



Feasibility and acceptability of smartphone applications for seizure self-management in China: Questionnaire study among people with epilepsy



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ABSTRACT

Objective: The aim of this report was to assess the feasibility and acceptability of using smartphone apps for seizure self-management in China.

Methods: All patients with epilepsy were consecutively recruited from the Neurology Epilepsy Prevention and Cure Center of West China Hospital from January 2015 to June 2015. Data on patients' clinical characteristics, mobile phone utilization habits, preferences for contents of apps for seizure self-management, medication adherence, and attitudes toward the use of smartphone apps were collected from 502 patients with epilepsy by questionnaire.

Results: Among 502 participants, 96.8% had their own mobile phones, and 94.4% owned a smartphone. Although only 9.5% (48/502) of participants had prior knowledge of apps for managing chronic illness, 66.7% (335/502) of participants reported that managing their seizure through an app would be useful. Sixty-five point five percent of participants reported that they would use a smartphone app for seizure self-management if it were free. Patients who were more likely to use an app were those with a low Morisky Scale score (patients with poor medicine adherence), young patients, patients who lived in cities, and patients with frequent seizures ($P < 0.001$, $P = 0.002$, $P < 0.001$, $P = 0.01$). Patients with higher education and with stable employment were also more likely to use an app ($P = 0.001$, $P < 0.001$).

Conclusions: This is the first study on the feasibility and acceptability of smartphone apps for seizure self-management in China. The findings of this study indicate that there is a positive attitude toward using epilepsy apps among patients with epilepsy. Based on patients' positive attitudes toward using epilepsy apps and the current development of mobile health in China, the use of smartphone apps could be a promising strategy for seizure self-management.

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1. Introduction

Epilepsy, characterized by recurrent unprovoked seizures, is one of the most common chronic neurological disorders in the world [1,2]. It affects individuals of all ages and although treatable, often requires life-long medication and sometimes surgery to control seizures [3]. More than 65 million people are affected worldwide, and in the United States, over 100,000 new cases are reported every year [4]. In the United States, over 3 million people have been diagnosed with epilepsy [1], and in Europe, the mean prevalence of epilepsy was estimated at 0.52% [5]. In developing countries such as China, the incidence is even higher, contributing significantly to global disease burden and causing restrictions on activities such as driving, psychological stress, and social problems [1].

To help combat this, clinical guidelines have increasingly recognized the effectiveness of epilepsy self-management programs in improving treatment adherence, controlling seizures, and reducing the negative impacts of epilepsy on patients [6,7].

Recent studies demonstrate that mobile phone applications (apps) hold potential to provide automated, tailored support for treatment adherence among individuals with chronic medical conditions [8]. In recent years, a multitude of mobile phone apps have been developed and successfully used to support effective self-management of patients with diabetes mellitus, hypertension, and other disorders [9–12]. Apps for seizure self-management have been used in developed countries such as Australia and the United States (US) [13,14]. While China has approximately 1.2 billion mobile phone users and this number is still growing [15], mobile health services in China are only now beginning to emerge, and professional smartphone apps have not yet been developed to assist patients in seizure management. A critical component to the success of any mobile phone apps is the willingness and ability of the target population to adopt and effectively utilize the

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technology [16]. Hence, the aim of this study was to determine the feasibility and acceptability of using smartphone applications for seizure self-management in China.

2. Methods

2.1. Subjects and interview

All patients with epilepsy were consecutively recruited from the Epilepsy Neurology Prevention and Cure Center of West China Hospital. Diagnosis of epilepsy required at least two unprovoked seizures [17]. Eligible patients were at least 15 years old; able to either write, read, or understand; and capable of completing the questionnaire. Investigators were trained identically on study methodology and subsequently interviewed all target patients at the inpatient and outpatient units of our epilepsy center. Patients were required to complete a questionnaire designed for this cross-sectional study. This study was approved by the Research Ethics Committee of the Medical School of Sichuan University. Written informed consent from each patient was obtained before enrollment in the study.

