Using mobile applications in the process of enhancing and restoring abilities in individuals with intellectual disability and other disabilities – a literature review

Piotr Korczak* A-D, Anna Zwierzchowska E-F

Jerzy Kukuczka Academy of Physical Education, Katowice, Poland

Abstract

Over the past few years technology especially mobile technologies have advanced significantly, while the cost of using mobile devices have decreased considerably. It is believed that this rapid technological evolution can provide an excellent opportunity to improve the independence of a handicapped person. However, it can also be a source of social exclusion. Certain obstacles such as inadequate built-in accessibility options can limit the use of smart devices amongst this vulnerable group of people. Therefore, functionality and practicality of mobile phones should be taken into consideration. The aim of this review was to determine whether mobile applications are used in the process of monitoring the physical activity, rehabilitation and education of a person with intellectual and/or other disabilities. To examine this issue we reviewed various literature extracts: we used the databases from the National Center for Biotechnology Information (NCBI) focused on PubMed database. According to the method of finding and selected results, we qualified for further analysis of the results, which showed up when searched for key words and expressions (mobile applications, disability, rehabilitation, intellectual disability). We found 115 scientific articles. From this sample, we selected 23 articles related to our study. A significant proportion of the studies carried out seem to confirm that the use mobile applications attempt to support the rehabilitation process of a person with a disability.

Keywords: smartphone, rehabilitation, modern technologies, ipad, tablet

Introduction

Mobile technologies have become ubiquitous. The number of mobile device users and the number of applications offered are growing worldwide. Nowadays almost every resident of the European Union has access to the Internet. Most of the users connect to the Internet via a mobile phone or a smartphone [1] – a device which offers multiple practical functions, such as a compass, an accelerometer, a gyroscope, a GPS receiver, etc. Mobile phones are widely used and they are well integrated into the everyday life of a young person. This is due to the wide range of applications that allow us to monitor our physical activity, lifestyle or diet.

These amenities in smartphones can be useful not only for communication and entertainment, but also prove more accessible and open new opportunities for people with disabilities. Furthermore, this positively

This is an Open Access journal, all articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International (CC BY-NC-SA 4.0). License (http://creativecommons.org/licenses/by-nc-sa/4.0/).
influences the process of adaptation of disabled individuals into the society.

A review of literature, based on this topic, has shown an increase of interest in the use of mobile phones by adults with intellectual disabilities [2]. Studies evaluating the use of mobile devices, such as the iPad, have found that people with intellectual and developmental disabilities use them, too [3–5].

It has been concluded that mobile devices are useful in monitoring health, physical activity, and therapy. There are considerable advantages of monitoring health through mobile devices: evaluating symptoms in real time, personalized feedback, opportunities for support, constant supervision of treatment, mobility and flexibility of use, and the potential for improved treatment [5]. It has been found that hand held electronic devices show potential in practical teaching of students with disabilities and enhancing their independence by allowing them to freely communicate via social media and accessing public places by showing them alternative routes that are suitable for their disability [4].

The aim of this literature review was to determine whether mobile applications can be used in the process of monitoring, rehabilitation and education of people with intellectual disabilities and with other disabilities. We have assumed that the widespread mobile technology development impacts significantly the use of mobile applications in monitoring, rehabilitation and education of a person with a disability.

Material and methods

According to the assumptions, we searched the PubMed database: US National Library of Medicine – National Institutes of Health. We used methods of data mining. The obtained results were searched through the use of key words and expressions: “mobile applications”, “disability”, “rehabilitation”, “intellectual disability”. The publications date back 10 years.

Results

From 115 results obtained from the Pub Med platform, we chose 23 articles linked to the study topic. We classified and categorized the studies into tables, taking into consideration the control group, Table 1 and Table 2. Our analysis of the PubMed literature showed an increase of studies published on mobile applications.

Tab. 1. Using mobile applications to work with people with disabilities – PubMed platform publications 2010–2020

<table>
<thead>
<tr>
<th>Author</th>
<th>Paper description</th>
<th>Study population*</th>
<th>Method*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kagohara 2013</td>
<td>Supporting the teaching process of people with disabilities using iPods and iPads</td>
<td>Persons with developmental disabilities (n = 47)</td>
<td>LR</td>
</tr>
<tr>
<td>Rand et al. 2015</td>
<td>Rehabilitation with the use of tablets, for patients with self-training impaired dexterity post stroke</td>
<td>Patients after stroke (n = 40)</td>
<td>ICS</td>
</tr>
<tr>
<td>Halim Z et al. 2015</td>
<td>Mobile application for hand gesture recognition system for patients with hearing impairment (n = 10)</td>
<td>Patients with hearing impairment</td>
<td>E</td>
</tr>
<tr>
<td>Gower et al. 2015</td>
<td>Creating new opportunities for people with disabilities</td>
<td>Persons with disabilities</td>
<td>ICS</td>
</tr>
<tr>
<td>Gray et al. 2016</td>
<td>Advances in e-health for people with complex care needs.</td>
<td>–</td>
<td>E</td>
</tr>
<tr>
<td>Rinne et al. 2016</td>
<td>Low cost technology access, mobile games for self-rehabilitation of arm disability post stroke</td>
<td>Patients after stroke (n = 345)</td>
<td>E</td>
</tr>
<tr>
<td>Ozinga et al. 2017</td>
<td>Determining postural stability in patients with Parkinson’s disease</td>
<td>Patients with Parkinson’s disease</td>
<td>E</td>
</tr>
<tr>
<td>Coutinho et al. 2017</td>
<td>Efficiency of iPad applications for visual and motor skills for children with special needs aged 4–10 months to 7 years (n = 20)</td>
<td>Children with special educational needs</td>
<td>O</td>
</tr>
<tr>
<td>Nüssli et al. 2020</td>
<td>Using mobile applications to motivate children in therapy</td>
<td>Children with disabilities</td>
<td>E</td>
</tr>
<tr>
<td>Neugebauer 2020</td>
<td>Navigation aid for blind persons by mobile application</td>
<td>Blind people (n = 7)</td>
<td>E</td>
</tr>
</tbody>
</table>

*Experiment – (E), Literature review – (LR), Individual case study – (ICS), Observation – (O), Special educational needs – (SPE), Intellectual disability – (NI).
in the context of intellectual disability. Almost all research teams presented positive effects of using modern technologies related to mobile applications in the rehabilitation of people with disabilities. In their studies, authors focused on the implications of creating new tools that support rehabilitation, programs of physical rehabilitation, activities and games dedicated to children and adolescents. Their aim was to enhance ability and compensate for deficits. All studies, we analyzed, concluded that mobile applications had a positive effect in therapy.

**Discussion**

Our results showed that mobile applications and their use in medical sciences have only recently started to become an area of interest to researchers. Numerous studies on this topic have been published after 2015, while before that year very few studies have been presented on PubMed. This trend can be confirmed by the results I have obtained. We found that most of the papers published on PubMed have been issued within the last four years. The reason seems to be the dynamic development of mobile applications on smart devices. This has been verified by several studies which focus has been on the evolution of mobile applications and increase of their popularity[6–8].

Statistics on PubMed reveal the particular interest of researchers in the usefulness of mobile applications. However, our study has not confirmed any significant interest of researchers in the use of mobile applications during the rehabilitation and revalidation of people with disabilities. Studies on mobile application usually focused on the importance of adapting mobile applications to the abilities of people with disabilities [9–13].

<table>
<thead>
<tr>
<th>Author</th>
<th>Paper description</th>
<th>Study population*</th>
<th>Method*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harrison et al.</td>
<td>Presentation of a review of the field of mobile mental health</td>
<td>Persons with intellectual disabilities</td>
<td>LR</td>
</tr>
<tr>
<td>Pérez-Cruzado</td>
<td>Increasing physical activity levels with a mobile application</td>
<td>Persons with intellectual disabilities (n = 40)</td>
<td>E</td>
</tr>
<tr>
<td>Donker et al.</td>
<td>Systematic review of scientific evidence for efficiency of mental health applications for mobile devices</td>
<td>Persons with intellectual disabilities</td>
<td>LR</td>
</tr>
<tr>
<td>Szabo et al.</td>
<td>Using mobile technology by individuals with aphasia: native iPad features and everyday applications</td>
<td>Persons with aphasia</td>
<td>LR</td>
</tr>
<tr>
<td>Ptomey et al.</td>
<td>Using technologies for a weight loss program for adolescents with disabilities.</td>
<td>Persons with intellectual disabilities</td>
<td>E</td>
</tr>
<tr>
<td>Bathgate et al.</td>
<td>Assessing diet with mobile application</td>
<td>Patients with Down Syndrome (n = 244)</td>
<td>E</td>
</tr>
<tr>
<td>Price</td>
<td>Facilitating public transport for people with intellectual disabilities with the use of a mobile application</td>
<td>Persons with intellectual disabilities</td>
<td>E</td>
</tr>
<tr>
<td>Fage</td>
<td>Tablet applications supporting inclusion of children with autism spectrum disorder</td>
<td>Children with autism spectrum disorder (n = 50)</td>
<td>E</td>
</tr>
<tr>
<td>Jones</td>
<td>Mobile Healthcare and People with Disabilities</td>
<td>Persons with disabilities</td>
<td>LR</td>
</tr>
<tr>
<td>Rogerson</td>
<td>Using a tablet mobile application to support therapy for children with autism</td>
<td>Parents of children with autism (n = 17)</td>
<td>E</td>
</tr>
<tr>
<td>Laubscher</td>
<td>The impact of the application on communication while playing in children with autism spectrum disorders</td>
<td>Children with a spectrum of autism</td>
<td>E</td>
</tr>
<tr>
<td>Deng</td>
<td>Needs and obstacles in the use of assistive mobile applications among people with autism</td>
<td>Patients with a spectrum of autism</td>
<td>E</td>
</tr>
<tr>
<td>Zhang</td>
<td>A mobile app implementing the international classification of functioning, disability and health rehabilitation set</td>
<td>Persons with disabilities</td>
<td>E</td>
</tr>
</tbody>
</table>

*Experiment – (E), Literature review – (LR), Individual case study – (ICS), Observation – (O), Special educational needs – (SPE), Intellectual disability – (NI).
Their authors concluded that it is enough to adequately modify programs or systems, so that it allows a person with disabilities to use it with considerable ease [14].

Studies show that adolescents with disabilities have complex needs in regard to lifestyle and controlling body mass. Mobile applications have a potential to increase the levels of physical activity in adolescents with disabilities in relation to their healthy peers and ensure appropriate support regarding healthy lifestyles [15]. Additionally, applications such as Google Maps can be an effective tool for supporting a person with an intellectual and developmental disability. These applications play a vital role in decreasing the dependence of a person with disabilities from their parents or other caretakers by facilitating them with easier modes of transportation, or producing large print maps and therefore making expensive GPS devices less necessary [16].

Studies have also shown that using mobile technologies may be one of the ways through which people with disabilities may understand their disability better [17]. Mobile applications help people with intellectual disabilities organize their physical activity during the day more effectively, in comparison to subjects who have not experienced multimedia intervention [18,19]. Studies proved that children with autism spectrum disorder have improved their socio-adaptive behavior. Also, their social interactions with parents or peers within the school environment have increased in relation to the use of mobile applications on their tablets, involving rehabilitation, support and cognitive applications [20–23]. The number of various mobile applications and activities aimed at cognitive training or support for numerous types of disabilities have been growing in digital application stores, such as Apple Store or Google Play Store [24]. Previous studies suggest that interventions in the field of psychological health delivered through mobile applications may be efficient in treating numerous psychological disorders, such as depression, stress and anxiety [25].

Our research has found yet another important aspect related to mobile applications. This is the use of inexpensive tools such as games and various applications which can be used in the motor rehabilitation of people with disabilities [26]. Authors of experiments related to this matter, have not only proved the importance of use of games and applications, but also observed a significant and positive effect. Moreover, doctors and physiotherapists have recently started noticing and appreciating the value of mobile applications in the process of monitoring rehabilitation processes. Some authors proved this thesis [27–32]. Patient’s rehabilitation can be controlled remotely with mobile applications; while monitoring diet or health from home significantly lowers the costs of the process [33]. Therefore, mobile applications and their development may result in improved quality of rehabilitation in people with disabilities.

Conclusions

Our study leads to the following conclusions:

1. A significant proportion of the discussed studies on using mobile applications whilst working with people with disabilities, attempt to support their rehabilitation processes through these mobile applications.
2. The interest in using mobile applications to work with people with intellectual disabilities has significantly increased from 2015 in comparison to earlier years.

Funding

This research received no external funding.

Conflicts of interest

The authors declare no conflict of interest.

References

1. https://ec.europa.eu/eurostat/documents/2995521/7771139/9-20122016-BP-EN.pdf/f023d81a-dce2-4959-93e3-8cc7082b6edd?fbclid=IwAR0vzt8d7rp8Lj5rOSuNhMaQAJ679B9RV-U1glGctx3L1cMU-s5w7YA0kIVk


