The acceptability and practicability of smartphone applications in self- management of Parkinson's disease patients in China

Dezhi Yuan

the Second Affiliated Hospital of Chongqing Medical University

Qiuye Zhao

the Second Affiliated Hospital of Chongqing Medical University

Jie Hu

the Second Affiliated Hospital of Chongqing Medical University

Xuefei Wang

the Second Affiliated Hospital of Chongqing Medical University

Xiaotian Zhang

the Second Affiliated Hospital of Chongqing Medical University

Qihui Jiang

the Second Affiliated Hospital of Chongqing Medical University

Kuan Tian

Basic Medical College of Chongqing Medical University

Ling Hu

Basic Medical College of Chongqing Medical University

Huirong Luo

Basic Medical University of Chongqing Medical University

Jing Li

Chongqing Medical University Institution of Basic Medical Sciences

Jianhua Ran

Basic Medical College, Chongqing Medical University

Jinfang Li (✉ LiJinfang0331@163.com)

the Second Affiliated Hospital of Chongqing Medical University <https://orcid.org/0000-0001-6971-2602>

Research article

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Abstract

Objective—To determine the practicability and attitudes among the elderly with Parkinson's disease (PD) in China unto the use of smartphone applications (APPs) for self-management of chronic condition.

Methods—Patients with PD who participated in the study ranged in age from 52 to 87 years.

Questionnaires were collected for attitudes towards using APPs for chronic condition from 204 PD patients, and the results were statistically analyzed. **Results**—The surveyed population had a smartphone ownership rate of about 65.19%; Among all patients, 82.84% were willing to use an APP for PD managing; among these patients, those who were inclined to use APPs were at younger ages, web users and with higher education, better medication adherence, longer PD courses, and worse conditions of PD— $P=0.001$, $P=0.001$, $P=0.001$, $P=0.041$, $P<0.001$, $P=0.013$. Additionally, the willingness of patients to use APPs for PD self-management is positively related to education level($P<0.001$) while the age and PD course are negatively related to it ($P=0.017$, $P<0.001$). **Conclusion**—Patients with PD have relatively low smartphone coverage. They are positive about using APP to manage PD and thus using APPs to help manage PD is a practicable method. Consequently, it is still necessary to improve the smartphones' coverage and develop practical and handy APPs for PD self-management.

Background

Parkinson's disease (PD) is a progressive, neurological disorder associated with degeneration of the dopamine-producing cells in the nigra and striatum[1]. The cardinal features of PD are bradykinesia, tremor, rigidity and postural instability[2]. Once suffering from PD, patients were disturbed by the motor symptoms of PD in daily functions , activities and roles[3]. Thereby, self- management is considered as one of the most effective measures to help improve their medication compliance for patients with PD and control clinical symptoms as well as weaken the adverse effects of this disease[4, 5].

Recent studies have indicated that smartphone APPs have potential for offering automated and customized support for medication compliance to individuals with chronic diseases conditions[6]. Recently, a variety of APPs have been developed and successfully applied to effective self-management of patients with diabetes, hypertension and other chronic diseases[7-11].Namely, PD self-management APPs have been used in developed countries such as Holland and Swedish[5, 12]. Meanwhile, China has had about 1.2 billion cell-phone users and the usage has been still growing[13], however, mobile health services are currently in the initial stage and have not yet prevailed in China. The key to obtaining the success of any APPs is catering for the willingness of targeted individuals and getting their acceptance as well as facilitating their use of the technologies[14, 15]. Thus, the purpose of our research was to investigate the acceptability and practicability of using APPs for PD self-management in China.

Methods

Subjects and interview

All Parkinson's patients were consecutively recruited from the Parkinson Clinic of the Second Affiliated Hospital of Chongqing Medical University. Parkinson's patients were examined by at least two experienced neurologists. In our study, Parkinson's disease was determined according to the diagnosis of PD and exclusionary criteria[16]. And all participants were able to read, or write, or understand what they were asked for so that they are capable of completing questionnaires. Also, investigators were trained rigorously in study methodology, then they subsequently interviewed all target patients at the inpatient and outpatient units of our Parkinson center. This study was approved by the Research Ethics Committee of the Second Affiliated Hospital of Chongqing Medical University. And each patient signed a consent form when enrolled in the study.

Content of questionnaire

The questionnaire consists of Part I, Part II, Part III and Part IV. Part I is used to inquire patients' characteristics, including demographic data (ages, gender, educational level, occupation) and the main clinical features of PD (disease course of PD, number of anti-PD drugs, Movement Disorder Society- Unified Parkinson's disease rating scale (MDS-UPDRS), Hoehn & Yahr Stage(H & Y)). Part II aims for surveying the number of patients who have mobile phones and the ways they used to obtain general information about PD, also, investigating the preference of patients with PD that smartphone APPs can push. According to a previous related survey, these content mainly contains general information about PD (symptoms, pathophysiology, epidemiology and prognosis), doctors' interaction with patients and their regular answers for patients' questions via Internet, primary medication advice about medication types, new medicine and side effects, symptoms recorded as video and written recordings of the motor symptoms and non-motor symptoms of PD, PD education for suitable rehabilitating exercises, positive outlook and adverse factors to be avoided such as missed medication, accidental fall, emotional disorder or sleep deprivation. Part III is mainly applied to evaluate medication adherence. An eight-item modified Morisky Medication Adherence Scale (MMAS-8) have moderate internal consistency (Cronbach's $\alpha = 0.556$) and good test-retest reliability (intraclass correlation coefficient = 0.729) [17-19]. And seven out of eight items (from items 1 to 7) need to be answered "yes/no", in which a 'no' score 1 point, and a 'yes' score 0 points. While 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 respectively scored as 1, 0.75, 0.50, 0.25, and 0, respectively[17]. Part IV is composed of a 10-item questionnaire concerning the assessment of the attitudes of the use of APPs for-self-managing PD. And these items were answered via using a 5-point Likert type scale with 5 being 'strongly agree', 3 being 'neutral' and 1 being 'strongly disagree', which has been improved from previous studies based on the use of APPs for chronic disease management in patients with chronic diseases such as epilepsy, obesity testing and daily medical care.

Statistical analysis

The statistical processing system used was SPSS 25.0. The demographics and clinical characteristics of all patients by attitudes towards APPs were described by means and standard deviations (means $\pm$ SD) for continuous variables and by frequency distributions for categorical variables. The clinical and

demographic features of attitude groups were analyzed using a Student's test for continuous variables, Pearson χ^2 test for categorical variables and Spearman correlation analysis.

Results

Demographics and clinical characteristics

A total of 208 patients were asked whether they would like to participate in the survey, then 204 participants (115 male and 89 female) agreed to do it, from January 2017 to May 2018. The average age of participants in our samples was 68.75 ± 9.54 years (ranged from 52 to 87 years). The number of patients who lived in cities and rural areas are 172 (84.31%) and 32 (15.69%) respectively. The mean education level of participants in our samples was 5.20 ± 3.14 years [from 1 year to 15 years]. In addition, 71.08% of patients could control PD by using less than two types of anti-Parkinson drugs. The mean Morisky Scale score was 5.75 ± 1.45 . The demographic details of the patients are given in Table 1.

Mobile phone possession and ways of obtaining PD information

Almost all repliers (96.08%, 196/204) had their own cell phones and most patients (65.19%, 133/204) claimed possession of smartphones and access to smartphones among households. According to our survey, 50.00% (102/204) of patients browsed the web, and 20.59% (21/102) of them preferred to use computers while 79.41% (81/102) of them preferred to use smartphones. Respondents claimed that their main sources of PD information were from clinic doctors (100%, 204/204), via a doctor and smartphone (15.20%, 31/204), or other media (7.43%, 16/204) (Fig. 1).

Willingness and attitudes towards the use of PD self-management APPs

Only 8.82% (18/204) of participants had learned about information of APPs for managing chronic diseases such as diabetes mellitus or hypertension[9, 12]. More than half of the surveyed patients replied that they would use APPs for PD self-management if they were provided for free and were useful and easy to operate, could remind taking medication on time, protect privacy and reduce economical and psychological burden. Results are shown in Table 2. Most importantly, participants had a more positive attitude toward using PD self-management APPs, if easy to operate.

Participants' interests in contents of smartphone APPs for PD management

Participants' interests in contents of smartphone APPs for PD self-management showed in Fig. 2. The percentages of patients interested in general PD information, interacting with doctor online, medication advice, symptoms recording and, Parkinson's disease education were 60.29%, 77.46%, 54.90%, 65.69% and 80.88%, respectively.

Characteristics of respondents with positive attitudes to using APPs

To weigh up which characteristic of patients distinguishes potential users better, correlations between every item related to patients and their attitudes towards smartphone APPs were analyzed. We chose the

survey item “I would try it out, if it were easy to operate.” to be measured, which is the key point concerning patients' benefits. Sociodemographic and clinical characteristics of participants were analyzed in Table 3. Among these patients, those who were more tend to use APPs were those who were younger, had higher education, had good medication adherence, browsed the web, had longer PD course and had worse conditions of PD [$P < 0.001$, $P = 0.001$, $P < 0.001$, $P = 0.041$, $P < 0.001$, $P = 0.01$]. There were no statistically differences between women and men ($P = 0.517$), resident location (urban and rural, $P = 0.795$), occupation (self-employer and stable work or retirees, $P = 0.478$) or drug intake number (no more than 2 and no less than 3 anti-PD drugs, $P = 0.162$) with respect to whether patients were glad to use it or not.

To further investigate the correlation between the characteristics of the above-discussed patients and APP acceptance, we performed a correlation analysis. The results suggest that the willingness to use APPs of patients to management PD is positively related to education level ($P < 0.001$). However, the age and PD course are negatively correlated with it ($P = 0.017$, $P < 0.001$), and MDS-UPDRS is uncorrelated ($P = 0.924$). Results are shown in Table 4.

