

HOSTED BY



Contents lists available at ScienceDirect

## International Journal of Nursing Sciences

journal homepage: <http://www.elsevier.com/journals/international-journal-of-nursing-sciences/2352-0132>

## Research Paper

## User experience of a self-management WeChat applet for patients with neurogenic bladder: A qualitative approach



Chun Zhao <sup>a,b</sup>, Surui Liang <sup>a</sup>, Xiaojiao Wang <sup>a,b</sup>, Linghong Gao <sup>c</sup>, Yuhong Lai <sup>a,b</sup>, Ying Huang <sup>a,b</sup>, Jue Li <sup>a,b</sup>, Ling Chen <sup>a</sup>, Wenzhi Cai <sup>a,b,\*</sup>

<sup>a</sup> Department of Nursing, Shenzhen Hospital, Southern Medical University, Shenzhen, Guangdong, China

<sup>b</sup> School of Nursing, Southern Medical University, Guangzhou, Guangdong, China

<sup>c</sup> Department of Spinal Cord Injury Rehabilitation, Shenzhen Longcheng Hospital, Shenzhen, Guangdong, China

## ARTICLE INFO

## Article history:

Received 28 August 2022

Received in revised form

3 November 2022

Accepted 19 December 2022

Available online 28 December 2022

## Keywords:

mHealth

Neurogenic bladder

Qualitative research

Self-management

WeChat applet

## ABSTRACT

**Objectives:** This study aimed to determine patients' perceived benefits of a WeChat applet for self-management of patients with neurogenic bladder (NGB) and identify the key factors hindering their adoption.

**Methods:** In the qualitative study, 19 NGB patients were invited for semi-structured interviews. They were hospitalized in the rehabilitation departments of two tertiary hospitals in Shenzhen and tried out the self-management applet for two weeks. Data were analyzed using the content analysis method.

**Results:** The results indicated that the WeChat applet of self-management was helpful and embraced by the NGB patients. Three perceived benefits were identified 1) being accessible, flexible, and intuitive to users, 2) driving bladder self-management, and 3) directing the way for care partners and family members. Challenges hindering the adoption of the applet included 1) negative attitudes of patients towards bladder self-management and patient characteristics, 2) concerns about the risks of mHealth, and 3) the necessity of applet upgrading.

**Conclusion:** This study showed feasibility of the WeChat applet for self-management among NGB patients to meet their needs for access to information during hospitalization and after discharge. The study also identified facilitators and barriers to patient use, providing valuable information for healthcare providers to implement mHealth interventions to promote self-management among NGB patients.

© 2023 The authors. Published by Elsevier B.V. on behalf of the Chinese Nursing Association. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## What is known?

- Mobile health (mHealth) has aided self-management of neurogenic bladder (NGB) adults in the United States and NGB children in the England.

## What is new?

- This study showed that the WeChat applet for self-management of NGB patients demonstrated feasible to meet patients' needs for access to information during hospitalization and after discharge.

- The study identified facilitators and barriers to patient use, providing valuable information for healthcare providers to implement mHealth interventions to promote self-management among NGB patients.
- Caregivers are potential users of assistant applet for NGB patient's self-management.

\* Corresponding author. Department of Nursing, Shenzhen Hospital, Southern Medical University, Shenzhen, Guangdong, China.

E-mail address: [caiwzh@smu.edu.cn](mailto:caiwzh@smu.edu.cn) (W. Cai).

Peer review under responsibility of Chinese Nursing Association.

## 1. Introduction

Neurogenic bladder (NGB) is a general term for diseases causing bladder and (or) urethral dysfunction due to neurological disorders and leads to a series of lower urinary tract symptoms and complications [1]. NGB is a complex and incurable chronic disease that has a serious impact on patients' physical and mental health and quality of life [2]. It has been reported that NGB patients have an average of up to 2.5 urinary tract infections per person per year [3], and 20%–80% of patients also develop upper urinary tract damage

such as ureteral dilatation, pyelonephritis, hydronephrosis, renal failure [4], and even death in severe cases [5].

Effective bladder self-management is a key measure to reduce the incidence of secondary complications, extend the life cycle, and improve the quality of life of NGB patients [6–9]. However, the current status of self-management of NGB patients after discharge from the hospital is not optimistic, with problems such as a lack of self-management knowledge, low self-management ability and poor adherence [10]. Evidently, there is an urgent need for more attention and intervention for effective self-management of NGB patients.

The introduction of smart technology has promoted self-management in different diseases, such as hypertension [11], spinal cord injury [12], and chronic obstructive pulmonary disease (COPD) [13]. In particular, mHealth has contributed to the self-management of NGB adults in the United States and NGB children in England [14,15]. Supporting for self-management of NGB patients in China after discharge from the hospital includes verbal health education, distribution of manuals, communication in Wechat groups, and telephone follow-ups [10,16]. Mobile Health (mHealth), e.g., the WeChat applet, provides a new approach to health information service delivery in China and has been found effective in improving patient self-management and self-management adherence [17,18].

The present research was part of a large co-design research project in China that aimed to develop an evidence-based WeChat applet (a self-management eHealth tool) to support the self-management of NGB patients in the community or after discharge from the hospital. This research was designed to determine the perceived benefits of the self-management tool and explore the barriers to users.

## 2. Materials and methods

### 2.1. Study design

A qualitative descriptive approach, a research method based on the philosophical foundation of naturalistic inquiry [19], was adopted to feature reality explanation and understanding phenomena and views of participants; on this basis, the survey results enriched with participant comments are formed [20,21]. Semi-structured face-to-face interviews were conducted to find the perceived benefits and factors impeding the practical adoption of the tool from the patients' perspective.

### 2.2. Description of the self-management WeChat applet

The research team developed the self-management WeChat applet for NGB patients based on evidence and the user's demand for bladder management. It was a free applet, and users could access it from WeChat by searching for the applet's name. It incorporated eight main modules. 1) Assessment of complication risks: this module allowed users to self-assess the risk of urinary tract infections, view risk assessment reports, and get further management recommendations. 2) Disease-related knowledge base: users could learn about NGB self-management knowledge on their own through this module. 3) Daily check-in area of bladder management: this module included three sub-modules for urinary incontinence, urinary retention, mixed retention and incontinence, allowing users to select different modules for daily clocking of bladder management according to their symptoms. 4) Self-report assessment: users could evaluate NGB symptoms and their self-management skills, and obtain scores and feedback through this module. 5) An online voiding diary: users could keep a urination diary in this module. 6) An online consultation with medical staff:

users could consult medical professionals in this module. 7) Educational videos: this module allowed users to view bladder self-management videos. 8) Personal Centre: users could modify and improve information in this module, receive message notifications, view privacy policy and user service agreement, log out, etc. See [Appendix A](#) for screenshots of the interface of the self-management WeChat applet.

### 2.3. Participants

Purposive sampling was employed to invite NGB patients from the rehabilitation department of two tertiary hospitals in Shenzhen, Guangdong, China. The inclusion criteria were as follows: 1) with an established diagnosis of NGB; the disease diagnosis code: N31.901 [1]; 2) 18–65 years old; 3) with the ability to use the smartphone; 4) with clear consciousness, good understanding and presentation; 5) volunteering to participate in research and sign informed consent. Participants were excluded if they 1) were hospitalized for the first time due to the primary disease of NGB or were in the acute stage of the disease; 2) had other functional impairment of severe organs (such as heart, brain, and kidney). The sample size was determined by theme saturation.

### 2.4. Study process

The researcher fully introduced the purpose of the study and implementation process to the participants, and informed consent was signed after they ensured having understood and were willing to participate. The participants were then introduced in detail about how to use the WeChat applet, assisted in logging in, and tried out for two weeks. During the trial period, the participants were free to use the applet without any intervention from the researcher. If they had any questions, they could contact the researcher at any time to get timely answers and guidance.

### 2.5. Data collection

After the 2-week trial, researchers conducted a one-on-one, face-to-face interview at an agreed time with the participants. The study team designed an initial semi-structured interview guide based on a systematic review of the evaluation of usability and acceptability in mobile medical self-management apps [22–27]. Then it was carefully reviewed and revised by a doctor with extensive experience in qualitative research and two nurse specialists. The principal interviewer (ZC) is a female postgraduate nursing student majoring in rehabilitation nursing of NGB patients and has gathered some descriptive qualitative research experience by reading literature and taking relative courses of practice and theory. Two pilot interviews were conducted beforehand to check the readability and appropriateness of the interview guide. The final interview guide is shown in [Table 1](#). On the premise of ensuring a quiet and comfortable interview environment, the time and places of interviews were set based on the participants' wishes. During the interviews, the investigator listened carefully, observed, and recorded the interviewee's facial expressions, movements, and other non-verbal behaviors. The investigator remained neutral and avoided making any judgment on the interview contents. All interviews were recorded with an electronic sound card.

### 2.6. Data analysis

The audio recording was transcribed verbatim within 24 h of the end of the interview. The accuracy was verified by two investigators' concurrent reading and listening of the tape-recorded interviews. The data collection was carried out simultaneously

**Table 1**  
Interview guide.

Questions
Could you talk about your general feeling about using this WeChat applet for self-management?
What do you think were the main advantages or benefits of using this WeChat applet?
What did you think were the main deficiencies or barriers of using this WeChat applet?
What are your suggestions for improving this WeChat applet (such as content, function, or interface)?

with data analysis using the content analysis [28,29].

The data were analyzed by the principal interviewer (ZC) and another investigator with rich experience in descriptive qualitative research at each time point. First, the two investigators read the transcripts several times to get an overall sense of the participant's interviews and experiences. Then, they independently coded the transcripts using the qualitative data analysis software NVivo, version 11.0, to identify possible coding units related to patients' experiences and views of using the applet. Subsequently, they discussed and compared the coding of each transcript to reach a consensus. When an agreement could not be reached, it was up to the group members to discuss and decide. Then, the formed codes and concepts were clustered into themes and subthemes through an interactive and inductive process based on shared characteristics. Data collection and analysis were repeated until saturation, with no further themes or subthemes emerging [30]. Finally, the final themes and sub-themes were sent to three participants (2, 3, and 12) to obtain feedback on the findings. Supportive quotes from participants were also selected.

## 2.7. Rigor

The rigor of this study was maintained through adherence to the criteria of dependability, credibility, confirmability, and transferability [31]. The employed strategies included peer debriefing (which meant the researchers consulted with each other to solve any divergence or inconsistency on methodological issues or data analysis and independently analyzed the data), an audit trail (which referred to a detailed record of the decisions made before and during the research and a description of the research process), and a thick description (which was a detailed description of the process, context, and people in the research). In addition, the principal interviewer (ZC) kept writing a reflection diary throughout the research, self-reflecting how her role as a researcher (a young woman with some relevant clinical experience) might affect the interviews, which helped her to observe the research phenomenon with "fresh eyes."

## 2.8. Ethical consideration

Ethical approval for this study was granted by the Ethics Committee of Shenzhen Hospital, Southern Medical University (Approval No.: NYSZYEC20210009) and Shenzhen Longcheng Hospital (Approval No.: 2021-3). All participants were informed, and informed consent was obtained before participating in the study. Participants were told they had the right to refuse to participate or launch at any time during the research. The confidentiality of research data was assured.

## 3. Results

A total of 24 patients with NGB were recruited for this study, and patients were interviewed at the end of the 2-week trial. Data saturation was reached when the interview reached the 17th patient, and we added 2 more patients for the interview, finally interviewing a total of 19 patients with NGB. Each patient was interviewed once, and the interview time ranged from 18 to 51 min, with an average time of 28.88 min. During the study, 3 patients were lost to interview (could not be contacted) and 2 patients refused to be interviewed. Table 2 presents the characteristics of the participants. The analysis yielded 2 themes and 6 subthemes.

### 3.1. Perceived benefits of promoting adoption

#### 3.1.1. Being accessible, flexible, and intuitive to users

All patients mentioned that the applet had a clear interface, convenient operation, and ease of use.

*"I find that it is very simple. As soon as you open it, you can see a few big modules, and you can click on whatever you want to see. It's very clear, it's easy to use, and it's modernized. You know I'm only in the fourth grade of elementary school (hahaha)." (P3)*

Some patients mentioned that compared with the traditional learning model, the self-management tool showed more flexibility in learning disease-related knowledge without limitations of time and place; that is, they could learn disease-related knowledge at their own pace.

*"When we go home, there is no doctor, no nurse. When I encounter a situation, then I can open it and see. Or sometimes, when I can't remember, I can also look for it here. I can also get up in the morning at home, before bed, or when I'm bored on the bus ... Open it and see how to prevent, how to treat, and how to fix it." (P1)*

*"It may not be a good thing to carry a pile of thick materials with you, I think I can immediately read it when I have time or whenever I want to open it." (P16)*

Another important aspect was that most patients mentioned that disease-related knowledge was more intuitive, clearer and easier to understand through the combination of pictures, texts and videos of the tool.

*"Through these pictures and videos, I watched it myself, learned it myself, and took the initiative to see it clearly, and how to manage it. I would know that the bladder is like this. If you tell me directly what a bladder is, I probably don't know what you're talking about." (P15)*

#### 3.1.2. Driving bladder self-management

After hospital discharge, the NGB patients mentioned that they left the education of the medical staff. Still, the rich information of the tool provided them with a reliable channel for learning, especially for newly ill patients.

*"A lot of new sick people don't know this disease-related information, and they really want to know. Even for us old patients, some knowledge is also not very clear. For example, for catheterization, I am very curious about whether it is better to have more catheterizations or not. If I don't, I'm afraid of hydronephrosis. After all, we have to learn this." (P8)*

**Table 2**  
General characteristics of participants (n = 19).

ID	Gender	Age	Education level	Occupation	Course of disease (months)	Marital status	Medical payment type
P1	Male	28	High school	Construction site worker	12	Married	Injury insurance
P2	Male	48	Junior high school	Construction site worker	60	Married	Injury insurance
P3	Male	57	Primary school	Construction site worker	18	Married	Injury insurance
P4	Male	45	Primary school	Farmer	12	Married	Medical insurance
P5	Male	39	Primary school	Truck driver	7	Married	Medical insurance
P6	Male	40	High school	Factory worker	5	Married	Medical insurance
P7	Male	48	Bachelor's degree	Self-employment	24	Married	Medical insurance
P8	Female	33	Junior high school	Shop assistant	36	Married	Medical insurance
P9	Female	56	High school	Unemployed	36	Married	Medical insurance
P10	Male	32	Bachelor's degree	Staff	9	Married	Medical insurance
P11	Male	26	Bachelor's degree	Staff	8	Single	Medical insurance
P12	Male	42	Bachelor's degree	Staff	6	Married	Medical insurance
P13	Male	51	High school	Self-employment	60	Married	Medical insurance
P14	Female	36	Bachelor's degree	Staff	20	Married	Medical insurance
P15	Male	23	Junior high school	Construction site worker	15	Single	Injury insurance
P16	Male	46	Primary school	Self-employment	10	Married	Business insurance
P17	Female	54	Junior high school	Self-employment	8	Married	Business insurance
P18	Male	32	Bachelor's degree	Teacher	28	Married	Medical insurance
P19	Male	51	High school	Unemployed	40	Married	Medical insurance

One of the patients specifically mentioned that bladder self-management through the WeChat applet was systematic. He recalled the bladder management during his illness, describing the convenience and systematization of the self-management applet.

