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Original Research

Smart phone applications for self-monitoring of the menstrual cycle: a review and content analysis

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Summary

Background: In last years, a spread of smart phone applications (apps) for the self-monitoring of individual health has been recorded, especially among young people. A broad number of healthcare apps is designed for women, encouraging the self-responsibility in the surveillance of their menstrual cycle. Aim of the present study was to provide a review and features analysis of the apps for the self-monitoring of the menstrual cycle available on the major official mobile-phone application platforms. *Materials and Methods:* A systematic search in Google Play Store and iTunes was performed from January to December 2017. The most popular apps for the monitoring of the menstrual cycle were downloaded and their functions and features were evaluated and compared. *Results:* The authors found a considerable difference between applications in the number of tracking functions. While some apps are more sophisticated and combine almost all possible functions for tracking the menstrual cycle (Clue, Life, and Period Tracker Lite), some others are simpler, and their purpose is merely to record menstrual days, without any precise calculation of the fertile days (Cycles). With iPeriod, the tracking of menstrual cycle and the received drugs can be recorded. *Conclusions:* All the studied apps are excellent in providing awareness of the menstrual cycle. Some of them record valuable information for the self-monitoring of the menstrual cycle. Which app to be used mainly depends on the data wanted to be gathered from the monitoring. Although most of the devices and apps are excellent in providing direct information to the user, some improvements are still possible. A future challenge will be how data would be gathered through smart phone apps and how could be used in clinical practice.

Key words: Connected health; Mobile phone; Gynaecology; Menometrorrhagia; Menstrual cycle; Monitoring.

Introduction

In light of the digital revolution, a dramatic change in the strategies for self-care has been recorded. The development of digital devices and associated applications (apps) have allowed people to monitor their bodily functions and record them into digital data. Due to their easy access, apps are currently spreading, especially among young people [1, 2].

The rationale of "digitising individual health" is to promote public health by enhancing preventive medicine and reducing healthcare costs. Notably, a broad number of healthcare apps is designed for women, encouraging the self-responsibility in the surveillance of their reproductive, functions, especially with respect to their menstrual cycle [1, 4].

A careful surveillance of the menstrual cycle may allow the detection of potential disorders, such as heavy menstrual bleeding (HMB). HMB is defined as excessive blood loss (more than 80 mL per cycle), which affects about one quarter of women in the childbearing age [5]. HMB may have a significant impact on health status [6] and can lead to complications, such as iron deficiency and anemia [7].

Despite the large development of apps for the monitoring of the menstrual cycle, there is still lacking a review summarizing the validity and efficacy of these tools. Thus, the authors aimed to provide a review and content analysis on the apps for the self-surveillance of the menstrual cycle available on iOS and Android mobile operating systems.

Materials and Methods

From January to December 2017, the authors performed a systematic search in the two major official internet-based mobile-phone application platforms in Europe, Google Play Store (version 8.2.55.T-all [0] [FP] 169487198 (80825500)) and iTunes (version 12.7.0.166). Apps were included only if available in English language. The key words used in the search were: menstrual cycle, menstrual bleeding, period, and gynaecology. They searched only among free of charge mobile apps and included smart phone apps that claimed to offer information, monitoring, support, and treatment in relation to gynaecologic health symptoms or illnesses.

The best six apps for menstrual cycle, with the highest rating on the internet and the most interesting according to 20 users-doctors were analysed by comparing their features and functions. Quality of the apps was evaluated according to the possibility of

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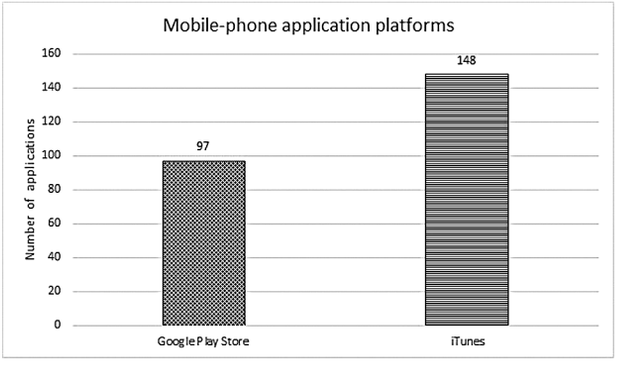

Figure 1. — Number of gynaecological applications found in each of mobile phone application platforms.

monitoring various features, ability of apps to estimate ovulation time and fertility days, the presence of educational information, ease of use of the app, possibility to transfer the data to pdf, and the presence of a safety features. As this study was a review, formal ethical approval was not required.

