

The effect of an android-based application on the knowledge of the caregivers of children with cerebral palsy

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Abstract

Background: Mobile health and e-learning may have a significant impact on training patients, physicians, students and caregivers. This study aimed to evaluate the effect of using an educational mobile application on the knowledge of the caregivers of children with cerebral palsy (CP).

Methods: We used a previously developed mobile application. The knowledge of 17 caregivers of children with CP (including parents) about the daily care of their children was evaluated through a self-assessment and a test with multiple-choice and true-false questions. Next, the application, which included several educational modules for the daily care of the children with CP, was given to the caregivers to use continually for two months. After this period, the knowledge of the caregivers was evaluated by the same tools. Data analysis was performed by SPSS-16, using paired-sample t-test or Wilcoxon test.

Results: The effect of the use of this educational application on the knowledge of caregivers in all childcare domains, except for eating, was reported to be significant ($p < 0.05$). Furthermore, the results of the multiple-choice test revealed that this application increased the knowledge of caregivers in all domains except playing ($p < 0.05$).

Conclusion: Training through novel technologies such as Smartphone along with their applications can improve the knowledge of caregivers about the daily care of children with cerebral palsy.

Keywords: Mobile Health, Smartphone, Cerebral Palsy, E-learning, Knowledge, Children, Parenting.

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Introduction

Cerebral palsy (CP) is one of the most common causes of disability in children (1). This disease includes a group of motor development and postural disorders that are created due to non-progressive brain damage during embryonic development in the first four weeks after birth or neonatal period, and results in a series of neurological, motor and postural impairments in children, which are continued throughout their life (1-4). The incidence rate of CP has been estimated to be 1.4-2.4 per 1,000 births worldwide and 2.06 per 1,000 births in Iran

(5-7).

Cerebral palsy affects the “activities of daily living” (ADLs) of children like “toileting”, “clothing”, “eating”, “bathing”, etc. and reduces their participation in such activities (8). These limitations force parents to provide a long time/lifelong care, which influences their lives. The care, most often provided inappropriately, prevents the child from normal development. On the other hand, teaching caregivers how to provide care for children with CP is very important to prevent the physical and mental complications of the disorder. Caregivers,

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using a right handling method, may reduce the intensity of abnormal patterns and improve the child independence in ADLs. In addition, teaching self-care practices such as “eating”, “clothing”, etc. improves the caring patterns, reduces the physical pressures imposed on the caregivers and improves muscular-skeletal pains in caregivers (9,10).

Mobile health (M-health), providing users with a wide range of features, has made a revolution in people's quick access to information worldwide. Global statistics shows that one in every five people around the world has a smartphone (11-14). Moreover, using cell phones has been recognized to be useful in training patients to control chronic diseases (15-18).

Considering the novelty and the increasing use of mobile applications in training physicians, patients and caregivers, in addition to the necessity of training caregivers of children with CP, the researchers developed a mobile application (19). However, its effect was not evaluated. Therefore, this study was conducted to evaluate the effect of using this mobile application on the knowledge of caregivers of children with CP.

Methods

Description of the Application

In this study, the effect of an Android application on the knowledge of caregivers of children with cerebral palsy was evaluated. The researchers of this study developed this application iteratively in several phases following a needs assessment of the caregivers of children with CP. The potential users of application and experts participated in all stages of the development. This application was developed using the free version of IntelliJ IDEA (Version 13) software for Android operating system (available from: <http://www.jetbrains.com/idea/>). This application includes the following educational modules: “Feeding”, “toileting”, “bathing”, “playing”, “handling and movement” (19). All educational materials, which were developed as texts and images in the applica-

tion, were extracted from a local educational guideline entitled “Learn More about Children and Do Better: For Children with Cerebral Palsy” (20). The complete description of needs assessment and the developed application, including the above-mentioned educational modules, have been described formerly (19). Figures 1 and 2 display some parts of the final developed application.



Fig. 1. Home Page of the Application (in Persian)



Fig. 2. A Screenshot of the Developed Application (in Persian)

Evaluation of the Application

This evaluation was conducted as a before-after study. We recruited all the caregivers of children with CP, who were admitted to Noor-e-Omid occupational therapy center in the time period of the study (two months) in 2015. This center is under the supervision of Tehran University of Medical Sciences (TUMS) in Tehran, Iran. We considered the following inclusion and exclusion criteria: Those caregivers who participated in different stages of the development of this application were excluded for the current evaluation, and only those caregivers who did not use this application before were included. Other inclusion criteria consisted were as follows: 1) A confirmed diagnosis of the child with CP by a pediatric neurology subspecialist; 2) Minimum literacy of reading and writing for the main caregiver of the child; 3) Tendency to cooperate and sign a written consent form by the caregiver; and 4) Having a smartphone with Android operating system for the caregiver. All the caregivers who met the above-mentioned criteria were invited through a convenience sampling method; of the caregivers, 20 provided a written consent to participate. During the study, three caregivers dropped out of the study for some personal reasons such as changing the healthcare provider. Therefore, the study was carried out with 17 participants.

