dispenser working hour, which means less dispensing or counseling time to provide patient counseling, has been identified as an important barrier to patient counseling.<sup>[2-4]</sup>

The density of pharmacists in China is much lower than in developed countries,<sup>[5]</sup> and a shortage of pharmacy staff has led to increased workloads and time constraints. Five outpatient pharmacists have to deal with at least

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**How to cite this article:** Liu QQ, Wang M, Chen F, Ji X, Xu J, Wang ZY. An evaluation on five dimensions of a mobile health application for patient counseling in ambulatory care pharmacy: a single-center cross-sectional survey based on pediatric caregiver's opinion. J Res Pharm Pract 2024;13:41-6.

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3000 prescriptions in 8 h and every day at a children's hospital. Each prescription is allocated <1 min to perform dispensing and patient counseling, which has a big gap with the minimum time (3 min) that the WHO recommends.<sup>[6]</sup> Other studies conducted in Saudi Arabia,<sup>[7,8]</sup> Nigeria,<sup>[9,10]</sup> South Korea,<sup>[11]</sup> and Ethiopia<sup>[12,13]</sup> also reported a problem similar to that of China.

To enhance the efficiency of patient counseling, we offer a hospital-developed mobile health application (mHealth app) [Figure 1], which can access basic medical information from the hospital's information system and be utilized by patients free of charge. This type of app has been employed to complement various self-management practices in medicine.<sup>[14-18]</sup> Traditional patient counseling would prioritize other aspects related to drug therapy.

Patient perspective is linked to the optimal use of medication because patients are more likely to adhere to and use their medications correctly when they are satisfied with the medication counseling.<sup>[19,20]</sup> It is a vital source of information for establishing effective pharmaceutical care to improve the quality of health-care services.<sup>[21]</sup> The assessment of patients for pharmaceutical services is a complex concept with multiple factors that is very difficult to measure,<sup>[19]</sup> we set the following dimensions for the mHealth app to make the evaluation more concrete: (1) transmission, transmit between different caregivers (82.1% of families have more than one caregiver involved in parenting in China,<sup>[22]</sup> which makes it necessary to transfer medication information between different caregivers); (2) accuracy, the quality of being true or correct; (3) accessibility, easy to use; (4) completeness, include all the needed relevant information; (5) experience, comprehensive interaction between patients and medication counseling mode.

处方记录详情		Details of prescription records	
[处方]维生素D滴剂 (胶囊型) [400iu*30粒/盒]		[Prescription] Vitamin D Drops (Soft Capsules) [400IU*30 pills/box]	
处方编码:		Prescription NO.:	
处方发生时间:		Prescription time:	
就诊人		Patient	
医生姓名		Physician	
科室名称	内科门诊(河西)	Speciality	Internal-medicine
处方类型	临时处方	Prescription type	Temporary
处方列表	处方录入时间:	Prescription details	Prescription entry time
● 维生素D滴剂 (胶囊型)	1盒	Vitamin D Drops (Soft Capsules)	1box
用药方式: 口服		Administration route: oral	
一次剂量: 400IU		Single dosage: 400IU	
频 度: 每天1次		Frequency: once every day	

**Figure 1:** The mobile health application and the translation of the app interface

Because assessing medication counseling is an important step in evaluating the quality of pharmaceutical care and identifying areas needing improvement, the aim of this study was to analyze caregivers' assessment of the mHealth app provided at the ambulatory care pharmacy of the children's hospital, from the above five dimensions, and improve it to make the mHealth app more responsive to caregivers' needs.

## METHODS

We conducted a 2-month cross-sectional randomized survey using questionnaires among outpatient caregivers at the Children's Hospital of Nanjing Medical University, a tertiary pediatric hospital, and the Jiangsu Provincial Children's Medical Center. The inclusion criteria required that pharmacotherapy be accompanied by a willingness to cooperate in completing the questionnaire. The method of selection of participants was simple random sampling. When the caregivers waited for their drug to be prepared in the ambulatory care pharmacy, a trained researcher chose participants randomly among them. The caregivers who were pleasant to complete the questionnaire would be chosen as participants. Participants returned completed questionnaires on the spot after using the mHealth app on the test mobile phone to obtain medical information from a test prescription; the trained researcher explained unfamiliar concepts, told correct medical information to help the participants confirm its accuracy, and made a quick check of the questionnaires to ensure that the survey was complete. We hope to address potential sources of bias through the above two efforts.