Results

The search resulted in 245 gynaecologic health-related apps for smart phone (Figure 1), of which nearly 100 ones aimed towards the self-surveillance of the menstrual cycle [9]. The six most popular apps were downloaded and assessed. The characteristics that were evaluated across the apps were: ovulation prediction, irregular cycle support, pill reminder, personal diary, mood, symptoms, temperature, weight and sex tracker, and educational information ability. Privacy and security of data were also managed differently among apps. Table 1 summarizes the differences among analysed mobile apps.

The difference between applications is mainly in number of tracking functions. While some applications are more sophisticated and combine almost all possible functions for tracking the menstrual cycle (Clue, Life, and Period Tracker Lite), there are other more simpler applications, whose purpose is merely to record menstrual days and do not provide more precise calculation of the fertile days (Cycles). With iPeriod application the tracking of heavy menstrual bleeding and the received drugs can be done.

Discussion

Since the advent of the 21st century, the spread of smart phones and their apps for the self-monitoring of individual health have consecrated a new era for healthcare, known as "eHealth" or "Medicine 2.0" [1, 2]. The usefulness of smart phone apps has also exploited in gynaecology and a large number are designed for the qualitative and quantitative monitoring of the menstrual cycle. Therefore, the traditional use of" a calendar and a pen" for tracking the menstrual cycle may be soon abandoned.

Aim of the present review was to report and analyse the most popular apps available on Google Play Store and iTunes. About 100 apps were retrieved by the present search. Six were downloaded and critically analysed. The difference between apps was mainly in number of tracking functions.

Application Clue appears to be the most sophisticated of the analysed apps, as it covers a variety of symptoms. In addition to tracking the menstrual cycle, fertile days and ovulation time, it is also one of the few smart phone apps that provides educational information. In the opinion of users, Clue is the most useful, exact, and transparent application for period tracking on the market nowadays. It also has possibility to set reminders to change hormonal rings and patches. The application that competes well with Clue, is the Period Tracker Lite.

In comparison to the Clue application, the Period Tracker Lite does not have the ability to record sexual activity and does not provide any instructional information. Application Life provides support for tracking irregular menstrual cycles. This feature was found only in two tested apps, namely Life and Monthly Cycles. By considering the irregularity of menstrual cycle, the application can achieve greater accuracy in the calculation of fertile days, especially with combination of other important details, such as temperature fluctuations, mood changes, and other specific symptoms. Specific symptoms were able to be tracked with all tested apps except application Cycles. Tracking of the basal body temperature and mood swings were also able to be monitored with all tested apps but Cycles and iPeriod, Cycles and Monthly Cycles, respectively. Another important feature is the ability to set the pill reminder, which reminds users to take contraceptive pills. Clue and Life are the only two apps that have this feature. The Period Tracker Lite has optional setting of pill reminder, however with a pre-payment.

In comparison to the aforementioned apps, application Cycles is the most basic application with the least number of features. This type of application is intended for women who do not want to record different symptoms but want to have an overview of the menstrual cycle and fertile days. Since the application does not consider fluctuations in temperature, mood changes, and other symptoms in calculating fertile days and ovulation, its calculation could be less reliable in comparison to the two aforementioned apps. On the other hand, in comparison with the flood of smart phone apps in the field of monitoring the menstrual cycle, the monitoring of intensities of menstrual bleeding through smart phone apps is still relatively unsophisticated. According to the present findings, there is only one smart phone application called iPeriod that is used to monitor abnormal and heavy menstrual bleeding. This application enables patients to record all information about their menstrual cycle and the drugs that they are receiving [8].

Self-monitoring is a new trend in personal healthcare,

Table 1. — *Comparison of applications for tracking menstrual cycle.*

App name	Devices	Period tracker	Fertility window	Ovulation prediction	Irregular cycle support	Mood tracker	Symptoms tracker	Temperature data for more accurate fertility charting	Pill reminder	Personal diary	Data	Weight tracker	Sex tracker	Educational information	Ability to enter previous months data	Customizable passcode for privacy
Cycles	iOS	✓	✓	✓	×	×	×	×	×	✓	Not possible to export data, possibility to connect to your partner's phone	×	×	×	×	✓
Monthly cycles	iOS, Android	✓	✓	✓	✓	×	✓	✓	×	✓	Graphical presentations, data export via e-mail	✓	✓	×	×	×
iPeriod	iOS 7.0 or later	✓	✓	✓	×	Exporting data	✓	×	×	✓	Possibility of exporting and printing data, extra graphical display	×	×	×	×	✓
Period Tracker Lite	iOS, Android	✓	✓	✓	×	Emoji-style icons for various moods	✓	✓	Present in deluxe app for extra 1.99$	✓	Exporting data via email, Backup data send to cloud	✓	×	×	×	✓
Clue	iOS 10 Android	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Life	iOS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	×	×

✓ - *available.* × - *non available*

based on the usage of electronic devices and software technologies, which collect, process, and display many data to manage personal health, and as such, provide potential support to the medical profession [1]. By self-monitoring, a patient becomes actively involved in self-care [2, 3].