Using a demographic questionnaire, the background data of the children and caregivers were collected. Then the knowledge of the caregivers about the correct daily care of the children with CP was evaluated by a two-part questionnaire. The first section (self-assessment) included five questions asking the caregivers to self-assess their knowledge of different aspects of daily care ("feeding", "toileting", "bathing", "playing", "handling and movement") of the children with CP. Responses were based on a five-point Likert scale, from very much to very little. The second section of the questionnaire comprised of 19 items: 10 true-false items, and nine multiple-

choice items (with only one correct answer). The questions of this section were taken from a knowledge assessment questionnaire developed by Razavi Afzal et al. (9). This tool was developed to assess the caregivers' knowledge about providing special care for children with CP, and was validated in rehabilitation centers in Tehran (9). We reviewed this tool and extracted appropriate questions based on the content of the application (questions about feeding, toileting, bathing, playing, handling and movement). The content of our questionnaire was validated by the application developers (the research team included two experts in developing and evaluating health information technology, the person who was the author of the local guideline developed the content of the application and was an expert in CP education) as well as one expert in health information technology out of the research team. The reliability of the questionnaire was assessed by Cronbach's alpha ($\alpha=0.88$).

This questionnaire was given to the caregivers prior to using the application. After they completed the questionnaire, we installed the application on their smartphones and instructed them how to use it. We asked the participants to use the application regularly for two months. The participants could contact the researchers through e-mail or telephone in case of facing any problem or a question about the application. After two months, the same questionnaire was given to the participants to be completed again. In coordination with the caregivers, we determined the time for installation of the software and the questionnaire distribution. All of the questionnaires were given to the caregivers in the clinic at the time of the children's visits.

To analyze the data concerning the self-assessment of knowledge, the scores of 1-5 were allocated to the answers for each question: Score 5 was for "very much" and score 1 for "very little". To analyze the data of the second part of the questionnaire, correct responses were given 1 point and false responses were given 0 point. Then, the

mean and standard deviation of the scores before and after using the application were calculated. Normality of data was evaluated by Kolmogorov-Smirnov test. In the case of normality of data, paired-sample t-test and in the case of non-normal data, Wilcoxon test were applied to analyze the effect of using this application. All statistical analyses were performed by SPSS (Version 16) software and $p < 0.05$ was considered as statistically significant.

With respect to ethical considerations, written consent forms were signed by the participants in all stages of the study, and an attempt was made not to interfere with the treatment process of the children. In addition, the participants were assured they could withdraw from the study at any moment without any concern about the treatment process of their children. The use of application was free of charge in all stages of the study. In addition, this study was approved by Tehran University of Medical Sciences (280/3/6 /58).

Results

Seventeen caregivers of children with CP (Three girls and 14 boys, aged 2-10 years) participated in this study. Among the caregivers, 82.2% ($n=15$) were female. Of the participating children, 29.4% ($n=5$) were in the level III of GMFCS E&R, 29.4% ($n=5$) in the level V, 17.6% ($n=3$) in the level IV,

17.6% in the level I and 6% ($n=1$) were in the level II.

The results of the self-assessed knowledge level before the use of application indicated that the highest rate of perceived knowledge (3.41 ± 0.87) was reported for "feeding" and the minimum rate (2.58 ± 0.79) was reported for "handling" (Table 1). The findings obtained after the use of application showed the maximum level of perceived knowledge for "handling" (4.05 ± 0.65). Based on the self-assessment, using this educational application increased caregivers' perceived knowledge in almost all domains including "toileting", "bathing", "handling" and "playing" ($p < 0.05$); only the increased knowledge about "feeding" was not found to be statistically significant ($p > 0.05$).

As for the multiple-choice and true-false questions, the results obtained before the use of application indicated the maximum level of knowledge for "handling" (4.11 ± 1.36), and the minimum level for "playing" (0.647 ± 0.492); moreover, the results acquired after the use of the application showed the maximum rate of knowledge for "handling" (5.82 ± 0.528) (Table 2). According to Table 2, the use of this application was shown to significantly increase the knowledge of caregivers in the domains of feeding ($p=0.007$), toileting ($p < 0.0001$), bathing ($p=0.001$) and han-

Table 1. Comparison of the Mean Scores of Self-Assessment of the Caregivers about their Knowledge of the Care for Children with Cerebral Palsy before and after the Use of the Application

Items	Before (Mean score \pm SD)	After (Mean score \pm SD)	Difference	p*
Feeding	3.41 ± 0.87	3.88 ± 0.69	+0.47	0.41
Toileting	2.82 ± 1.28	3.82 ± 0.80	+1	0.005
Bathing	3.17 ± 1.07	3.82 ± 0.72	+1.47	0.017
Handling and movement	2.58 ± 0.79	4.05 ± 0.65	+1.47	<0.0001
Playing	2.64 ± 0.99	3.76 ± 0.75	+1.12	<0.0001

*P-value was calculated by paired-sample t-test.