An anonymous questionnaire was designed consisting of 11 questions with multiple-choice or scoring questions. Questions 1–4 were the basic information of patients and caregivers. Questions 5–9 were the caregiver's appraisal on five dimensions. Questions 10–11 were the willingness of the caregiver to be a return visit.

The sample size was determined based on the formula for calculating sample size in a normal distribution ( $n = Z^2\sigma^2/d^2$ ) with a 95% confidence interval (CI) ( $Z = 1.96$ ), a population standard deviation of 0.5 ( $\sigma$ ), and an error range of 5% (E). Therefore, it was necessary to obtain 384 valid questionnaires. Considering the invalid sample, we expanded the aimed sample capacity to 500.

Since the outcome was evaluated based on five dimensions, the predictors included the relationship between the patient and caregiver, the patient's age, and the caregiver's age range. Additionally, the caregiver's parenting experience was considered a potential confounder, while the caregiver's skill in using the mobile internet was identified as an effect modifier.

The panel of experts invited to assess the content validity of the questionnaire consisted of five experts in the field of pharmacy who had been engaged in work related to outpatient pharmacies in pediatric hospitals for more than 10 years. Each expert evaluated the clarity and representativeness of the questionnaire content on a 4-point Likert scale, with 1 and 4 indicating the lowest and highest levels of clarity and representativeness, respectively.

To confirm the reliability of the survey over time through a test–retest procedure, we enquired about the willingness of the participants to complete the questionnaires. Those who were willing to return were asked to answer the questionnaire again by telephone 7 days later.

Questionnaires with identical or regularly repeated answers to all the questions were excluded. The corresponding questions were all invalidated if the answer was irrelevant to the question or if the answers to different questions had logical errors in between.

The data used for questionnaire quality evaluation and descriptive statistical analysis were entered into Microsoft Excel version 16.01 and SPSS Statistics version 24, IBM Corp., Chicago, IL, USA.

The clarity and representativeness of each item were evaluated through the Item-Level content validity index, (I-CVI),<sup>[23]</sup> which is calculated by the number of experts who rated either “3” or “4” in each item divided by the total number of experts. The Content Validity Index for Scales (S-CVI),<sup>[14]</sup> which is the arithmetic mean of the I-CVIs, was used to evaluate the clarity and representativeness of the entire questionnaire.

Participants who responded to the same questionnaire within a 7-day interval were included in the study. Test–retest reliability was assessed using intraclass correlation coefficients (ICCs) with 95% CI.

## RESULTS

In total, we received 500 completed questionnaires from 500 caregivers, of which 478 (95.6%) were deemed valid.

Five invited experts (one pharmacy department director who was in charge of pediatric ambulatory care pharmacy for 18 years, one pharmacy supervisor who worked in pediatric outpatient pharmacies for 20 years, and three senior pharmacists who worked in patient counseling rooms for 22, 11, and 10 years, respectively) evaluated the content validity of the questionnaire. The I-CVI value for all questions was 1.000, which is consistent with the I-CVI criteria given by previous

research,<sup>[24]</sup> as the number of experts was five, indicating that the questions were all clear and representative. The S-CVI value of 1.000 was within the acceptable range,<sup>[25]</sup> confirming the content validity of the questionnaire [Table 1].

Of the 147 caregivers willing to return, 138 participated in the test–retest reliability assessment, excluding 2 participants with incorrect phone numbers, 3 caregivers contacted by phone who were not the same caregivers who participated in the previous questionnaire, and 4 caregivers who changed their willingness. The ICC ranged from 0.806 to 0.869, indicating excellent reliability for all items [Table 1].

Transmission, accuracy, accessibility, and completeness were all accepted by the caregivers as the mean scores were more than 3.5 (out of 5.0), with the exception of experience (2.1) [Figure 2].

Combined with the age of the children, the caregivers were divided into different age groups according to their relationship with the children: 18–29 years (most parents of children below 3 years), 30–39 years (most parents of children from 3 to 12 years), 40–49 years (most parents of children over 12 years and babysitters), and over 50 years (most grandparents and babysitters) [Figures 3 and 4].