Self-monitoring can tremendously reduce the number of needed clinical appointments, which lowers travel costs for patients, and may decrease workload for healthcare providers. At the same time, it may shorten the waiting periods for patients that need consultation with healthcare workers. Another positive attribute of self-monitoring is immediately detected result, which greatly affects motivation, as it gives patients an instant feeling of reward, if they are doing well [4].

Smart phone apps have many advantages over outdated paper based menstrual cycle calendars. The apps count the days from the beginning of previous menstrual bleeding, calculates expected days of ovulation, and expected next menstrual bleeding, thus liberating users from frustrating and time consuming manual day counting. Irrespective to regularity of cycles, the smart phone apps adjust the menstrual cycle for users based on monthly entered period information, providing accurate calculations of menstrual and fertile days. Tracking of fertile days could be very convenient for family planning [9]. The effectiveness of fertility awareness-based methods (FABM) depends on recording fertility biomarkers and following evidence-based guidelines. Although many smart phone apps offer exact track of fertility biomarkers, only minority of them use evidence-based FABM [10]. To date there are not any studies, which would confirm that smart phone apps can support prevention of unwanted pregnancy [11]. Furthermore, smart phone apps may also have a role in the management of menstrual disorders, such as HMB. The main problem in chronic conditions is non-adherence to the treatment regimens, mostly because patients are aware of the positive impact of their therapy only in the short term. During the period, when they are asymptomatic, they are most prone to stop taking the prescribed medications, which leads to complications and additional hospitalizations. The smart phone apps can remind the user not to forget taking drugs during menstrual cycle and the communication with the health provider (Figure 2). In comparison to the control group, the test iPeriod group (adolescents who received the application) experienced fewer cases of episodes of heavy bleeding and fewer missed medication treatments. The smart phone apps has also provided users with rapid and simple access to the information of possible medical issues [12].

Although smart phone technology has many potential advantages, it also has some limitations. The greatest policy concerns of connected health are quality, privacy, and safety of gathered data. Moreover, since these smart phone apps still have no safety standards, it is a matter of time before medical errors and unintentional harm to patient can occur. This is why evaluation of each medical smart phone app is needed. Their usefulness, accuracy, authority, objectivity, functionality, and ultimately, design, should be tested and evaluated [13]. In fact, researchers found out that only 20 out of more than 1,000 smart phone apps met accuracy criteria [14]. Researchers showed that most of existing smart phone health apps are non-evidence based [15].

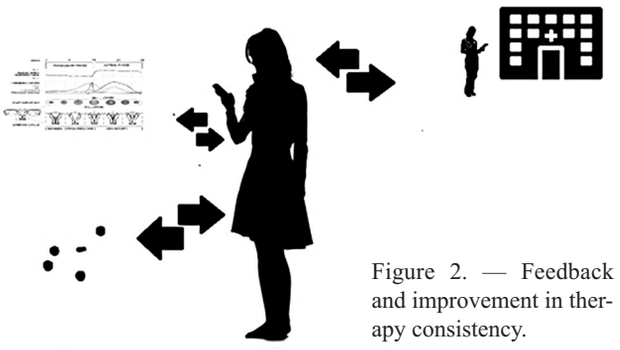

Figure 2. — Feedback and improvement in therapy consistency.

Another restriction for wider use of various smart phone apps for medical purposes is security and privacy. Protection of personal data in healthcare is very important, therefore, this remains one of the major limitations of wider use of such apps in healthcare [16]. In addition, the lack of clear guidelines on the frequency of testing for parameter and accuracy of measurements by the patient are also very important obstacle of self-monitoring [17]. Nevertheless, the usage of smart phone technology in personal health should be considered in the broader context of connected health. The implementation of such studies about usability and accuracy of the apps described above is necessary for the further implementation of the connected health approach. Connected health approach has the potential to empower patients, clinicians, and healthcare planners alike by means of delivery of pertinent information at key touch points [18]. The possibility to validate mobile apps gathered data and introduce them in to the patient electronic health record can increase the quality of healthcare and sharing with the medical practitioner.

Conclusions

Many apps that are used in gynaecology have a variety of possible monitoring parameters. Importance of these smart phone apps lies in ability of women to act on certain issues and a visit to a medical practitioner is not always immediately needed. Furthermore, most of the studied apps are excellent in providing information for the self-monitoring and from the distance for the practitioner without getting to the office. