RESEARCH ON THE INTERFACE USABILITY OF HOSPITAL WECHAT PUBLIC PLATFORM IN THE FORM OF INTERNET

Chen-Rao Zhong¹, Chien-Hsiung Chen² and Jin-Long Lin³
¹Master’s student / Department of Design, National Taiwan University of Science and Technology
²Professor / Department of Design, National Taiwan University of Science and Technology
No.43, Keelung Rd., Sec.4, Da’an Dist., Taipei City, Taiwan
³Master’s student / Department of Industrial Design, National Cheng Kung University
No.1, Daxue Rd., East Dist., Tainan City 701, Taiwan

ABSTRACT
This study explores whether the Chinese Hospital WeChat Public Platform interface conforms to the user's operating habits and behavioral needs at the present stage by investigating the interface usability of Hospital WeChat Public Platform. Firstly, in the literature review, this study refers to the four usability principles of ISO 9241-11 (1998) and Nielsen (1994) summarized by Young et al. (2006) and regards these principles as the criteria for the WeChat Public Platform evaluation in hospital samples. Secondly, using the performance measurement method to conduct a quantitative analysis of the data, it is concluded that there are significant differences among the three hospital samples of the three task interfaces. Then, the design suggestions are obtained through four usability principles: (1) The interface's presentation should have primary and secondary levels and be arranged orderly to enable users to operate effectively and quickly. (2) Besides providing an excellent operation system, simplifying interface levels and steps is also one way to improve efficiency. (3) The interface is the most intuitive presentation of information, so its interface presentation should be concise and consistent, and the function level distribution should be reasonable to improve user's degree of satisfaction. (4) On the design of Hospital WeChat Public Platform interface, designers should pay more attention to the users who haven’t used WeChat applications and design a standard interface to meet the need of user's learnability. Thus, the interface design should conform to the four principles of usability, and the user's demand is the key to the design.

KEYWORDS
Hospital Registration System, WeChat Public Platform, Interface Design, Usability Principle, Performance Measures, One-way ANOVA Between Groups

1. INTRODUCTION
With the advent of the age of big data and popularity of social software, China has derived a new registration method that you can register immediately if you follow the WeChat Public Platform. Major hospitals keep pace with the times and use the WeChat Public Platform to create new model of mobile Internet registration, and promote new forms of Internet development. In the era of "Internet+," various industries actively optimize and upgrade themselves by utilizing the Internet platform, and the medical industry is no exception. Based on the Internet, the "Internet+ medical treatment" is deeply integrated with the traditional medical and health services to form a new type of medical through the mobile Internet, Internet of Things, cloud computing, big data and other information technologies, and thus to promotes mobile information services and intelligent medical services that benefit all people (Meng et al., 2016). According to Tencent's official data, in China, WeChat is currently the communication and social platform with the largest user base. By 2020, the number of monthly active accounts of WeChat is up to 1.2025 billion, and the number of accounts of WeChat Public Platform has exceeded 20 million. WeChat Public Platform has become the preferred channel for hospitals to develop information construction and optimize the medical treatment process due to its richness of contents, the accuracy of message transmission, and the mobility of functional operation. Therefore, with the alternation of the Internet era and the promotion of WeChat Public Platforms, the medical industry actively builds a Hospital
WeChat Public Platform in the context of the needs of patients and hospital reforms. This will help improve hospital service quality, promote the hospital information construction, optimize the medical treatment process, and improve patients' medical treatment efficiency.

To sum up, making the Hospital WeChat Public Platform's interface easier to understand and operate has become an important topic. This study explores whether the Hospital WeChat Public Platform interface presentation conforms to users' cognition and behavior. The research objectives are summarized as follows:

1. Assess the Hospital WeChat Public Platform interface design and understand users' interaction requirements when they operate the interface.
2. Investigate the relationship between the user's operation experience of registration and the Hospital WeChat Public Platform interface to explore the usability factors that affect the user's operation.
3. Explore the usability principles and put forward suggestions on the Hospital WeChat Public Platform interface design elements.