Table 2. Comparison of the Scores of the Caregivers' Correct Responses to the Questions about the Daily Care for Children with Cerebral Palsy before and after the Use of the Application

Items#	Before (Mean score \pm SD)	After (Mean score \pm SD)	Difference	p*
Feeding (5)	3.58 ± 1.17	4.58 ± 0.618	+1	0.007
Toileting (5)	2.88 ± 0.26	4.23 ± 0.831	+1.35	<0.0001
Handling and movement (6)	4.11 ± 1.36	5.82 ± 0.528	+1.71	<0.0001
Bathing (2)	0.76 ± 0.492	1.64 ± 0.492	+0.88	0.001
Playing (1)	0.647 ± 0.492	0.941 ± 0.242	+0.294	0.25

*P-value was calculated by paired-sample t-test and Wilcoxon test.

#The figures in parentheses indicate the number of questions and maximum score.

dling ($p < 0.0001$). However, the use of application did not increase the knowledge of caregivers significantly in the domain of playing ($p = 0.25$).

Discussion

This study evaluated the effect of an educational Android-based application on the knowledge of caregivers of children with CP through self-assessment as well as a test of multiple-choice and true-false questions. The results of the caregivers' knowledge assessment via the self-assessment indicated that most of them had average knowledge about all domains of childcare before using the application; this finding is in line with the results of the study by Razavi Afzal and Farzi (1,9). The caregivers reported the minimum level of knowledge for the domain of playing. This domain of care had not been considered much in previous studies (9). After using the application, the self-assessed knowledge of caregivers in most domains increased significantly. That is, the use of application increased the knowledge of caregivers in most of the domains.

As for toileting ($p < 0.005$), bathing ($p = 0.017$) and playing domains ($p = 0.0001$), the effect of this educational application on the knowledge of caregivers was found to be statistically significant, which is in agreement with the results of Farzi and Karande, indicating the significant efficacy of teaching the caring principles of children with cerebral palsy to caregivers (1,21). Furthermore, the results of this study revealed that the use of application did not significantly increase the knowledge of caregivers about feeding the children with CP ($p = 0.41$). This could be due to the fact that the caregivers enjoyed a favorable status in terms of feeding the child prior to the use of application. The caregivers reported an average and good level of knowledge about feeding, and none of them had selected the "very little" option. In the study of Razavi Afzal et al. it was found that feeding is one of the domains on which families have been trained in rehabilitation clinics,

even inconsistently (9). According to the study of Razavi Afzal et al., it can be concluded that the caregivers' perception of high level of knowledge about "feeding" is the cause of ineffectiveness of using this application in increasing their knowledge of feeding, expressed through self-assessment.

The findings of this study indicated that most of the caregivers did not have a high level of knowledge about the caring methods of children with CP, which is in line with the findings of Razavi Afzal and Farzi et al., showing that the majority of the mothers of children with CP were not much aware of the childcare methods (1,9). Additionally, the findings showed that the use of application significantly increased the knowledge of caregivers in feeding, toileting, and bathing domains. This result is in agreement with the findings of the study by Farzi et al., in which the knowledge of mothers was enhanced after participating in an educational program, as well as the results of Karande et al., which demonstrated the positive effect of an educational program on the knowledge of caregivers of children with CP (1,21). The studies carried out on the effect of other educational applications have yielded similar results. For example, the study of Silveria et al. showed that using the tablet-based application motivates the elderly to follow personal educational programs at home independently, and positively changing their behavior towards their physical activities (17).

In addition, the results of this study revealed that the use of this application did not have a significant impact on the knowledge of caregivers in the "playing" domain ($p > 0.05$). Based on the reports by some users, due to the inadequacy of the scientific recommendations for this domain, the users were not able to use the "playing" module sufficiently, and their knowledge was not significantly increased as a result. This confirms the study by Razavi Afzal et al. in which the caregivers did not use and pay attention to the presented education about "playing" (9). According-

ly, the practical guide of this domain should be designed comprehensively to improve its impact on the knowledge of the users.

Some limitations for this study should be considered. We were able to invite only 20 caregivers who consented to participate in the study, but three of them did not complete the study. Therefore, the sample size was a limitation. Although we could show the positive effect of this application on caregivers' knowledge, conducting studies with larger sample sizes is highly recommended.

Conclusion

The use of an educational mobile application by the caregivers of children with CP positively increased their knowledge of appropriate daily care for children. Accordingly, the use of this application helps the caregivers of children with CP to access the required information about critical childcare at anytime and anywhere and to better deal with childcare management. Therefore, this application can be used as a supplement along with other treatment and rehabilitation practices of children with CP.

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