In terms of transmission and accessibility, as caregivers’ age increased, the scores decreased significantly. In terms of accuracy and experience, caregivers’ ratings were in agreement regardless of age; the former characteristic was at the top, whereas the latter was at the bottom. For completeness, the mean score was intermediate as the 30–49 age groups had slightly higher scores than the other age groups [Figure 5].

## DISCUSSION

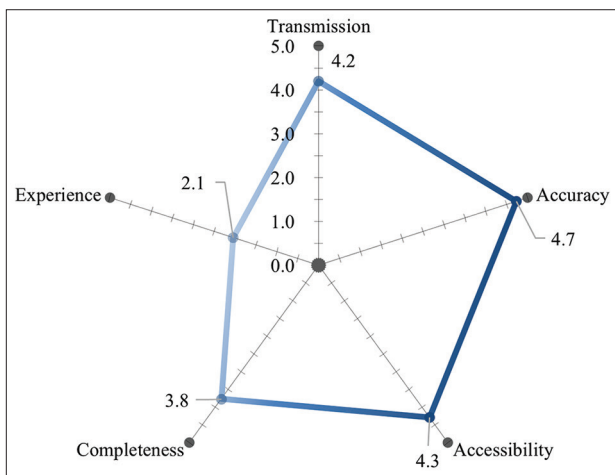
When the accuracy of the mHealth app was endorsed by caregivers of different ages as all the information was printed, the experience gained the opposite, as it could not provide more communication about medication with pharmacists. The results suggest that although patient counseling is the transmission of medication information, it is also the transmission of humanistic care, which can be embodied by communication. Humanistic care should not be omitted when focusing on the efficiency of patient counseling because of the particularities of the receiver and the content of the information.

The results indicated that the mean scores for transmission and accessibility plummeted among caregivers over 50 years, probably because they could not use the mobile Internet proficiently. Although this age group accounts for more than one-third of

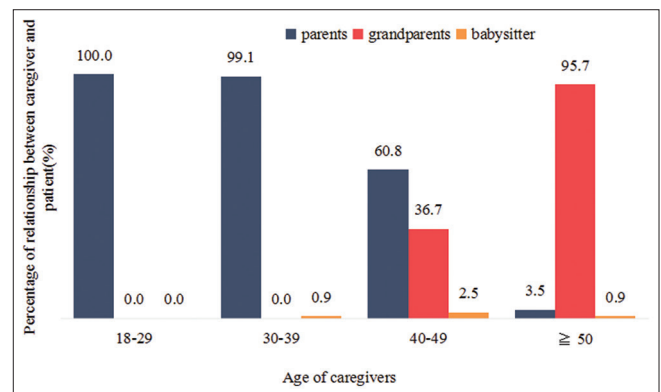
**Table 1: Content validity and test-retest reliability of the questionnaire**

Item	I-CVI <sup>a</sup>		ICC <sup>c</sup>
	Clarity	Representativeness	
Relationship with the patient	1.000	1.000	-
Age of the patient	1.000	1.000	-
Age range of the caregiver	1.000	1.000	-
Education level of the caregiver	1.000	1.000	-
Score on the transmission	1.000	1.000	0.855
Score on the accuracy	1.000	1.000	0.833
Score on the accessibility	1.000	1.000	0.869
Score on the completeness	1.000	1.000	0.806
Score on the experience	1.000	1.000	0.827
Telephone return willingness	1.000	1.000	-
Contact number for return visit	1.000	1.000	-
S-CVI <sup>b</sup>	1.000	1.000	-

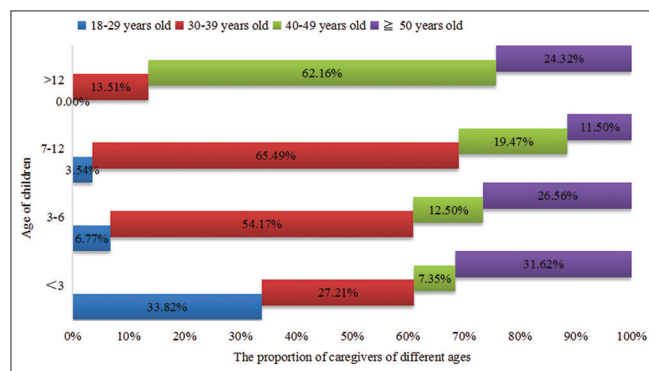
<sup>a</sup>Evaluated the clarity and representativeness of each item, the number of experts who rated either “3” or “4” in each item divided by the total number of experts, <sup>b</sup>Evaluated the clarity and representativeness of the entire questionnaire, the arithmetic mean of the I-CVIs, <sup>c</sup>Evaluated test-retest reliability with 95% CI. S-CVI=Content Validity Index for Scales, I-CVI= Item-Level Content Validity Index, ICC=Intraclass correlation coefficient, CI=Confidence interval



