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A Preliminary Review of the mHealth Apps Focused in Endometriosis and Chronic Pelvic Pain

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Abstract

Introduction: Smartphone applications (apps) are equivalent to programs run on personal computers. The interest in smartphones has brought the field of mobile health (mHealth). Despite the big number of women with endometriosis and the severity of their symptoms, mHealth apps within this field have not been reviewed to date. The aim of this study is to assess the status of contemporary apps targeted at endometriosis and women with chronic pelvic pain.

Material and methods: Smartphone mHealth apps specifically relating to endometriosis and chronic pelvic pain were identified by searching the largest app stores (Apple iTunes, Google Play, BlackBerry World). Only apps in the English language were included.

Results: 26 app were included in the study for further analysis. Nine (34.6%) are clinical guidelines. Seven (27%) are social networking, allowing users to share their stories. Eight apps (31%) used as patient's diary. Twelve out of 26 apps (46%) had documented evidence base practice. Eleven (42%) had Medical Professional involvement in their development.

Discussion: As technology portability, ubiquity, accessibility at point of care delivery and processing power of smartphones offers huge potential in the healthcare context.

Implications for practice and/or policy: This is the first study to review apps targeted on endometriosis and is a valuable reference for clinicians, app designers, and policy makers with an interest in the area.

Conclusions: Endometriosis is a chronic disease with a huge impact in women life. As healthcare providers, we need to take advantage of the technology to improve our patient's life.

Keywords: Endometriosis; mHealth; Pelvic pain

Introduction

Smartphone applications (apps) are equivalent in their capabilities to programs run on personal computers. Smartphones are able to replace personal computers for functions, such as Web browsing, document processing, video and music playing, task management, and video games, with the advantage of portable accessibility and proximity to the consumer [1]. Smartphones currently dominate the growth of mobile phone handsets in many countries. They now account for 88% of all mobile phone handsets in Australia [2], 72% in Singapore [3], in the United Kingdom [4] and in the United States [5] 65% and 51% in New Zealand [6].

Substantial interest has arisen around the use of smartphone and tablet technologies in the health care context. This interest has brought the field of mobile health (mHealth), defined as the delivery of health care and health-related services via communications devices, into sharp focus [7]. Such devices are carried in the pockets of the majority of health care professionals working in developed health care systems [8-10] and there are currently more than 40,000 mHealth apps available for download through app stores [11]. Patients can use the applications in their own devices that are a way to develop a better relationship with their doctors, to be more engaged with their own health and as results more involved. The mHealth sector as a whole is expected to generate approximately $26 billion by the end of 2017 [12]. App markets have grown rapidly with the increasing usage and acceptance of smartphones [13]. The most popular examples of such markets include Apple iTunes, Android Google Play, BlackBerry World, and Windows Phone Stores.

Examples of medical applications can be the AirStrip ONE Web RPM, which is a cardiac monitor or the Aetna, ITriage. This patient-facing mobile app allows patients to directly find information on their health conditions and gives them step-by-step guidance to treat conditions in the most effective way

possible. The use of mHealth apps has been evaluated in various fields of medical practice including obesity surgery [13], colorectal surgery [14], vascular surgery [15], hernia surgery [16], pain management [17] and urology [18]. However, there are concerns about the absence of evidence base and of the involvement of the healthcare providers. That's why, further studies and clinical trial are important, in order to improve accuracy and efficacy in clinical practice.

About 176 million of women worldwide suffer from endometriosis [19,20]. Despite this large number of women with endometriosis and the severity of their symptoms, mHealth apps within this field have not been reviewed to date. It is very difficult to determine the prevalence of endometriosis, but in the everyday clinical life very often women with chronic pelvic pain, undiagnosed are visiting their doctors. The prevalence of the disease increased from 5% to 20% to over 60% to 80% in women with infertility and/or pelvic pain [17]. The prevalence clearly increases with the awareness and the training of the surgeon. On average it takes 7.5 years from onset of symptoms to get a diagnosis 20 and women can waste several years visiting doctors from different specialties, before they will see a gynaecologist.

The aim of this study is to assess the status of contemporary apps targeted at endometriosis and women with chronic pelvic pain with particular focus on their documented evidence base (EB) and the degree of medical professional involvement (MPI) in design. This is a way to look into the existed application and the medical input. In addition, that can confirm or not the significance and the credibility or these apps.

Materials and Methods

Smartphone mHealth apps specifically relating to endometriosis were identified by searching the four largest app stores (Apple iTunes, Google Play, BlackBerry World). Each app store was searched using terms related to endometriosis and chronic pelvic pain and its presentation. With respect to endometriosis and chronic pelvic pain presentation the terms dysmenorrhea, dyspareunia, dysuria and dyschezia were used.

For each app data was extracted from the app store overview provided by the developer and from the developer website and consisted of: 1) app store category, 2) year of release and publisher information, 3) app price, 4) target consumer, 5) documentation of Evidence Base, 6) documentation of Medical Professional Involvement, 7) commercial interests, 8) number and score of star rating reviews **(Table 1)**.