Discussion

This study investigated the willingness of Parkinson's patients (primarily the elders) from various backgrounds using self-management APPs. Although the smartphone usage levels of the old have been still lower than of the younger, the aged would prefer to manage PD through the exclusive APPs. Therefore, using APPs for Parkinson's self-management is feasible.

In our study, 96.08% participants (196/204) owned mobile phones, and 67.35% ones (133/196) owned smartphones[20]. There are substantial patients using smartphones, but a few ones searching for PD information through their phones. Furthermore, m-Health and electronic health (e-Health) APPs for self-management of chronic disease both have been rapidly developed[8, 21], however, most patients still acquire information about PD by asking doctors at clinic in China. And few patients with PD had knowledge of smartphone APPs for self-management before being surveyed[22, 23]. Thus, the present study shows that the number of Parkinson's patients using smart phones is less than of the previous study[15]which may result from the perception and acceptance of the elders, who are vulnerable to PD, being lower. Therefore, in terms of older Parkinson's patients, the popularity of smartphones needs to be further boosted.

In regards to the content of smartphone APPs of PD self-management, patients are eager to gain access to Parkinson's disease education, recording their symptoms and communicating about their condition with doctor online by the APPs. And the appeals for the content of APPs can exactly reveal that there are shortage of general PD information, related medical education and communication with doctors in China. Furthermore, patients are in urgent need of the APP that can record both motor and non-motor symptoms to manage PD better. These may be just what Chinese Parkinson's patients need urgently.

Compared with the older participants, the younger, who are more tend to use the APPs for self-management, are more frequent web users with higher education standards and better medication compliance as well as longer PD courses and worse conditions of PD. And the reason why younger patients and the ones with higher education were more inclined to use the APPs may be that their perception and acceptance of smart devices can be higher. Namely, participants who often browse the web may have positive attitudes toward using the APPs because they are more familiar with Internet and could accept new things more easily. And the ones with longer PD courses and worse conditions of PD may prefer to use the APPs due to their need of professional platforms where they can get advice on how to manage and control PD. The finding was consistent with previous study of patients with epilepsy[24], but in contrast to the study of evaluating kidney transplant patients attitudes about using m-Health technology for managing and monitoring medication therapy, which indicates poor medication compliance or severe medication side effects have not an influence on patient's attitude to use m-Health[25]. Contradictorily, in our survey, patients with poor medication adherence were more likely to use APPs—to some extent, on account of their need of being supervised more conveniently in health care and having better access to the guidance of specialists via the exclusive Apps.

The study still has several limitations. Firstly, all patients with PD were recruited from a single location.in the future, a multi-center and large-sample experimental study will be supposed to be conducted. Secondly, this study investigated patients' attitudes toward smartphone APPs for PD self-management, without the feedback on the progress of use of the Apps in practice. Nonetheless, we have tried our best to apply the APPs to the management of patients with PD, and the technology would be supposed to be improved continuously.

Conclusion

In conclusion, this is an infrequency and significant study on practicability and acceptability of smartphone APPs for PD self-management among the elderly. The results indicated that a certain number of Parkinson's patients had already owned smartphones and suggested that APPs could provide a novel way for patients to manage their disease. The study also demonstrated that there was a positive attitude toward smartphone APPs for patients. Consequently, improving smartphones usage levels as well as developing practical and handy APPs would become a promising strategy for PD self-management.

Abbreviations

m-Health: mobile-health **e-Health:** electronic-health

SD: standard deviations **APPs:** applications

PD: Parkinson's disease **H & Y:** Hoehn & Yahr Stage

MMAS: Morisky Medication Adherence Scale

MDS-UPDRS: Movement Disorder Society-Unified Parkinson's disease rating scale

Declarations

Ethics approval and consent to participate

A verbal consent was obtained from each study participant and approved by the Research Ethics Committee of the Second Affiliated Hospital of Chongqing Medical University (No. (2019) No. 268).

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

None.

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Authors' contributions

Dezhi Yuan: Study design, data acquisition, statistical analysis, drafting of manuscript, and manuscript revision; Qiuye Zhao: Study design, data acquisition, statistical analysis, and significant review of the manuscript; Jie Hu: Statistical analysis, and significant review of the manuscript; Xuefei Wang: Data acquisition, and interpretation of study findings; Xiaotian Zhang: Study design, and data acquisition; Qihui Jiang: Design of this study, and data acquisition; Kuan Tian: Data acquisition, and drafting of manuscript; Ling Hu: Data acquisition, statistical analysis; Huirong Luo: Drafting of manuscript, and manuscript revision; Jing Li: Study design and manuscript revision; Jianhua Ran: Study design, interpretation of study findings, and manuscript revision; Jinfang Li: Study design, interpretation of the study findings, and significant review of the manuscript. All authors reviewed the manuscript for intellectual content, approved the final version, and agreed to be accountable for the work.

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Tables

The tables could not be attached here due to technical limitations. They can be found in the supplemental files.

Figures

Figure 1

The methods of obtaining Parkinson's disease information

Figure 2

Participants' interests in the contents of smartphone apps for PD self-management

Supplementary Files

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