

Research Article



Information Needed for Designing a Mobile Application for Increasing Physical Activity in Patients with Multiple Sclerosis

Shadi Khaleghdoust^{1*}, Marjan Ghazisaedi², Nastaran Ghotbi³

1. Medical Informatics, School of Allied Medical Sciences, Tehran University of Medical Sciences, Tehran, Iran.

2. Department of Health Information Management, School of Allied Medical Sciences, Tehran University of Medical Sciences, Tehran, Iran.

3. Department of Physiotherapy, School of Rehabilitation, Tehran University of Medical Sciences, Tehran, Iran.



Citation Khaleghdoust Sh, Ghazisaedi M, Ghotbi N. Information Needed for Designing a Mobile Application for Increasing Physical Activity in Patients with Multiple Sclerosis. Journal of Modern Rehabilitation. 2022; 16(3):222-227. <https://doi.org/10.18502/jmr.v16i3.10145>

<http://dx.doi.org/10.18502/jmr.v16i3.10145>

Article info:

Received: 19 Apr 2021

Accepted: 17 Jun 2021

Available Online: 01 Jul 2022

Keywords:

Multiple sclerosis; Mobile application; Physical activity; Information requirements

ABSTRACT

Introduction: Multiple sclerosis (MS) is a chronic degenerative autoimmune disease targeting the central nervous system, causing impairment in both physical and cognitive functioning. There is currently no cure for MS; its treatment is based on symptom management. One way for symptom management is to have physical activity which has been shown to reduce the number, length, and duration of disease relapse and remitting. The opportunities for mobile health use have increased significantly in recent years, largely due to technological advances in mobile applications. This study aims to determine the information needed for designing a mobile application to increase the physical activity of patients with MS.

Materials and Methods: This is a descriptive study that was done in two stages. Participants were a panel of experts. The data collection tool was a researcher-made questionnaire based on the Likert scale with confirmed validity and reliability (Cronbach's alpha=0.79). Items with an agreement percentage of 50% and more were identified as the required information for the application.

Results: The information requirement were the patient profile (consisted of demographic and clinical information) and application features including education section, physical activity library, reminder system, and fatigue assessment.

Conclusion: The needed information of this program were determined in 2 groups, profile section and app features; The patient's profile includes demographic and clinical information, and the system's features section includes the education section, the physical activity library, the reminder system and the fatigue assessment.

*** Corresponding Author:**

Shadi Khaleghdoust, MSc.

Address: Medical Informatics, School of Allied Medical Sciences, Tehran University of Medical Sciences, Tehran, Iran.

Tel: +98 (938) 5886033

E-mail: khaleghdoust.sh@gmail.com



Copyright © 2022 Tehran University of Medical Sciences. Published by Tehran University of Medical Sciences
This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International license (<https://creativecommons.org/licenses/by-nc/4.0/>).
Noncommercial uses of the work are permitted, provided the original work is properly cited.

1. Introduction

Multiple sclerosis (MS) is the most common central nervous system disorder [1], and a chronic disability with significant socioeconomic burden [2, 3]. In this disease, the myelin sheath of the cells in the central nervous system is progressively degraded [4]. This disrupts the transmission of nerve impulses and causes some muscles to lose their ability [5]. MS generally occurs at the age of 20-50 years [6]. The prevalence of MS in Iran was previously low, but studies have shown its increase in recent years [7]; the number of new MS patients was tripled from 2002 to 2008 in Iran [8]. There are about 70,000 patients with MS in Iran, caused Iran ranked first in the Middle East [9]. Although MS is one of the most common causes of disability in young people, the cause of this disease is still unknown. It is thought to be an immune system disorder caused by the combination of genetic susceptibility and environmental factors from birth to early adulthood [10]. There is no known cure for MS; the treatment of the disease is mainly done by reducing progression and controlling symptoms. Symptoms of MS may include (but are not limited to) muscle weakness, loss of coordination, cognitive impairment, vision problems, bowel and bladder problems, and other central nervous system disorders. The MS has different manifestations [11] which can severely affect the patients' quality of life. Therefore, it is essential that all possible measures be taken to slow down the progression and control the symptoms of MS to help improve the quality of life in the long run.

Disease management techniques primarily include medication and encouraging patients to change their lifestyle including physical activity. Physical activity has been proved to be an effective way to help manage the symptoms of MS [12]. Evidence suggests that patients with MS do not have enough physical activity [13, 14], but the advancement of technology has made it possible to have more physical activity [15]. The use of mobile devices for health care is known as mobile health (mHealth) [16]. Opportunities for mHealth have increased significantly in recent years, largely due to technological advances in mobile communications. For example, at the beginning of 2017, more than half of the world population used smartphones; approximately two-thirds of the world population owned mobile phones, and more than half of web traffic worldwide came through mobile phones [17]. Considering the chronic nature of MS and the importance of continuous treatment for this disease, the development of mobile applications

seems to be helpful. Since mHealth tools have the ability to facilitate the reception of treatments in patients with chronic diseases [18], this study aims to determine the information required for designing a mobile application to increase the physical activity of patients with MS. Results of this study can provide valuable information to help designers and developers of mHealth for MS.

2. Materials and Methods

This is a descriptive study. In order to extract the necessary data, a search was conducted in databases of PubMed, Web of Science, Scopus, Embase using the keywords: Multiple Sclerosis, Physical activity, Information Needs, and Mobile application without considering a time limit. The data extracted by the review of studies and library resources were used in developing a researcher-made questionnaire to survey the opinions of experts. The items were rated on a 5-point Likert scale from 0 (strongly disagree) to 5 (strongly agree). This questionnaire was designed in two parts (Patient profile and application-related information) and had a total of 40 questions with an ability to be answered by providing descriptions. The face validity of the questionnaire was confirmed by five experts in health information management and physiotherapy. The reliability was confirmed by obtaining a Cronbach's alpha of 0.79.

The research was conducted in the School of Rehabilitation Sciences at Tehran University of Medical Sciences and Ibn Sina Hospital Rehabilitation Center in Tehran, Iran. These centers had specialized physiotherapy for MS patients and a large number of MS patients in Tehran are admitted. The inclusion criteria for the participants were availability, work experience in the field of MS, and willingness to participate in the study. In this regard, 16 physiotherapists were selected to complete the questionnaire from the physiotherapy clinics of mentioned centers. The study objectives were explained to them, and they were assured of the confidentiality of their information. Finally, the questionnaires were completed on the same day. The collected data were described using descriptive statistics (frequency) in SPSS v. 22 software. The information with at least 50% necessary elements according to experts and the research team were finally selected.

3. Results

The characteristics of physiotherapists participating in the survey including gender, age, years of work experience, and educational degree are presented in Table 1. Most of

Table 1. Demographic characteristics of participants

Characteristics		No. (%)
Gender	Female	11(69)
	Male	5(31)
	Total	16(100)
Age (y)	<30	4(25)
	31-40	5(31)
	41-50	2(12.5)
	>50	5(31)
	Total	16(100)
Years of work	<5 years	7(43)
	5-10 years	4(25)
	11-15 years	1(7)
	>15 years	4(25)
	Total	16(100)
Educational level	Bachelor's degree	5(31)
	Master's degree	4(25)
	PhD	7(7)
	Total	16(100)

JMR

them were female with a mean age of 38 years, a mean work experience of 10 years, and with a PhD degree.

In the patient profile section, all patient's information including name, year of birth, gender, place of birth, occupation, marital status, income level, covered insurance, living status [at home with family, at home alone, at home with a caregiver, living in nursing homes], education, height, weight, duration of MS, type of MS, symptoms, medications, comorbid diseases, and family history of MS were questioned, in addition to the information related to the necessary features and abilities of the application including patient education, exercise techniques, reminder, and fatigue measurement. The physiotherapists' percentage of agreement with these information are presented in [Table 2](#).

As can be seen from [Table 2](#), in the patient profile section, all items obtained the required score from the physiotherapists in terms of importance. In this section, the average percentage of agreement was 85% for the

demographic data and 97% for the clinical data. The overall percentage of agreement for the patient profile section was 90%. Regarding the application features, all items also obtained the required score from the physiotherapists in terms of importance. In this section, the average percentage of agreement for the patient education data was 93.75%; for the exercise techniques data, 93.75%, for the reminder data, 96.25%; and for the fatigue measurement data, 96.8%. The overall percentage of agreement was 95%. Analyzes performed on the questionnaire to assess the information indicated that almost all information were selected correctly.

4. Discussion

The first step in designing a mobile application to increase the physical activity of patients with MS is to identify the needs of users and the required features of the application. In this regard, this study attempted to survey the needed information for a mobile application to increase the physical activity of patients with MS in

Table 2. Data required for designing a mobile application for MS patients

Sections	Items	Percentage Agreement	
Patient profile	Demographic data	First and last name	75
		Year of birth	100
		Gender	100
		Place of birth	87.5
		Occupation	100
		Marital status (single, divorced, married, widow/widower)	81
		Income level (low, medium, high)	81
	Clinical data	Insurance covered	56.25
		Living conditions (at home with family, at home alone, at home with a caregiver, living in nursing homes)	81
		Education al level	93.75
		Height	81
		Weight	100
		Duration of MS	100
		Type of MS (Unknown, RRMS, SPMS, PPMS, PRMS)	100
Application features	Patient education	Symptoms (fatigue, dizziness, blurred vision, diplopia, tingling in the limbs, movement disorders, difficulty with urination and defecation, imbalance)	100
		Used medications	100
		Comorbidities	100
	Exercise techniques	Family history of MS (grade 1, grade 2, grade 3)	100
		Familiarity with MS	93.75
		Familiarity with treatment methods	100
		Familiarity with physical activity (including general and disease-specific instructions)	100
		Access to educational and scientific articles	81
	Reminder	How to evaluate the patient	81
		Stretching exercises	93.75
Strengthening exercises		93.75	
Fatigue as- essment	Balance exercises	100	
	Aerobic exercises	100	
	Necessary reminder to take medicine	100	
	Necessary reminder to do exercises	73.75	
	Necessary reminder to visit the doctor	73.75	
	Motivating and relaxation quotes	100	
	Targeted activities	93.75	
	Fatigue measurement	100	
	Display of fatigue level	93.75	

the form of mobile health. Survey results showed that these information included patient profile [demographic and clinical data], patient education, exercise techniques, reminder, and fatigue assessment.

Considering that patient education plays an important role in the management of chronic diseases that can cause disability and psychological and social problems, one of the features that should be used in mobile applications is the patient education. A study was conducted in Sweden for developing an educational program to improve the patients' abilities. They suggested that patient education plays an important role in the management of MS [19].

Physical activity is one of the most important needs of people with MS, which can reduce their fatigue and improve their quality of life. The rehabilitation techniques used by health care providers in patients with MS are not enough to meet these patients' needs. These patients need information and knowledge about the benefits of exercise and physical activity, new techniques for workout at home and in treatment centers, and equipment for performing and maintaining exercises. The use of mobile phone technologies for health and fulfilling the potential needs of users has received great attention in recent years. A study on exploring the needs of people with MS for mhealth solutions showed that the desired mhealth features to increase physical activity include: the ability to track activity, the ability to encourage a person to complete a task or goal, the ability to customize goals, and the use of games [20].

Another feature that should be considered in mhealth applications is the reminder system. Drug reminder feature is very important in self-care management, because cognitive impairment is one of the symptoms of MS that occurs in some patients depending on the location of lesions. This symptom may interfere with the patient's memory and cause the patient to forget their medication. As a result, the development of drug reminder application for these patients may be an innovative solution to their problems [21-23]. In 2015, a study was conducted in the UK about reminder apps to help people with brain injuries do their daily chores. In this study, a mobile app was designed that reminded them of their activities [24]. This study indicated the importance of reminder apps. Of course, it should be noted that patients and their target audience in this study were people with brain injuries. A medical reminder app can be used by different individuals including patients, parents, specialists and caregivers. Reminder apps are used to notify people to take their pills, meals, walking, exercise, visit the doctor, etc. Data stored in reminder app can help caregivers

remember things [25]. According to a study by Kendall et al., the use of reminder apps can help manage daily activities and future health [26]. Fatigue is one of the most common debilitating symptoms in people with MS [27]. Fatigue management is one of the basic needs of people with MS. Evidence shows that the use of mobile apps for energy management in patients can significantly reduce their fatigue and increase their satisfaction [28]. This feature allows the user to access information and tools that measure the level of fatigue, and use it to adjust their physical activity. One of the limitations of this study was the physiotherapists' lack of familiarity with the potential of mhealth, which was solved by giving explanations to them.

5. Conclusion

Since the specific needs of MS patients regarding physical activity and physiotherapy have not yet fully met, it can be said that the present tools are not able to meet the needs of patients with MS. By solving their problems with exercise and physical activity using mobile applications, exercise can become a routine and attractive task at home for them. The development of mobile applications for physical activity of MS patients is recommended to increase their quality of life and reduce the complications of the disease.

Ethical Considerations

Compliance with ethical guidelines

This research was approved by the Ethics Committee of [Tehran University of Medical Sciences](#) (Code: IR.TUMS.SPH.REC.1397.292).

Funding

This article was extracted from a master thesis in Medical Informatics for [Tehran University of Medical Sciences](#). This research did not receive any grant from funding agencies in the public, commercial, or non-profit sectors.

Authors' contributions

Designed and conducted the study, collected and analyzed the data, and drafted the manuscript: Shadi Khaleghdoust; Participated in data collection, analysis, and interpretation: Marjan Ghazisaeedi and Nastaran Ghotbi; Read and approved the final manuscript: All authors.

Conflict of interest

The authors declared no conflict of interest.

Acknowledgments

The authors would like to thank all physiotherapists of Ibn Sina Hospital and the School of Rehabilitation Sciences, Tehran University of Medical Sciences for their cooperation.

References

- [1] Oh J, Vidal-Jordana A, Montalban X. Multiple sclerosis: clinical aspects. *Current Opinion in Neurology*. 2018; 31(6):752-9. [DOI:10.1097/WCO.0000000000000622] [PMID]
- [2] Saei M, Holakouie-Naieni K, Mostafavi E, Sahraian MA, Mahmoodi M, Mansournia MA, et al. Spatial analysis of multiple sclerosis disease in Tehran Metropolitan Zone, Iran, 2001-2012. *Iranian Journal of Public Health*. 2014; 43(5):621-9. [PMID]
- [3] Pugliatti M, Rosati G, Carton H, Riise T, Drulovic J, Vécsei L, et al. The epidemiology of multiple sclerosis in Europe. *European Journal of Neurology*. 2006; 13(7):700-22. [DOI:10.1111/j.1468-1331.2006.01342.x] [PMID]
- [4] Karpatkin HI. Multiple sclerosis and exercise: A review of the evidence. *International Journal of MS Care*. 2005; 7(2):36-41. [DOI:10.7224/1537-2073-7.2.36]
- [5] Wu N, Minden SL, Hoaglin DC, Hadden L, Frankel D. Quality of life in people with multiple sclerosis: Data from the Sonya Slifka Longitudinal Multiple Sclerosis Study. *Journal of Health and Human Services Administration*. 2007; 30(3):233-67. [PMID]
- [6] McAlpine D, Compston A, McDonald IR, Lassmann H, Confavreux C, Noseworthy J, et al. *McAlpine's multiple sclerosis*. Amsterdam: Elsevier Health Sciences; 2005. [Link]
- [7] Etemadifar M, Janghorbani M, Shaygannejad V, Ashtari F. Prevalence of multiple sclerosis in Isfahan, Iran. *Neuroepidemiology*. 2006; 27(1):39-44. [DOI:10.1159/000094235] [PMID]
- [8] Sahraian MA, Khorramnia S, Ebrahim MM, Moinfar Z, Lotfi J, Pakdaman H. Multiple sclerosis in Iran: A demographic study of 8,000 patients and changes over time. *European Neurology*. 2010; 64(6):331-6. [DOI:10.1159/000321649] [PMID]
- [9] Raeisi R, Noghsan Mohammadi M, Almodaresi S. [Determination of spatial and temporal distribution of MS patients in Kerman (Persian)]. *Health_Based Research*. 2017; 3(3):217-26. <http://hbrj.kmu.ac.ir/article-1-187-en.html>
- [10] Olsson T, Barcellos LF, Alfredsson L. Interactions between genetic, lifestyle and environmental risk factors for multiple sclerosis. *Nature reviews Neurology*. 2017; 13(1):25-36. [PMID]
- [11] Coyle PK, Hamaad M. Multiple sclerosis. In: *Neurologic diseases in women*. Kaplan PW, editor. New York, NY Springer Publishing Company; 2005. [Link]