*"I've been ill for a long time. In the beginning, I checked the information bit by bit, scraped together a little, and gradually accumulated some understanding of NGB. If there is such a systematic applet, you don't have to spend a lot of time looking for Baidu and Google like me, and you don't have to doubt the authenticity of the information. You only need to open this applet."* (P11)

Another significant aspect was that some patients referred to that they knew nothing about their possible future complications and ways to recognize abnormal symptoms before participating in the study; they resorted to the applet for an early look at possible complications and key points to watch for disease-related symptoms. The related symptoms could be identified and immediately pre-treated for early prevention with the applet.

*"We need to be careful about such things as what causes complications and what points to look out for. There are a lot of people who have complications that are not properly prevented (sigh). We're also scared. We are so young, after all."* (P19)

As an effective tool for objective assessment of lower urinary tract symptoms in NGB patients, a urination diary can preliminarily judge the severity of the disease and monitor the treatment effect. Patients need to follow the doctor's recommendation to keep a urine diary regularly. Patients believed that compared with the traditional paper and pencil recording of urination diaries, the electronic record through this applet was more convenient and intuitive and was conducive to long-term preservation.

*"It's too troublesome to use pen and paper to record the urination diary. But with this tool, I can keep track of it anytime and anywhere. When I go to the clinic, sometimes the doctor looks at the status of my urinary diary, and then I can take it out whenever I want."* (P14)

There were many unforeseen difficulties for patients after discharge, most of whom expressed that when they felt uncomfortable or confused, they could consult professional medical staff

in time through the tool, thus solving their doubts timely.

*"Sometimes, I don't know what to do. I usually ask other patients with the same illnesses as me in the patient group. But you know that people will reply if they want to reply. And if they don't want to reply, they will not reply. But if I have this applet, when I have a problem, I think I can consult you directly."* (P2)

### 3.1.3. Directing the way for care partners and family members

Some patients pointed out that most of their family members could also benefit from the tool, which could increase their knowledge of diseases and realize closer cooperation with doctors.

*"My wife often asks doctors and nurses what should be done to help me recover and how family members should cooperate with patients in bladder management. Perhaps, this applet can be used as a tool for family members or caregivers ... like a window of a clearer understanding of what needs to be done with our recovery."* (P12)

Most patients said that their family members often searched for information beneficial to their recovery, which consumed a lot of time, with the authenticity of the information not guaranteed. From this point, this tool saved time and, more importantly, was worthy of their trust.

*"When we leave the hospital and encounter something we don't understand, we often have to spend time searching online. But sometimes, some advertisements pop up, and we don't know which ones are credible. At least this platform was developed by your professionals. I don't have to be too suspicious. Maybe I can use it with confidence."* (P3)

One patient expressed his psychological experience with his illness and pointed out the potential help of the applet in addressing emotional issues, enabling others to get to know him, understand him, and accept him, especially intimate family members and friends.

*"You know, patients like us are afraid of being misunderstood by others, especially after discharge. We have to be in contact with many people. Sometimes your friends don't understand you, and even your family doesn't understand you. But if I show them this*

platform directly, they might understand my condition. I think maybe they would consider me more and accept me.” (P4)

### 3.2. Challenges hindering adoption

#### 3.2.1. Negative attitudes of patients towards bladder self-management and patient characteristics

A proper understanding of the disease is the cornerstone of effective patient self-management. Some patients believed that NGB progressed slowly and there was no need to use this tool; others simply believed that bladder management was about drinking more water and catheterizing, and that he/she and the caregivers had internalized bladder management knowledge and there was no need to use this tool.

“I think NGB is a chronic disease, and if you delay it for a year, two years, or three years, it's not said to deteriorate too badly, so I don't feel I need to use your platform right now.” (P10)

“I know all the knowledge about the bladder. Bladder management is to drink more water and catheterize. There's nothing else to do.” (P13)

Another important aspect was that individual patients had low self-efficacy and thought they could not manage their bladder; going to a hospital for examination was the most direct way.

“I can't manage it myself. So why do I learn so much? We are not professionals, so we can only go to the hospital to take medicine. It's useless to learn by yourself. You can't manage it yourself, or why do you need a hospital?” (P5)

Certain knowledge and experience reserve is the prerequisite for using the tool for patients. Older patients were less exposed to information technology in their daily lives and presented a relatively poor ability to accept and adapt to new things. They felt that they were not used to using the tool for self-management.

“Like we are getting older, our exposure to these new things is relatively limited, and we don't have this habit. (Shaking head) If there is any problem, I am still willing to call the nurse I am familiar with or go directly to the hospital.” (P9)

#### 3.2.2. Concerns about the risks of the mHealth

Risk perception refers to patients' uncertainty about the reliability of new technologies. Patients believed a certain level of risk in mHealth. Some patients mentioned that in the event of an emergency, using the online consultation function of the tool might delay the precious opportunity of offline medical treatment.