2.2. Content of questionnaire

The questionnaire included four main parts. Part I requested patients' characteristics, including sociodemographic data (age, gender, educational background, marital status, occupation) and the main clinical features of the disease (seizure type, age of onset of epilepsy, seizure frequency, number of AEDs). Part II surveyed mobile phone ownership of patients and the methods they used to obtain general information about epilepsy. It also surveyed the content of smartphone applications that patients were most interested in. According to a previous survey, these contents mainly included general information about epilepsy (definitions, pathophysiology, epidemiology, and prognosis); first aid and safety, particularly seizure first aid, injury prevention, and avoidance of dangerous activities; medication information primarily about medication types and side effects; seizure diary for video and written recordings of the process of epileptic seizures; and epilepsy education for avoiding some trigger factors such as missed medication, sleep deprivation, or alcohol intake. Part III mainly evaluated medication adherence using an eight-item modified Morisky Medication Adherence Scale (MMAS-8) with a moderate internal consistency (Cronbach's $\alpha = 0.556$) and good test-retest reliability (intraclass correlation coefficient = 0.729) [18–20]. Of the eight items, seven items (items 1 to 7) were yes/no questions, in which a 'no' answer received a score of 1, and a 'yes' answer received a score of 0. Item 8 was measured on a five-point Likert scale, in which responses of 'never', 'once in a while', 'sometimes', 'usually', and 'all the time' were scored 1, 0.75, 0.50, 0.25, and 0, respectively [18]. The total scores ranged from 0 to 8, and adherence levels can be categorized into high (= 8), moderate (≥ 6 but < 8), and poor (< 6) based on seizure control and adverse effects [19,21]. Part IV consisted of a 10-item questionnaire that focused on assessment of the attitudes of patients toward the use of smartphone apps for managing their epilepsy. These items were answered using a 5-point Likert-type scale with 1 being 'strongly disagree', 3 being 'neutral', and 5 being 'strongly agree'. This scale was modified from previous studies assessing patients' attitudes toward smartphone apps for managing chronic illness and cell phone-based services for obesity detection and daily healthcare management [21–23].

3. Statistical analysis

The statistical processing system used was SPSS for Windows (version 17.0). The demographics and clinical characteristics of all patients and of patients grouped according to their attitudes toward epilepsy apps were described by means and standard deviations for continuous variables and by frequency distributions for categorical

variables. The clinical and demographic features of attitude groups were analyzed using a Student's *t*-test for continuous variables and Pearson χ^2 test or Fisher exact test for categorical variables. Participants with an 'agree' or a 'strongly agree' answer to the question whether they were willing to use the apps if they were free were compared to those with a 'disagree', 'strongly disagree', or 'neutral' answer, and then we analyzed the sociodemographic and clinical characteristics of those who had positive attitudes toward the use of epilepsy apps.

4. Results

4.1. Demographics and clinical characteristics

From January 2015 to June 2015, 550 patients were asked if they were willing to participate in the survey, among which 502 patients (272 men; 230 women) agreed to participate. Patients chose not to participate because of lack of time or lack of interest. The mean age of participants in our sample was 27.98 ± 9.21 years (ranged from 15 to 73 years). The number of patients who lived in a city was about three-fold the number of patients who lived in rural areas. The demographic details of the patients are given in Table 1. Nearly half of the patients reported having generalized tonic-clonic seizures (49.8%, 250/502). The onset of epilepsy ranged from 1 year to 71 years (mean: 18.98 ± 9.81 years). The mean length of time that patients had experienced seizures was approximately 9 years, and 57.8% of patients experienced more than one seizure a year. Additionally, 57.2% of patients could control seizure occurrence by using just one antiepileptic drug. The mean Morisky Scale score was 6.47 ± 1.67 .

Table 1
Sociodemographic and epilepsy-related clinical characteristics of survey participants.

Variable	No.	%
Age (years)		
15–25	243	48.4
26–35	163	32.4
36–73	96	19.1
Gender		
Male	272	54.2
Female	230	45.8
Resident location		
Urban	364	72.5
Rural	138	27.5
Education level		
\leq Junior high studies	176	35.1
Senior high studies	113	22.5
\geq University studies	213	42.4
Occupation (employment)		
No work	124	24.7
Stable work	290	57.8
Student	88	17.5
Seizure type		
Partial or focal seizures		
SPS	25	5.0
CPS	153	30.5
SGTC	44	9.0
Generalized seizures		
GTCS	250	49.8
TAS	30	6.0
Number of AEDs		
\leq One AED	287	57.2
\geq Two AEDs	215	42.8
Seizure frequency		
\leq Once a year	212	42.2
\geq Twice a year	290	57.8

SPS, simple partial seizure; CPS, complex partial seizure; SGTC, secondarily generalized tonic-clonic seizure; GTCS, generalized tonic-clonic seizure; TAS, typical absence seizure; AED, antiepileptic drug.

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