2. BRIEF LITERATURE REVIEW

Based on the function of WeChat application, WeChat Public Platform is one of the most important instant communication platforms in mobile Internet era, which has wide range of communication methods, strong user stickiness, high acceptance and accessibility. It implements a new model of online and offline access and establishes relations with users mainly through the interactive forms (Deng, 2020). To this end, mobile medical will become a new way to seek medical treatment in the future, which can alleviate the contradiction between doctors and patients and promote medical service quality. So, the WeChat Public Platform is the best medium (Huang et al., 2017). With the help of the medium WeChat Public Platform, hospital mobile medical service system can not only improve the stability of medical treatment and improve the patient's convenience and satisfaction, but also reduce hospital development costs (Xiong, 2020). Then, WeChat Public Platform is the most direct way for users to contact. Its interface design will directly affect the user's appreciation, browsing, and adhesiveness. The design elements such as text, graphics, color, navigation, and other information are combined to present to the users (Shen, 2016).

For this reason, many Chinese scholars have put forward relevant researches on the design of the hospital system interface of the WeChat Public Platform. He et al. (2020) used the UTAUT model to study patient satisfaction. They analyzed that effort expectation, performance expectations, facilitating factors, service pricing and individual innovation positively affect patients' satisfaction and these factors are used as the basis for the design of mini-program prototype. Sun (2018) used the five elements of user experience as the standard of hospital system's interface design and tested the system’s function and its usability. Combined with the characteristics of young and middle-aged users using medical applications, Liu (2018) considered that a minimalist interface should include the recognizability of graphics, the order of structure, and the interaction of animations to improve the user's adhesiveness, which coincides with this article's viewpoint.

In terms of usability, ISO 9241-11 (1998) defines usability as: Effectiveness, Efficiency, and Satisfaction of a system for specific users and specific uses in a specific operational environment. Nielsen's (1994) five usability principles are often cited by scholars, including Learnability, Efficiency, Memorability, Errors, and Satisfaction. To this end, Young et al. (2006) summarized the three attributes defined by ISO 9241-11 (1998) and the usability attributes proposed by Nielsen (1994). They listed four usability principles as well as their measurement methods. Referring to the four usability principles summarized by Young et al., this study will discuss the usability of the Hospital WeChat Public Platform interface design elements. In summary, the following is a list of four usability principle definitions and measurement methods:

1. Effectiveness: It refers to the user's accuracy and completion rate when completing specific operational tasks and objectives. The evaluation method is the task completion rate.
2. Efficiency: It refers to the ratio of the user's task completion rate to time, which is evaluated by the time spent on task performance.
3. Satisfaction: It refers to the participant’s feeling and acceptance degree of users when operating the interface. The evaluation method is the score obtained by users' rating the scale.
4. Learnability: It refers to whether users can effectively and quickly learn the interface's operation. The evaluation method is to find out whether the operation behavior is easy to learn through non-participatory observation.
3. RESEARCH METHOD

3.1 Methods and Architecture

This study aims to explore the comprehensive influencing factors when users operates the Hospital WeChat Public Platform. Therefore, the experiment will focus on the hospital registration system's different functional interfaces on the WeChat Public Platform. Through online research, the hospital registration systems of the WeChat Public Platform of three first-class hospitals in Shenzhen, Guangdong Province are selected as the experimental samples to explore the differences, advantages, and disadvantages of different interface designs bringing for users. Using SPSS statistical software to analyze the experiment's significance and supplemented by non-participatory observation, the experiment mainly adopts One-way ANOVA and focuses on the quantitative study of task performance and System Usability Scale (Starting now referred to as SUS) to explore users' operation experience and usage needs for the Hospital WeChat Public Platform interface. The specific experimental process is as follows:

   Experiment A: Questionnaire survey and task design
   (1) First, the participant is asked to fill out an online questionnaire, including name, gender, age, education level, past registration methods, and functional preferences.
   (2) Summarize and sort out the questionnaire; select functions considered important by the participants in the questionnaire; use these functions selected and the main functions explored in the literature as the experimental operation task's functional items.

   Experiment B: Task operation and SUS measurement
   (1) Invite the participants to operate the experiment task, and explain the experiment content and process briefly to them, including the introduction of the participant, the introduction of the experiment sample, and the introduction of the task content.
   (2) Ask the participants whether they know the task or not, and start the task operation after getting the oral response. Observe the problems occurred during their operation on the interface without disturbing them and record the time of each task's operation with a timer while the participants operate the tasks.
   (3) After the task, introduce the scale's content to the participants before guiding them to fill in the SUS, and then explore the participants' scoring criteria and reasons.
   (4) After completing the operation task and SUS, learn about the participants' operation feelings and feedback.

3.2 Participants

After screening the questionnaire survey of Experiment A, 30 participants who have never used the three experimental samples are invited to participate Experiment B. Among them, there are 11 males and 19 females, and their ages range from 18 to 31. Each Participant participates in one Hospital WeChat Public Platform operation and carried out five tasks aiming at the interface design's usability. All participants use the same experimental equipment, and the network environment connected in the same field. In addition, the operation information and content received are the same to ensure the comparability of experiments.

3.3 Equipment and Samples

The device used in the experiment is a smartphone made by an Apple company. The model is an iPhone XR, with a 6.1-inch touch screen and 1792 x 828 pixels, and an LCD screen is used. The dimension is 150.9mm × 75.7mm × 8.3mm (length × width × thickness), and the system is IOS operating system. The performance timer uses the stopwatch function of the smartphone.

The experiment selects Shenzhen, China, which has the development needs for medical information construction and digitalization, as the city of tested sample hospitals. Taking the authority and representativeness of the sample comparison into account, this experiment selects the top six tertiary general public hospitals in 2018 (Shen Chuang Zong He, 2019). Then, from the perspectives of satisfaction, public welfare, competitiveness, and design style, we choose three WeChat Public Platforms as experimental samples tested, and finally select "Hospital sample 1", "Hospital sample 2", "Hospital sample 3". The design style and functional level layout of these three Hospital WeChat Public Platforms are different. The following figure shows the first page of the operation interface of the three Hospital WeChat Public Platforms:
3.4 Task Design

Because the experimental operation cannot disrupt the hospital's regular registration order, there is no actual registration in this experiment, so individual functions cannot be explored. Deng (2020) and Xiong (2020) classified "Intelligent diagnosis guidance" and "Appointment registration" as the main functions of the Hospital WeChat Public Platform. While Zhou and Shao (2020) divided "Appointment registration" into "Patient management," "Appointment registration," and "Appointment record." Li (2015) tested the main functions of the hospital registration system, including "Interactive guidance," "Medical card management," "Doctor management," and "Inquiry appointment registration." Through the questionnaire survey, users consider that the four functions of "Appointment registration," "Appointment inquiry," "Order inquiry and payment," and "Doctor list" are essential. Through literature and questionnaire, the functions of "Intelligent diagnosis guidance," "Appointment registration," "Medical card management," and "Doctor list" are selected as the functional items of experimental operational tasks.

To sum up, this experiment will focus on the four functions including "Intelligent diagnosis guidance", "Appointment registration", "Medical card management" and "Doctor list", and according to the medical treatment and registration process, the task themes will be designed as follows: Intelligent diagnosis guidance - Medical card management - Appointment registration - Setting attention - Viewing the doctors' list. The specific task content and purpose are shown in Table 1.

![Figure 1. Interface home pages of three hospital samples](image1)
(Hospital sample 1 on the left, Hospital sample 2 in the middle, Hospital sample 3 on the right)

![Figure 2. Questionnaire survey on functional preferences of Hospital WeChat Public Platform](image2)
Table 1. Task content and purpose description

<table>
<thead>
<tr>
<th>Task</th>
<th>Task theme</th>
<th>Task content</th>
<th>Task purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Intelligent diagnosis guidance</td>
<td>Enter the medical guidance AI system to fill in the date of birth and gender information, enter the disease's condition, check the recommended department, and return to the home page.</td>
<td>Understand whether it is easy for user to operate the AI diagnosis system</td>
</tr>
<tr>
<td>2</td>
<td>Medical card management</td>
<td>Find the medical card management page, add name/ID/mobile phone number to bind the medical card, then delete it and return to the home page.</td>
<td>Explore whether the function of the management account conforms to the user's operational awareness and behavioral cognition</td>
</tr>
<tr>
<td>3</td>
<td>Appointment registration</td>
<td>Enter the appointment registration area, select the department/physician/date, and select the time available for the appointment to view the registration information. Return to the home page without clicking the registration.</td>
<td>To explore the differences of registration levels and interface presentation of different public platforms</td>
</tr>
<tr>
<td>4</td>
<td>Setting attention</td>
<td>Follow three doctors with five stars in the clinic, and finally return to the home page.</td>
<td>investigate whether the function fits the user's needs by the behavior of following the physicians</td>
</tr>
<tr>
<td>5</td>
<td>Viewing the list of doctors</td>
<td>Please unfollow the three physicians just followed from the physician list and return to the homepage.</td>
<td>To explore the user's intuition and learnability of information transmission in personal accounts</td>
</tr>
</tbody>
</table>

4. RESEARCH RESULTS

4.1 Task Performance Results

One-way ANOVA analysis is conducted by SPSS statistical software. The shorter the time it takes, the better the performance. The significant standard α value is set as 0.05, and P <0.05 indicates a significant difference. As shown in Table 2, there are significant differences in Task 1 (F=3.681, P=0.039<0.05), Task 4 (F=8.800, P=0.001<0.05) and Task 5 (F=3.682, P=0.039<0.05), while there are no significant differences in Task 2 (F=0.679, P=0.516>0.05) and Task 3 (F=2.046, P=0.149>0.05). The detailed results are as follows:

Table 2. ANOVA test results of five task performance

<table>
<thead>
<tr>
<th>Task theme</th>
<th>Hospital sample 1 M(SD)</th>
<th>Hospital sample 2 M(SD)</th>
<th>Hospital sample 3 M(SD)</th>
<th>F value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Intelligently diagnosis</td>
<td>141.71 (22.67)</td>
<td>164.73 (68.73)</td>
<td>109.72 (31.35)</td>
<td>3.681</td>
<td>0.039*</td>
</tr>
<tr>
<td>guidance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Medical card management</td>
<td>136.70 (43.60)</td>
<td>160.00 (77.36)</td>
<td>133.90 (34.42)</td>
<td>0.679</td>
<td>0.516</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Appointment registration</td>
<td>80.64 (31.73)</td>
<td>118.70 (86.92)</td>
<td>71.82 (23.20)</td>
<td>2.046</td>
<td>0.149</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Setting attention</td>
<td>63.86 (26.13)</td>
<td>142.89 (71.13)</td>
<td>74.72 (22.64)</td>
<td>8.800</td>
<td>0.001*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Viewing the list of doctors</td>
<td>29.68 (12.13)</td>
<td>34.75 (11.22)</td>
<td>65.87 (53.44)</td>
<td>3.682</td>
<td>0.039*</td>
</tr>
</tbody>
</table>

* Table P<0.05, there is a significant difference between the three samples (unit: second)
4.1.1 Task 1: Intelligent Diagnosis Guidance

Task 1 (F=3.681, P=0.039<0.05) has a significant difference in task performance. As shown in Table 3, there is a significant difference between Hospital sample 3 (M=109.72, SD=31.35) and Hospital sample 2 (M=164.73, SD=68.73), but there is no significant difference between Hospital sample 1 (M=141.71, SD=22.67) and Hospital sample 2 (M=164.73, SD=68.73) as well as Hospital sample 3 (M=109.72, SD=31.35). The task performance of Hospital sample 3 (M = 109.72, SD = 31.35) is better than that of the other two hospitals samples. The AI system's response speed and guidance are the factors that affect the performance of this task. Intelligent diagnosis guidance is a new function developed. The system completion degrees of the three samples are not high, and their reaction speeds are slow. However, the guidance mode of Hospital sample 3 is optional, and its guidance is better. In the other two samples, it needs to input disease keywords manually to identify, so the participants spend more time inputting disease keywords. Therefore, the guidance of the system is the key to the performance of this task.