“When I consulted you (the applet), did I waste time on you, and so I miss the best time to go to the hospital? (Frowning)” (P6)

However, not all patients shared this view, among whom some pointed out that if the situation was more urgent or serious, they would directly choose to go to hospital.

“If it's an emergency or I'm not feeling well, I'll go straight to the hospital.”(P17)

“I'll consult about it for minor issues, rather than just rely on it for slightly intractable issues.” (P1)

Another aspect was that very few patients believed that their privacy and related data were at risk of leakage.

“In addition to providing a good service, your platform actually wants to get some user data and use them to sell ads and stuff, right? (Doubtful)” (P7)

#### 3.2.3. Necessity of applet upgrading

Most patients mentioned that other patients with the same illness were an important source of information and emotional support. Therefore, they strongly hoped that the applet could realize the intercommunication between patients, i.e., increasing the function of the patient circle.

“I really want to communicate with other people who undergo the same disease as me, share experiences with each other, and see how others are treated if they have any successful experiences. Like the friend circle, I'll chat with them on the applet.” (P16)

One patient recalled his experience of seeing a doctor in a hospital. He mentioned that there was no real multidisciplinary integration among medical staff of related departments, resulting in high time costs and low communication efficiency. Therefore, the online consultation function of the applet was expected to enable interdisciplinary communication between doctors, nurses and patients.

“In the past, when I was hospitalized, I had to go to doctors from different departments each time, and each doctor would give a different opinion. If online consultation is available, it is hoped that a patient's one problem can be received and discussed by the medical staff of the relevant department at the same time, so that the best advice may be given to the patient.” (P11)

Some patients also mentioned that they would really like this tool to push some information about quality medical resources, such as the comprehensive ranking of rehabilitation departments.

“What patients are most concerned about is actually the way and direction of access to care, such as the national ranking of rehabilitation departments, and giving us that information.” (P12)

## 4. Discussion

### 4.1. Principal findings

To our knowledge, this is one of the first studies to explore the views of NGB patients in China on a WeChat applet for self-management of the bladder. The primary aim of this study was to explore the perceived benefits of a self-management WeChat applet for NGB patients and to identify the barriers to their adoption. The results from the interviews indicated the acceptability and feasibility of the e-tool for NGB patients' self-management of the bladder. In particular, the three perceived benefits of this applet were identified: 1) being accessible, flexible, and intuitive to users, 2) serving as a motivator for bladder self-management, and 3) giving a right direction for care partners and family members. Furthermore, we also identified some factors that might hinder the practical adoption of the applet, including 1) negative attitudes of patients towards bladder self-management and patient characteristics, 2) concerns about the risks of the mHealth, and 3) the necessity of further improvement of the tool.



#### 4.2. Perceived benefits

In general, participants of the study perceived the tool to be acceptable and useful, with expectations on improving bladder self-management. This work was substantiated by Wilde et al. [14], who explored the feasibility of a web-based self-management intervention for intermittent urinary catheter users with spinal cord injury. They found that patients presented significant improvements in catheterization practices over 3 months, including the frequency of catheterizations every 4–6 h (increasing from 71% to 77%), and most participants also rated its usefulness, satisfaction, and web-based usability highly. In our study, participants also recognized that this tool had the following advantages. First, the applet was accessible, intuitive, and flexible for users. As noted in previous studies, this applet has straightforward navigation, a plain layout and design, and intuitive technology, all of which are relevant factors in promoting adoption [32,33].

Secondly, the applet's ease of access to knowledge allowed patients to obtain more information, especially the observation points of possible complications and disease-related symptoms. On this basis, there would be a series of other benefits, such as early prevention of complications and timely medical treatment to prevent further progress of the disease. Studies in other populations have provided evidence for that benefit [34,35]. In addition, almost all patients agreed that electronic voiding diary recording was simple and standardized and facilitated long-term retention compared to traditional paper and pencil recording. Sussman et al. [36] also found that online voiding diaries improved patient compliance with recording. The ability to get in touch with medical staff promptly was another driver of bladder management. Most patients reported that they could not get counseling when they had problems outside the hospital. The online consultation through this applet provided timely and professional answers that increased their confidence in recovery.

Finally, this tool is expected to aid caregivers in daily patient care. This is because NGB is mostly caused by spinal cord injury, which causes limb disorders in most patients. Some patients' self-management is partially or fully compensated by family members or caregivers. In order to take good care of patients, family caregivers also need knowledge of bladder management. The rich and evidence-based disease-related knowledge on this applet (see [Appendix A Supplementary data](#)) reduces their search time and helps get support from medical staff. This was consistent with a study exploring the opportunities and challenges of a self-management app for stress injury prevention in patients with spinal cord injury [37].

#### 4.3. Barriers to adoption

Current attitudes and behavioral patterns of patients toward bladder self-management are important factors determining the adoption of e-tools. In our study, some participants shared a wrong perception of bladder self-management, so they failed to consider themselves as the primary audience of the tool. For example, some patients insisted that NGB progressed slowly; thus, bladder management was not an urgent need; some felt that bladder management was just drinking plenty of water and catheterization. Other patients held that self-management of the bladder was so challenging that a doctor was indispensable. For these patients with a negative attitude toward self-management, although potentially applicable, the tool might not be accepted and bring incremental benefits to them. This finding was consistent with a previous study on patients' attitudes toward a self-management eHealth tool in the atrial fibrillation population [25].