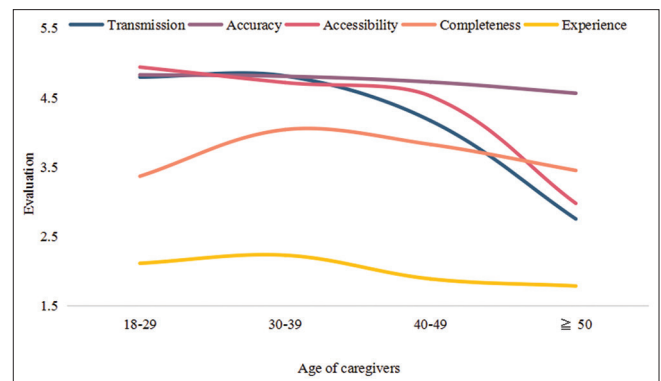
**Figure 2: The mean score of five dimensions**



**Figure 3: Relationship between children and caregivers of different ages**



**Figure 4: Age of caregivers for children of different ages**



**Figure 5: Evaluation of five dimensions of the mobile health application by caregivers of different ages**

the population,<sup>[26]</sup> it makes up only about a quarter of China’s mobile Internet users.<sup>[27]</sup> However, according to another research on the silver generation in China, the number of mobile Internet users over the age of 50 years, the main contributor to the growth of the

number of Internet users, is close to 300 million.<sup>[28]</sup> When they become more and more proficient in using the mobile Internet, the transmission and accessibility of the mHealth app will be increasingly recognized by them and in line with their needs. However, before that, we should maintain the traditional medication



counseling model they are familiar with as they were the main caregivers of children in more than 50.0% of Chinese households.<sup>[22]</sup>

In contrast, because the mHealth app only provided information about usage and dosage, the mean score of its completeness was not as good as the accuracy and was particularly lower among caregivers under 29 years and over 50 years, who focused more on completeness and needed more medication information, as they made up 65.4% of the caregivers with children under 3 years. This result should be considered when considering ways to improve mHealth apps.

According to the characteristics of caregivers of pediatric patients in China, further research will focus on gathering commonly needed medication information for caregivers through patient counseling rooms to supplement the content of the mHealth app, which will be developed and upgraded to a version that could provide more medication information and communication with pharmacists to improve its completeness and experience.

Few studies have assessed the five dimensions of an mHealth app for patient counseling in outpatient pharmacies from a pediatric caregiver's perspective. Different cultures and types of patients may cause different evaluations of this type of mHealth app. Therefore, the five-dimensional assessment model of this study could be used to evaluate other mHealth apps for patient counseling to make them more in line with the needs of users of different cultures or types.

Although the survey sample was from a single center, which is the major limitation of this study, the sample sources were diverse and representative, as the patients of this regional hospital were not only from Jiangsu Province but also from its adjacent areas.

According to the opinions of caregivers of pediatric patients in outpatient pharmacies in this study, the accuracy of the mHealth app is excellent, the transmission and accessibility need to give the silver generation some time to accept and adapt, and the experience and completeness should be improved. Other mHealth apps for patient counseling should evaluate the corresponding users using this five-dimensional assessment model to improve themselves.

## AUTHORS' CONTRIBUTION

All authors contributed significantly to the planning, conduction and the execution of the this study including data collection and analyses, and the paper writing and approval.

## Acknowledgments

We would like to thank all the caregivers for participating in the survey, the staff of the Outpatient Pharmacy for supporting the research, and the experts from the Department of Pharmacy for providing professional advice on the questionnaire.

## Financial support and sponsorship

This study was financially supported by the Jiangsu Pharmaceutical Association – Hengrui Hospital.

## Conflicts of interest

There are no conflicts of interest.

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