Only apps in the English language and specifically targeting endometriosis and chronic pelvic pain were included. App mentioned symptoms similar to endometriosis, but not related with chronic pelvic pain were excluded.

Table 1 App store overview provided by the developer and from the developer website.

Apps name	Target Consumer	Cost	EB	MPI	AVERAGE Rating (stars) 0-5	Function
Endo warriors	Public	Free	No	Yes	4.8	Educ. Tool Self assess Social networking
Endo treatment	Public	Free	No	No	3.5	Educ. Tool Self assess Social networking
Endo symptoms	Public	Paid	No	No	4.6	Diary educ. Tool Self assess
Symptoms of endometriosis	Public	Free	No	No	N/A	Self assess Guidelines Diary
Endo diary cell High LLC	Public	Paid	Yes	Yes	2.6	Educ. Tool Self assess Diary Guidelines Social networking
Pain diary and forum	Public Medical Professionals	Paid	Yes	Yes	4	Educ. Tool Self assess Diary
Endom and me	Public	Paid	Yes	No	N/A	Educ. Tool Self assess Diary

Event guide for WCE 2017	Public Medical Professionals	Free	Yes	No	N/A	Educ. Tool Self assess Diary Guidelines Congress app
Endo symptoms health apps studio	Public	Free	Yes	Yes	N/A	Educ. Tool Self assess Social networking Diary
ESHRE endo	Medical Professionals	Paid	Yes	Yes	4.7	Educ. Tool Self assess
Endo March 2014	Public	Free	No	No	4.3	Diary
Endometriosis symptoms-good health	Public	Free	YES	No	N/A	Educ. Tool Diary Social networking
Pain companion	Public	Paid	No	No	4.3	Self assess Diary Social networking
My pain diary	Public	Free	No	No	4.1	Self assess
MyEndometriosis Team, MyHealthTeams, Inc	Public	Free	No	No	N/A	Educ. Tool guidelines
Endometriosis - Brawn apps	Public	Free	Yes	Yes	N/A	Educ. Tool Self assess
Flutter - Flutter Health limited	Public	Free	Yes	Yes	N/A	Educ. Tool Social networking Diary
EndoEmpowered by Melissa M.Turner	Public	Free	No	No	N/A	Educ. Tool Diary
Phendo	Public Medical Professionals	Free	No	Yes	N/A	Self assess Guidelines
The endometriosis diet	Public	Paid	No	No	N/A	Educ. Tool
Endometriosis diary	Public	Paid	No	No	N/A	Educ. Tool
Symptoms of endometriosis	Public	Paid	Yes	Yes	N/A	Self assess Guidelines
Endometriosis and Pelvic Pain Treating and tips	Public	Paid	Yes	Yes	N/A	Educ. Tool Self assess
51 ways to treat endometriosis	Public	Paid	Yes	Yes	N/A	Guidelines educ. Tool
Endometriosis Natural Treatment and tips	Public	Paid	Yes	Yes	N/A	Guidelines educ. Tool

Results

The App store search revealed 18 relevant apps **(Figure 1)**. 6 were identified as duplicates, available for download in both the Google Play app store and the Apple iTunes. In all cases duplicates were removed, resulting in the exclusion of 6 apps. 13 other apps were identified in Google Play app store and one in Blackberry World. 26 apps were in total included in the study for further analysis **(Figure 1)**.

The first endometriosis app was released in 2013. A large proportion of apps 22/26 (84%) were targeted at the general public or patients. Of those remaining were targeted 3/26 (12%) at clinicians and only 1/26 app (3.8%) at medical students.

12/26 apps (46.15%) charged for download. The cost ranged from £1.24 to £19.99, with a median price of £6. There is one app, which is only for members, paying annually.

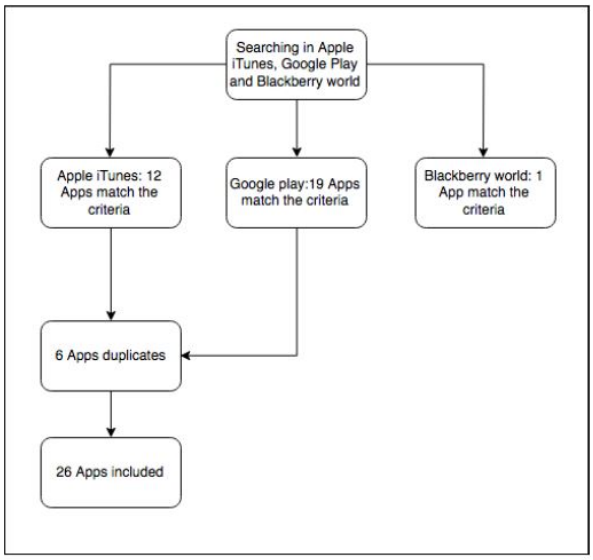

Figure 1 Smartphone mHealth apps relating to endometriosis and chronic pelvic pain were identified by searching the largest app stores (Apple iTunes, Google Play, BlackBerry World. In total were identified 32 apps. Six were duplicates, so 26 were included in this study.

App functionality

The applications in this study had various functionalities. Some of them have more than one functionality. There are 16 app (61.5%) which are used as educational tools. They are focused on the symptoms and how to avoid them or improve the everyday quality of life.