- [12] Motl RW, Pilutti LA. The benefits of exercise training in multiple sclerosis. *Nature Reviews Neurology*. 2012; 8(9):487-97. [PMID]
- [13] Motl RW, McAuley E, Snook EM. Physical activity and multiple sclerosis: A meta-analysis. *Multiple Sclerosis*. 2005; 11(4):459-63. [DOI:10.1191/1352458505ms1188oa] [PMID]
- [14] Motl RW. Lifestyle physical activity in persons with multiple sclerosis: The new kid on the MS block. *Multiple Sclerosis*. 2014; 20(8):1025-9. [DOI:10.1177/1352458514525873] [PMID]
- [15] Motl RW, Dlugonski D, Wójcicki TR, McAuley E, Mohr DC. Internet intervention for increasing physical activity in persons with multiple sclerosis. *Multiple Sclerosis*. 2011; 17(1):116-28. [DOI:10.1177/1352458510383148] [PMID]
- [16] Ryu S. Book review: mHealth: New horizons for health through mobile technologies: Based on the findings of the second global survey on eHealth (global observatory for eHealth series, volume 3). *Healthcare Informatics Research*. 2012; 18(3):231-3. [PMCID]
- [17] Kemp S. Digital in 2017: Global Overview [Internet]. 2017 [Updated 2017 January 25]. Available from: <https://wearesocial.com.sg/blog/2017/01/digital-in-2017-global-overview/>
- [18] Hamine S, Gerth-Guyette E, Faulx D, Green BB, Ginsburg AS. Impact of mHealth chronic disease management on treatment adherence and patient outcomes: A systematic review. *Journal of Medical Internet Research*. 2015; 17(2):e52. [PMID] [PMCID]
- [19] Landtblom AM, Lang C, Flensner G. The study circle as a tool in multiple sclerosis patient education in Sweden. *Patient Preference and Adherence*. 2008; 2:225-32. [PMID] [PMCID]
- [20] Giunti G, Kool J, Rivera Romero O, Dorronzoro Zubiete E. Exploring the specific needs of persons with multiple sclerosis for mHealth solutions for physical activity: Mixed-methods study. *JMIR mHealth and uHealth*. 2018; 6(2):e37. [PMID]
- [21] Learmonth YC, Adamson BC, Balto JM, Chiu Cy, Molina-Guzman I, Finlayson M, et al. Multiple sclerosis patients need and want information on exercise promotion from healthcare providers: A qualitative study. *Health Expectations*. 2017; 20(4):574-83. [PMID] [PMCID]
- [22] Tonheim AN, Babic A. Assessing information needs for a personal multiple sclerosis application. *Studies in Health Technology and Informatics*. 2018; 247:486-90. [PMID]
- [23] Costello K, Kennedy P, Scanzillo J. Recognizing nonadherence in patients with multiple sclerosis and maintaining treatment adherence in the long term. *The Medscape Journal of Medicine*. 2008; 10(9):225. [PMID]
- [24] Jamieson M, McGee-Lennon M, Cullen B, Brewster S, Evans J. Issues influencing the uptake of smartphone reminder apps for people with acquired brain injury. In: *Proceedings of the 17th International ACM SIGACCESS Conference on Computers & Accessibility 2015 Oct 26 (pp. 339-340)*. <https://dl.acm.org/doi/abs/10.1145/2700648.2811368>
- [25] Reiner NL, Fischer HR, inventors; Reiner, Nobert Leo, Fischer, Helaine Reiner, assignee. Care giver data collection and reminder system. United States patent US 5,691,932; 1997. <https://patents.google.com/patent/US5691932A/en>
- [26] Kendall L, Eschler J, Lozano P, McClure JB, Vizer LM, Ralston JD, et al. Engineering for reliability in at-home chronic disease management. *Annual Symposium Proceedings. AMIA Symposium*. 2014; 2014:777-86. [PMID]
- [27] Ghotbi N. Fatigue in Iranian patients with neurological conditions: An assessment with Persian Fatigue Severity Scale. *Health Science Journal*. 2013; 7(4). [Link]
- [28] Gamueda MA, Grant J, Ortega A, Song J. Managing fatigue with technology for individuals with multiple sclerosis. *Student Research Posters*. 2017; 58. [DOI:10.33015/dominican.edu/2017.OT.RP.22]