In our research, patients' concerns about the possible risks of

mHealth tools were an important factor prohibiting the practical adoption, consistent with findings in other populations [22]. This implies that in the future, attention and relevant measures should be considered in improving the transparency of user data and enabling users to fully retain the ownership, control, and deletion rights of data to reduce the perceived risk of patients and enhance the trust of the platform [38,39].

Furthermore, we found that elderly patients would be less likely to use the tool. A previous study on mHealth engagement revealed that only 7% of older adults (aged 65 and above) expressed an interest in using smartphone health apps [40]. They preferred more traditional methods of information gathering to apps. However, in contrast to these expectations, if elder patients considered new technologies beneficial, they would be willing to learn to use new technologies [41].

#### 4.4. Future improvement of the applet

Although patients recognized the usefulness of the tool, shortcomings still exist and hinder their adoption, which underscores the need to design such tools to cater to patients' needs. Patients are direct users of the self-management e-tool, and thus meeting their needs is the key to accelerating the adoption of the applet and ensuring real benefit [34].

Key recommendations from participants for future tool upgrading focus on the optimization of the education provided by the tool and customization features. On the basis of patients' overall suggestions, the function module for the patient group of the tool should be developed in the next step. Moreover, it is also necessary to continue to enrich the content of the tool and add relevant information on medical resources. In addition, based on the existing online consultation function, the participation of interdisciplinary personnel should be embraced as much as possible to provide more comprehensive and accurate decision-making.

#### 4.5. Strengths and limitations

To our knowledge, this is the first study to explore the perceptions of the Chinese NGB patient population on the use of eHealth tools for self-management and will help provide a reference for healthcare providers to implement eHealth interventions to promote self-management among NGB patients. Still, it has limitations in that we only recruited NGB patients who could operate smartphones. However, it should be noted that family caregivers play an important role in the management of some NGB patients. Therefore, interviews with primary caregivers should be considered in future studies.

### 5. Conclusion

We identified the perceived benefits of the self-management e-tool and the key barriers to its adoption from the perspective of NGB patients in China. The findings are expected to provide a theoretical basis for the future optimization and implementation of this e-tool, and also help provide a reference for the self-management of other patients with chronic diseases.

#### Funding

This study was supported by the Science and Technology Project of Shenzhen, Grant number: [JCYJ20210324142406016].

#### Data availability statement

The datasets used and analyzed during the current study are

available from the corresponding author on reasonable request.

### CRediT authorship contribution statement

**Chun Zhao:** Conceptualization, Methodology, Validation, Formal analysis, Investigation, Data curation, Writing-original draft, Writing-review & editing, Project administration. **Surui Liang:** Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Data curation, Writing-review & editing, Supervision, Project administration. **Xiaojiao Wang:** Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Data curation, Writing-review & editing. **Linghong Gao:** Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Data curation, Writing-review & editing. **Yuhong Lai:** Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Data curation, Writing-review & editing. **Ying Huang:** Conceptualization, Methodology, Validation, Formal analysis, Writing-review & editing, Supervision, Project administration. **Jue Li:** Conceptualization, Methodology, Validation, Formal analysis, Writing-review & editing, Supervision, Project administration. **Ling Chen:** Conceptualization, Methodology, Validation, Formal analysis, Resources, Writing-review & editing, Supervision, Project administration. **Wenzhi Cai:** Conceptualization, Methodology, Validation, Formal analysis, Funding acquisition, Writing-review & editing, Supervision, Project administration.

### Declaration of competing interest

The authors have declared no conflict of interest.

### Acknowledgments

We would like to thank the Science and Technology Project of Shenzhen for providing funding for this project. We also would like to thank all the participants in this study and medical staff of Rehabilitation Department of Shenzhen Longcheng Hospital and Shenzhen Hospital, Southern Medical University for their valuable support. Lastly, we would like to thank KetengEdit ([www.ketengedit.com](http://www.ketengedit.com)) for its linguistic assistance during the preparation of this manuscript.