Nine apps (34.6%) are clinical guidelines providing information about the diagnosis, the clinical management and the treatment. Seven apps (27%) are social networking, allowing users to share their stories and experiences of endometriosis. Eight apps (31%) were patient's diary, allow their menstrual cycle and symptoms to be recorded. Patients will be able to add their appointment's dates, to allow reminders or "push notifications" to be sent through these apps to ensure appointments are not forgotten or missed. There was only one app as a conference app tool.

Evidence base and medical professional involvement in development

The number of women experiences chronic pelvic pain is increasing. The apps are aiming to explain to patients how to deal with their symptoms. In addition, there are apps, which are introducing clinical guidelines and support the clinical management of these cases. Only 12 from the 26 apps (46%) had documented evidence base practice, however 11/26 (42%) had Medical Professional involvement in their development.

16 apps functioned as educational tools and from these only 6/26 (37.5%) had documented evidence base and 4 health professional input.

App store review data

App stores used two methods for rating apps. The first was a star scoring system where an app was given 1 (worst score) to 5 (best score) stars depending on user satisfaction and the second was through written reviews. 14 apps had one or more star rating reviews. The average (mean) star rating was 4.1. The average (mean) length of review was 11.2 words and the average (median) number of written reviews per app was 3.

Commercial interest

From the 26 apps only two had commercial interest, about products possible helping endometriosis symptoms and a clinical service.

Discussion

The use of smartphones can change potentially the everyday clinical practice and the healthcare context, by taking advantage of the portability, such as the accessibility at point of care delivery. Implementation of new technology within healthcare infrastructures has traditionally been a challenging process requiring change of culture, through a difficult process with both technical and social barriers [21]. However, using smartphone technology on a personal level has helped to face fewer barriers than has been the case with other technologies. As a consequence, adoption and utilization of smartphone technology in the clinical practice has been increased [22], bringing with it huge opportunities to improve efficiency and effectiveness within medical practice.

This is the first study to review apps specifically targeted at the field of endometriosis and can be a valuable reference starting from the clinicians, app designers, and possibly the policy makers with an interest in the area. Endometriosis plays a very important role in women's life. The symptoms can be so bad, that can affect their everyday life. Women often need to change their lifestyle or even quit from some activities. That's why, it is not surprising that the majority of apps (61.5%) are focused on the symptoms and how to avoid them or improve the everyday quality of life.

A total of 7 different functionalities were identified through this review highlighting the diverse potential of apps targeted at endometriosis. These ranged from simple educational reference tools and glossaries to more complex functions such as self-assessment, appointment management and reminders, social networking tools allowing users to share their experiences of endometriosis with their peers.

However, as with reviews of apps in other specialties, there was a concerning lack of documented evidence based medicine (EB) and medical professional involvement (MPI). A lack of EB or MPI in the development of such apps may result in the wrong approach of endometriosis, its symptoms and its management. This can be risky for women using the apps, since sometimes this can be their only approach and understanding of the disease.

There are around 40.000 mHealth apps. It is not always possible for patients to recognize these of high quality concerning safety, usability, functionality and efficacy. It is notable, that only the minority of the apps is actually reviewed. The written reviews are in most of the cases sort, subjective and unstructured. So, this study has identified the fact that the star rating or the written review systems are not so effective in that spectrum. It is necessary the apps' developers to install a different way or approach to ask for reviews from their users.

It is obvious that one of the limitations of this study is the fact that the data have come from apps' reviews or the information that developers provide. It is though possible that the EB and MPI can be accessed, once the app is fully downloaded. However, it is not very likely to happen, since the information provided will guide the consumers to download it or not.

Implications for practice and/or policy

The current paper is not the first to highlight safety concerns surrounding mHealth apps [23]. In order to safeguard consumers, the Medicines and Healthcare Products Regulatory Agency (MHRA) in the UK has recently followed the example set by the United States Food and Drug Administration (FDA) and widened its public health responsibility for ensuring the safety of medical devices to include specific categories of mHealth apps [24,25]. It is the responsibility of individual app developers to endure legal compliance, but in the same time it is important to establish clear regulation about developing mHealth apps. The medical involvement can always add the evidence based knowledge and a different perception for the users.

Conclusion

This study demonstrates a large number and wide diversity of function amongst mHealth apps available in the field of endometriosis. Such applications empower users with the ability to quick access educational material (and in the case of physicians to access this material at the point of care delivery), locate and make appointments with physicians, understand more deeply the disease, communicate with a bigger community and find support.

However, despite their huge potential there is a concerning lack of EB and MPI in app development, both in this field and others, resulting in concerns around their safety. In this regard there is a need for full authorship disclosure and high quality clinical trials of smartphone based mHealth interventions. A robust framework for evaluating mHealth apps is required to allow consumers to readily identify high quality apps from the many thousands available. Such a framework would also serve to promote the widespread adoption of smartphone technology and apps in the clinical arena.

Contribution to Authorship

Dr. Gkrozou F is responsible for the data collection, data analysis, writing the manuscript. Ms Waters N had the initial idea and she has reviewed and improves the final manuscript.

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