Table 3. The LSD post hoc results of Task 1

<table>
<thead>
<tr>
<th>Experimental sample</th>
<th>Hospital sample 1</th>
<th>Hospital sample 2</th>
<th>Hospital sample 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital sample 1</td>
<td>—</td>
<td>0.268</td>
<td>0.128</td>
</tr>
<tr>
<td>Hospital sample 2</td>
<td>—</td>
<td>—</td>
<td>0.012*</td>
</tr>
<tr>
<td>Hospital sample 3</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

4.1.2 Task 4: Setting Attention

Task 4 (F=8.800, P=0.001<0.05) has a significant difference in task performance. As shown in Table 4, there are significant differences between Hospital sample 2 (M=142.89, SD=71.13) and Hospital sample 1 (M=63.86, SD=26.13) as well as Hospital sample 3 (M=74.72, SD=22.64), while there are no significant differences between Hospital sample 1 (M=63.86, SD=26.13) and Hospital sample 3 (M=74.72, SD=22.64). Hospital sample 2 (M=142.89, SD=71.13) costs the longest time, so its task performance is the worst. This function makes it convenient for patients to find their favorite doctor for a consultation quickly. The main reason affecting task performance is the recognition degree of text and icons. The degree of recognition is mainly related to the position, the expression of the text and the design of the icons. In Hospital sample 2, the icon is too complex and is situated at the bottom, what’s more, the meaning conveyed by words is not clear, so the participants cannot quickly understand the icon's intention and spend more time looking for the icon.

Table 4. The LSD post hoc results of Task 4

<table>
<thead>
<tr>
<th>Experimental sample</th>
<th>Hospital sample 1</th>
<th>Hospital sample 2</th>
<th>Hospital sample 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital sample 1</td>
<td>—</td>
<td>0.001*</td>
<td>0.599</td>
</tr>
<tr>
<td>Hospital sample 2</td>
<td>—</td>
<td>—</td>
<td>0.002*</td>
</tr>
<tr>
<td>Hospital sample 3</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

4.1.3 Task 5: Viewing the List of Doctors

Task 5 (F=3.682, P=0.039<0.05) has a significant difference in task performance. It can be seen from Table 5 that there are significant differences between Hospital sample 3 (M=65.87, SD=53.44) and Hospital sample 1 (M=29.68, SD=12.13) as well as Hospital sample 2 (M=34.75, SD=11.22). Simultaneously, there are no significant differences between Hospital sample 1 (M=29.68, SD=12.13) and Hospital sample 2 (M=34.75, SD=11.22). Hospital sample 3 (M=65.87, SD=53.44) takes the longest time, so its task performance is the worst. The number of functional operation levels is the main reason that affects this task: the fewer operation levels, the simpler the using process. Hospital sample 1 only has three levels to view the doctors' list, while Hospital sample 3 has five levels, making the operation more complicated.
Table 5. The LSD post hoc results of Task 5

<table>
<thead>
<tr>
<th>Experimental sample</th>
<th>Hospital sample 1</th>
<th>Hospital sample 2</th>
<th>Hospital sample 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital sample 1</td>
<td>—</td>
<td>0.728</td>
<td>0.019*</td>
</tr>
<tr>
<td>Hospital sample 2</td>
<td>—</td>
<td>—</td>
<td>0.040*</td>
</tr>
<tr>
<td>Hospital sample 3</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

4.2 System Usability Scale Results

SUS was proposed by John Brooke (1996) to test the usability of the interface. Since its establishment, it has been widely used in rapid scoring and testing the usability. The three hospital samples' scores are analyzed by One way ANOVA, and the following results are obtained (see Table 6). There is no significant difference in SUS evaluation among the three hospital samples (F=2.180, P=0.133>0.05). The participants said that the usage experience and the aesthetics of the interface were their criteria. The interface design of Hospital sample 3 is relatively consistent, and the white background with black text makes them feel simple and legible, which is consistent with Padda's (2003) view of interface readability. However, there are still some aspects to be adjusted in the use of functions.

Table 6. ANOVA Test Results of SUS

<table>
<thead>
<tr>
<th>Task theme</th>
<th>Hospital sample 1 M(SD)</th>
<th>Hospital sample 2 M(SD)</th>
<th>Hospital sample 3 M(SD)</th>
<th>F value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUS</td>
<td>56.75 (19.04)</td>
<td>52.00 (18.55)</td>
<td>70.50 (23.74)</td>
<td>2.180</td>
<td>0.133</td>
</tr>
</tbody>
</table>

Using the SUS score scale proposed by Bangor and Kortum (2009), the usability of three Hospitals' WeChat Public Platforms are explored. As shown in Figure 3, Hospital sample 3 (M=70.50, SD=23.74) has passed the qualifying standard of usability (that is, the mean score reaches 68 or more); and hospital sample 2 (M=52.00, SD=18.55), hospital sample 1 (M=56.75, SD=19.04) have not reached the qualifying standard of usability. It can be concluded that there is no significant difference among the WeChat Public Platforms of these three Hospitals. All of them belong to the qualified range according to the SUS score scale. They cannot meet users' needs, and there is still room for improvement.

Figure 3. Comparison of SUS scores of three Hospital WeChat Public Platform
5. DISCUSSION

Combined with literature review and research results, the four usability principles, respectively Effectiveness, Efficiency, Satisfaction, and Learnability, will be taken as the directions of discussion:

(1) Effectiveness: In this experiment, all of the 30 participants complete the five specific tasks and goals. Therefore, the interface design of the three Hospital WeChat Public Platforms meets the basic functional requirements of users. However, there are significant differences in three tasks’ performance, which is worthy of further exploration.

(2) Efficiency: Through the ANOVA analysis, there are significant differences in task 1, task 4, and task 5. Hospital sample 3 has the highest efficiency in Task 1, while Hospital sample 1 has the highest efficiency in task 4 and task 5. Comparing the three operational tasks, it can be found that in task 1, "Intelligent diagnosis guidance" is the least efficient. The experiment shows that the reason is that the AI system in task 1 “intelligent diagnosis guidance” is slow in response and low in guidance, which significantly affects the operation on the interface. Therefore, in the interface design, the speed of system operation and the guiding intention will significantly affect the interface's ease of use.

(3) Satisfaction: After operating the interface, the user's feeling and experience on the interface can be quantified through the scale. In the SUS analysis, Hospital sample 3 is more in line with the users’ satisfaction standard than the other two hospital samples. After the experiment, through the participants' feedback, most of them think that the interface of Hospital sample 3 is more concise and consistent than other samples. However, Hospital sample 3 is not the best in task performance. Therefore, it can be inferred that the influencing factor of the satisfaction of Hospital WeChat Public Platform is interface presentation rather than task performance.

(4) Learnability: In this experiment, all the participants have not used these three hospital samples before, but the participants who have used the WeChat application operate more smoothly and find the task target more quickly than those who have not used the WeChat application. Therefore, the learnability of Hospital WeChat Public Platform is related to the fact that whether the participants have used the WeChat application before. This is consistent with Wang and Huang’s (2015) point of view that “ease of use depends on the user's previous experience in interactive functions” in their study on mobile e-books’ ease of use.

6. CONCLUSION

This study aims to explore the comprehensive influencing factors when users operates the Hospital WeChat Public Platform. The literature and experimental results provide a more specific design basis for the Hospital WeChat Public Platform interface. According to the discussion on four principles of ease of use, this study puts forward some design suggestions of usability on the interface of the Hospital WeChat Public Platform: (1) The interface's presentation should have primary and secondary levels and be arranged orderly to enable users to operate effectively and quickly. (2) Besides providing an excellent operation system, simplifying interface levels and steps is also one way to improve efficiency. (3) The interface is the most intuitive presentation of information, so its interface presentation should be concise and consistent, and the function level distribution should be reasonable to improve user's degree of satisfaction. (4) On the design of Hospital WeChat Public Platform interface, designers should pay more attention to the users who haven’t used WeChat applications and design a standard interface to meet the need of user's learnability. The findings of this study contribute to the research on the interface usability of the Hospital WeChat Public Platform and are expected to give relevant designers more consideration. To meet the needs of the age of aging in China, we will conduct more experiments on the middle-aged and elderly groups in the subsequent studies.

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