### Appendices. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijnss.2022.12.009>.

### References

- Amarenco G, Sheikh Ismaël S, Chesnel C, Charlanes A, LE Breton F. Diagnosis and clinical evaluation of neurogenic bladder. *Eur J Phys Rehabil Med* 2017;53(6):975–80. <https://doi.org/10.23736/S1973-9087.17.04992-9>.
- Ginsberg D. The epidemiology and pathophysiology of neurogenic bladder. *Am J Manag Care* 2013;19(10 Suppl):s191–6.
- Siroky MB. Pathogenesis of bacteriuria and infection in the spinal cord injured patient. *Am J Med* 2002;113(1):67–79. [https://doi.org/10.1016/S0002-9343\(02\)01061-6](https://doi.org/10.1016/S0002-9343(02)01061-6).
- Groen J, Pannek J, Castro Diaz D, Del Popolo G, Gross T, Hamid R, et al. Summary of European association of urology (EAU) guidelines on neuro-urology. *Eur Urol* 2016;69(2):324–33. <https://doi.org/10.1016/j.eururo.2015.07.071>.
- Nseyo U, Santiago-Lastra Y. Long-term complications of the neurogenic bladder. *Urol Clin North Am* 2017;44(3):355–66. <https://doi.org/10.1016/j.ucl.2017.04.003>.
- Tang F, Cheng ZY, Wen XX, Guan JY. Effect of continuous care intervention on the quality of life in patients with neurogenic bladder dysfunction. *J Int Med Res* 2019;47(5):2011–7. <https://doi.org/10.1177/0300060519833563>.
- Wilde MH, Zhang F, Fairbanks E, Shah S, McDonald MV, Brasch J. Perceived value of a urinary catheter self-management program in the home. *Home Healthc Nurse* 2013;31(9):465–73. <https://doi.org/10.1097/NHH.0b013e3182a89791>.
- Wilde MH, Bliss DZ, Booth J, Cheater FM, Tannenbaum C. Self-management of urinary and fecal incontinence. *Am J Nurs* 2014;114(1):38–45. <https://doi.org/10.1097/01.NAJ.0000441794.78032.f9>.
- Komatsu H, Oishi T, Osaku D, Kudoh A, Shimogai R, Chikumi J, et al. Long-term evaluation of renal function and neurogenic bladder following radical hysterectomy in patients with uterine cervical cancer. *J Obstet Gynaecol Res* 2020;46(10):2108–14. <https://doi.org/10.1111/jog.14394>.
- He Y, Zhang M, Peng M, Zhang L, Liu S. Research progress on self-management of neurogenic bladder patients. *Chinese General Practice Nursing* 2019;17(23):2828–31. <https://doi.org/10.12104/j.issn.1674-4748.2019.23.004> [In Chinese].
- Li R, Liang N, Bu FL, Hesketh T. The effectiveness of self-management of hypertension in adults using mobile health: systematic review and meta-analysis. *JMIR Mhealth Uhealth* 2020;8(3):e17776. <https://doi.org/10.2196/17776>.
- Liu T, Xie SM, Wang YM, Tang J, He XK, Yan TB, et al. Effects of app-based transitional care on the self-efficacy and quality of life of patients with spinal cord injury in China: randomized controlled trial. *JMIR Mhealth Uhealth* 2021;9(4):e22960. <https://doi.org/10.2196/22960>.
- Bentley CL, Powell L, Potter S, Parker J, Mountain GA, Bartlett YK, et al. The use of a smartphone app and an activity tracker to promote physical activity in the management of chronic obstructive pulmonary disease: randomized controlled feasibility study. *JMIR Mhealth Uhealth* 2020;8(6):e16203. <https://doi.org/10.2196/16203>.
- Wilde MH, McMahon JM, Fairbanks E, Brasch J, Parshall R, Zhang F, et al. Feasibility of a web-based self-management intervention for intermittent urinary catheter users with spinal cord injury. *J Wound Ostomy Continence Nurs* 2016;43(5):529–38. <https://doi.org/10.1097/WON.0000000000000256>.
- Carter B, Whittaker K, Sanders C. Evaluating a telehealth intervention for urinalysis monitoring in children with neurogenic bladder. *J Child Health Care* 2019;23(1):45–62. <https://doi.org/10.1177/1367493518777294>.
- Jiang P, Wen X. Application progress of continuing nursing in patients with neurogenic bladder. *The Medical Forum* 2021;25(6):873–5. <https://doi.org/10.19435/j.1672-1721.2021.06.073> [In Chinese].
- Pang X, Hu S, Li H, et al. Development and usability evaluation of syndrome management platform for Low Anterior Resection Syndrome in patients with rectal cancer. *Chinese Nursing Management* 2022;22(3):445–9. <https://doi.org/10.3969/j.issn.1672-1756.2022.03.024> [In Chinese].
- Zhao Q, Shi R, Meng A, et al. Development and application of a mobile App for home care of central venous catheters in cancer patients. *Journal of Nursing Science* 2020;35(21):50–3. <https://doi.org/10.3870/j.issn.1001-4152.2020.21.050> [In Chinese].
- Sandelowski M. Whatever happened to qualitative description? *Res Nurs Health* 2000;23(4):334–40. [https://doi.org/10.1002/1098-240x\(200008\)23:4<334::aid-nur9>3.0.co;2-g](https://doi.org/10.1002/1098-240x(200008)23:4<334::aid-nur9>3.0.co;2-g).
- Colorafi KJ, Evans B. Qualitative descriptive methods in health science research. *HERD* 2016;9(4):16–25. <https://doi.org/10.1177/1937586715614171>.
- Sandelowski M. What's in a Name? qualitative description revisited. *Res Nurs Health* 2010;33(1):77–84. <https://doi.org/10.1002/nur.20362>.
- Byambasuren O, Beller E, Hoffmann T, Glasziou P. Barriers to and facilitators of the prescription of mHealth apps in Australian general practice: qualitative study. *JMIR Mhealth Uhealth* 2020;8(7):e17447. <https://doi.org/10.2196/17447>.
- Ayre J, Bonner C, Bramwell S, McClelland S, Jayaballa R, Maberly G, et al. Factors for supporting primary care physician engagement with patient apps for type 2 diabetes self-management that link to primary care: interview study. *JMIR Mhealth Uhealth* 2019;7(1):e11885. <https://doi.org/10.2196/11885>.
- Singh G, MacGillivray M, Mills P, Adams J, Sawatzky B, Ben Mortenson W. Patients' perspectives on the usability of a mobile app for self-management following spinal cord injury. *J Med Syst* 2020;44(1):26. <https://doi.org/10.1007/s10916-019-1487-y>.
- Cher BP, Kembhavi G, Toh KY, Audumulam J, Chia WYA, Vrijhoef HJ, et al. Understanding the attitudes of clinicians and patients toward a self-management eHealth tool for atrial fibrillation: qualitative study. *JMIR Hum Factors* 2020;7(3):e15492. <https://doi.org/10.2196/15492>.
- Parker AM, Nelliott A, Chessare CM, Malik AM, Koneru M, Hosey MM, et al. Usability and acceptability of a mobile application prototype for a combined behavioural activation and physical rehabilitation intervention in acute respiratory failure survivors. *Aust Crit Care* 2020;33(6):511–7. <https://doi.org/10.1016/j.aucc.2020.02.010>.
- Torbjörnson A, Ribu L, Rønnevig M, Grøttland A, Helseth S. Users' acceptability of a mobile application for persons with type 2 diabetes: a qualitative study. *BMC Health Serv Res* 2019;19(1):641. <https://doi.org/10.1186/s12913-019-4486-2>.
- Elo S, Kyngäs H. The qualitative content analysis process. *J Adv Nurs* 2008;62(1):107–15. <https://doi.org/10.1111/j.1365-2648.2007.04569.x>.
- Hsieh HF, Shannon SE. Three approaches to qualitative content analysis. *Qual Health Res* 2005;15(9):1277–88. <https://doi.org/10.1177/1049732305276687>.
- Bowen GA. Naturalistic inquiry and the saturation concept: a research note. *Qual Res* 2008;8(1):137–52. <https://doi.org/10.1177/1468794107085301>.
- Milne J, Oberle K. Enhancing rigor in qualitative description: a case study. *J Wound Ostomy Continence Nurs* 2005;32(6):413–20. <https://doi.org/10.1097/00152192-200511000-00014>.

