Mental and Physical Mobile Health Apps: Review

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Abstract

Tremendous development in mobile technologies has emerged as a powerful tool in health care with more than 160,000 mobile health apps available for download from the apps stores. However, there is a lack of meticulous testing for efficacy, reliability and accuracy of these applications. The purpose of this paper is to review the current state of the art of the development of mobile health applications dedicated to chronic and disabling diseases that are manifested by a physical or mental disability in the patient, namely: brain injury, stroke and spinal cord injury; psychoactive substance abuse and addiction, depression, stress, and anxiety. We performed search in both Android and Apple apps stores and developed a database to carry out searches' results analysis. Many apps dedicated to diagnostic and treatment are designed without involvement of healthcare professionals and there is an inequality of users' profiles in both mental and physical mobile apps. We plan to evaluate the usefulness, efficiency and suitability of most relevant application in the Moroccan context. Comparison and evaluation of efficacy of these applications is underway.

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Keywords: brain injury, stroke, spinal cord injury, psychoactive substance abuse, addiction, depression, stress, anxiety, mental health, physical health, mhealth app

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1. Background

E-health expresses itself in a plurality of fields of therapy, along the care pathways. The mobile Health "m-health", one aspect of e-health, is defined¹ as 'medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices'.

In Morocco, the use of mobile health technology may represent real opportunities; insofar as development of the Moroccan health system is subject to constraints related to a progressive increase of healthcare demand for the management of chronic diseases² or healthcare provision in rural areas (only one doctor for 11345 inhabitant in rural areas³). Access difficulties to health care services and shortage of health care professionals (health professional to population ratio of 1.86 for 1000⁴) are the main issues encountered in the control and prevention of chronic diseases together with the heaviness of health care costs⁴. By 2030, the proportion of Moroccan elderly people will count 15.3% (as a consequence of a decrease in the mortality rate and a growth in life expectancy) and the proportion of young people will decrease to 29.8% (as a consequence of a low birth rate). This demographic transition can only results in an increased prevalence of chronic conditions qualified as main causes of death and disability worldwide.

Moroccan Sectoral Strategy for Health 2012-2016, involved capacity building of health professionals and early screening of pathologies responsible for causing mental and / or physical disabilities. Indeed these disabilities resulting from chronic diseases have frequently the same risk factors, which are controllable as they are closely linked to poor eating habits, sedentary lifestyle, stress, alcohol and other psychoactive substances addiction⁵. They have also non modifiable risk factors including aging and genetics. According to the national study on disability in Morocco, People with disabilities manifested a strong need for better access to care services (55.3%), medicines (21.3%) and technical assistance (17.5%)⁶. With this limited access to healthcare services, traditional approaches to health care need to be reviewed to fit actual demands. In this context, the strategy highlights the importance to develop an efficient, reliable and responsive health monitoring system, involving a network of multiple stakeholders via Information and Communication Technology.

Mobile technology can be a valuable solution in healthcare field. N F BinDhim et al. carried out a quantitative survey of 8241 participants from multiple countries to examine the usefulness of mobile phone apps on depression screening, monitoring and self-management, which provides promising results⁶. Utility has also been shown for mHealth usage for smoking cessation to enhance patients' treatment adherence⁷. A study published on the application of mobile technology for stroke rehabilitation revealed the benefits of its use in therapy⁸.

According to the Institute for Healthcare Informatics (IMS, USA) survey conducted on September 2015, there are more than 160,000 mobile health apps available for download from the Google app and Apple iOS stores⁹. However, there are few studies that rigorously evaluate mobile Health apps use from the perspective of user effectiveness and security of mobile intervention apps compared to face-to-face diagnostic and therapy¹⁰. The purpose of our paper is to review the current state of the art of development on mobile health apps dedicated to chronic and disabling diseases that are manifested by a physical or mental disability in the patient, namely: Brain Injury (BI), Stroke and Spinal Cord Injury (SCI); Psychoactive Substance Abuse and Addiction (PSAA), Depression, Stress and Anxiety.

The rest of this paper is structured as follows: Section 2 provides a description of the research procedure and tools. Section 3 presents results in three parts: (1) which data and information flows identify the use of mHealth apps on the apps platforms? (2) How Entities are related to each other using the Conceptual Data Model? (3) What classification characterizes identified apps focusing on type of disability, functionality and purpose, users' profile and annual evolution of mental and physical health app releases? Finally a discussion of obtained results is achieved and perspectives and possible future interest are included.
2. Materials and Methods

The approach followed to achieve the present review includes several steps. First we performed a preliminary search of mental and physical mobile health apps on the two dominating commercial apps platforms: Android (over 80% of the Smartphone market) and the Apple iOS (around 14%), in order to identify and analyze data and information flows describing the use of mHealth apps on Google play store for Android and Apple iTunes store for iOS. In the second step, we converted identified requirements into a Conceptual Data Model (CDM). Third we built the database in an open source database management system (MySQL) according to the CDM previously developed. This database was used to collect data of mental and physical health apps. In the following step, we searched mobile health apps related to both categories (mental and physical) using as keywords: ‘brain injury’, ‘stroke’, ‘spinal cord injury’, ‘addiction’, ‘depression’, ‘stress’ and ‘anxiety’. Eligibility criteria were the following: apps whose description is not in Arabic, English or French were dismissed, apps studied are the top 10 search results focused on mental and/or physical disabilities, and published only in "Medical", "Health & Fitness", "Books & Reference", "Education", and "Lifestyle" categories. When searching by ‘Spinal cord injury’ keyword in the Apple app store, only 8 results were showed, we decided to search by other keywords: (‘Spinal cord’ or ‘Central nervous system’ or ‘medulla’) and (‘trauma’ or ‘dysfunction’), no relevant results were found by these combinations. We collected data by reading in-store description and information. Some of these descriptions were not sufficient, so in order to have more clear explanations, we downloaded the app on a Samsung Galaxy S4 Mini GT-I9190 if it is designed for Android and on an iPad model MD367NF/A for iOS dedicated apps since apps found on Apple iTunes was designed for both iPhone and iPad. Finally, we reviewed data collected and grouped together similar functionalities and classes.

3. Results

3.1. Data Description:

Each Application "Mobile_app" is referenced by an identifier "ID_App" and a name "APP_NAME", it can be managed (= created, updated, reviewed or inventoried) by one or more manager and displayed in multiple stores in different languages. An mHealth app can be free, paid or in free light version with limited functions. A manager (developer) can make multiple updates of the mobile app and must comment what’s new in the update. The manager can be legal or natural person and represent different categories of users: Patient, Health Professional, Patient’s family, Researcher or Computer Scientist. Other important parameters related to the user are the number of installs, average note attributed to the app, the users’ remarks, and permissions required to download the app.
3.2. mHealth apps Conceptual data model

![Diagram](image)

Fig. 1. mHealth apps Conceptual Data Model

3.3. Apps for mental and physical health

A total of 2,190 apps were found by entering search keywords in both Google play and Apple iTunes stores, 350 apps were reviewed and 136 relevant apps were identified in both app stores. We note that multiple apps refer to more than one of the studied disabilities, so the same app appears among search results for different keywords. In these cases, apps are counted one time. Hence, 70 apps are available in Google play store and 66 apps in Apple app store. 79 (58 %) apps are available for mental disabilities, from them 9 (11 %) destined for healthcare professional. Whereas 56 (41 %) are available for physical disabilities, among them 35 (63 %) are designated for healthcare professional. Table 1 shows the number of apps identified by user’s profile for each disability. In the table 2 is shown the classification of apps by user’s profile, the majority (29; 66%) of the applications destined to healthcare professionals are for educational use. Table 3 summarizes classification of identified apps by functionality; there is a lot more apps that offer informational content, relaxation and meditation than those dedicated to the storage of basic patient details, teleconsultation or validated scales measuring psychological or physical symptoms like Hamilton Depression Rating Scale (HAM-D) or National Institutes of Health Stroke Scale (NIHSS, USA). With regard to implication of health professionals in development of mobile apps, only 20 (14%) of identified apps were designed under supervision of healthcare professionals.
A classification of apps based on their developers’ descriptions is illustrated by Fig. 2 (a). It shows that tools for treatment and education are the main purpose of development of apps identified (respectively 51% and 25%), 1% of applications allows the healthcare professionals to monitor the patient, and 4% of the apps are destined to physical recovery and rehabilitation. On the other hand, the majority of identified apps are displayed in the stores under Health and Fitness (56; 41%) and Medical (55; 40%) categories, percentages of displayed apps in others categories are as follows: Education 13 (10%), Lifestyle 8 (6%), Books and Reference 4 (3%). Fig. 2 (b) shows the number of apps per year of design or update for both apps platforms: Android and iOS. 32 (24%) apps were updated in the first quarter of the current year (2016) and 45 (33%) apps were updated throughout last year (2015), 29 (21%) in 2014, 18 (13%) apps updated in 2013, 6 apps during the year 2012, 4 (3%) applications were updated during 2011 and only 1 (1%) app updated six years ago. 21 (72%) apps updated for more than 2 years were designed without implication of healthcare professionals. Regarding required permissions, we note that 22 apps (17%) require access to identity on Smartphones to download apps, 11 (50%) apps from them related to mental category. We noted also that none of apps identified during this study has been designed in the Middle East region or in North Africa.
Table 3. Classification of apps by functionality

<table>
<thead>
<tr>
<th>Functionality</th>
<th>Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informational Content</td>
<td>29 (15 %)</td>
</tr>
<tr>
<td>Relaxation</td>
<td>25 (13 %)</td>
</tr>
<tr>
<td>Meditation</td>
<td>23 (12 %)</td>
</tr>
<tr>
<td>Hypnosis, Invalidated Questionnaire</td>
<td>9 (6 %)</td>
</tr>
<tr>
<td>Useful Internet links</td>
<td>8 (4 %)</td>
</tr>
<tr>
<td>Tracking tool</td>
<td>7 (3.5 %)</td>
</tr>
<tr>
<td>Access to scientific journal articles, Mental Exercises, Recovery of speech</td>
<td>6 (3 %)</td>
</tr>
<tr>
<td>Cognitive Behavioral Therapy (CBT), Counter abstinence, Text chat</td>
<td>5 (2.5 %)</td>
</tr>
<tr>
<td>Clinical practice guidelines, Quiz</td>
<td>4 (2 %)</td>
</tr>
<tr>
<td>Assessment tool, Breathing exercise, Graphics illustrations, Reference guide</td>
<td>3 (1.5%)</td>
</tr>
<tr>
<td>Access to magazine articles, Alternative and Augmentative Communication (AAC), Educational exercises, National Institutes of Health (USA) Stroke Scale NIHSS, Patient Health Questionnaire (PHQ-9), Physical Exercises, Stroke scoring tool, The 12 steps of Alcoholics Anonymous 3D graphics illustrations, Acceptance Commitment Therapy (ACT), Acupressure, Anonymous social network, Audio chat, Chromotherapy, Glossary, Hamilton Depression Rating Scale (HAM-D), Helplines, Information Sharing Tool, Learning facilitator, Narcotics Anonymous (NA) Meeting calendar, Note-taking, Patient education by medical illustrations, Spending calculator, Storage of basic patient details, Support Groups, Teleconsultation, Video chat</td>
<td>1(1%)</td>
</tr>
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4. Discussion and Conclusion

According to the results presented above, most (58 %) of mental mobile health apps are more oriented to patient use than health professional use, whereas no mental apps target Researchers, with the exception of fewer ones dedicated to PSAA. On the contrary, physical health apps are dedicated in majority (66%) to health professionals and have mainly educational purpose; but target also Patient’s family and Researchers which means that the field of physical mobile rehabilitation is still under investigation and that the involvement of the patient's family is essential. These results also demonstrate the need to compensate the huge gap of inequality with regard to users’ profiles during apps development in order to fully exploit the potential of mHealth related to patient engagement and monitoring\textsuperscript{12}. Following prior findings, some of apps are classified under medical category while they should belong to educational one. This lack of relevance reduces users’ chances to find a suitable application. Furthermore, many apps dedicated to treatment and diagnostic are designed without involvement of healthcare professionals which threatens users’ security and raises questions about effectiveness of these apps, whence comes the interest of assessment criteria of effectiveness, efficiency and relevance of apps\textsuperscript{10}. In the same context, deepening investigation deserves to be carried out regarding the reasons of requests of permission to download apps on Smartphones in order to ensure whether security measures for personal data are implemented. There is also a need for further investigation within private mobile apps, e.g. it’s the case for U. M Waldmann \textit{et al}. who conducted a study with a restricted app to medical student education\textsuperscript{13}.

One of the interesting apps in the field of mental disabilities, aiming to threat PSAA, is "No More! Quit your addictions", free for Android. It basically uses a counter abstinence to motivate patients to face their addiction and a tracking tool to promote patient's sense of responsibility. This app also utilizes a meditation system aiming to increase motivation with inspirational phrases. It allows the user to customize shortcuts in order to access quickly useful internet links or call a trusted person. The weakness of this app lies in the fact that it is designed without involvement of healthcare professionals and should be validated before using.

We plan to evaluate the usefulness, efficiency and suitability of this application for Moroccan patients by inviting suitable number of patients to test the application for a given duration at local psychiatric hospitals. Given the lack
of apps development in the Middle East and North Africa (MENA), this will be the first investigation of mHealth use in this region in the field of Psychoactive Substance Abuse and Addiction.

References