- [32] Peng W, Kanthawala S, Yuan SP, Ali Hussain S. A qualitative study of user perceptions of mobile health apps. *BMC Public Health* 2016;16(1):1158. <https://doi.org/10.1186/s12889-016-3808-0>.
- [33] Jeffrey B, Bagala M, Creighton A, Leavey T, Nicholls S, Wood C, et al. Mobile phone applications and their use in the self-management of Type 2 Diabetes Mellitus: a qualitative study among app users and non-app users. *Diabetol Metab Syndr* 2019;11:84. <https://doi.org/10.1186/s13098-019-0480-4>.
- [34] Richards R, Kinnersley P, Brain K, Staffurth J, Wood F. The preferences of patients with cancer regarding apps to help meet their illness-related information needs: qualitative interview study. *JMIR Mhealth Uhealth* 2019;7(7):e14187. <https://doi.org/10.2196/14187>.
- [35] Wu RC, Ginsburg S, Son T, Gershon AS. Using wearables and self-management apps in patients with COPD: a qualitative study. *ERJ Open Res* 2019;5(3):36–2019. <https://doi.org/10.1183/23120541.00036-2019>.
- [36] Sussman RD, Richter LA, Tefera E, Park AJ, Sokol AI, Gutman RE, et al. Utilizing technology in assessment of lower urinary tract symptoms: a randomized trial of electronic versus paper voiding diaries. *Female Pelvic Med Reconstr Surg* 2016;22(4):224–8. <https://doi.org/10.1097/SPV.0000000000000266>.
- [37] Amann J, Fiordelli M, Scheel-Sailer A, Brach M, Rubinelli S. Opportunities and challenges of a self-management app to support people with spinal cord injury in the prevention of pressure injuries: qualitative study. *JMIR Mhealth Uhealth* 2020;8(12):e22452. <https://doi.org/10.2196/22452>.
- [38] van Haasteren A, Gille F, Fadda M, Vayena E. Development of the mHealth app trustworthiness checklist. *Digit Health* 2019;5:2055207619886463. <https://doi.org/10.1177/2055207619886463>.
- [39] Albrecht UV. Transparency of health-apps for trust and decision making. *J Med Internet Res* 2013;15(12):e277. <https://doi.org/10.2196/jmir.2981>.
- [40] Gordon NP, Hornbrook MC. Older adults' readiness to engage with eHealth patient education and self-care resources: a cross-sectional survey. *BMC Health Serv Res* 2018;18(1):220. <https://doi.org/10.1186/s12913-018-2986-0>.
- [41] Cajita MI, Hodgson NA, Lam KW, Yoo S, Han HR. Facilitators of and barriers to mHealth adoption in older adults with heart failure. *Comput Inform Nurs* 2018;36(8):376–82. <https://doi.org/10.1097/CIN.0000000000000442>.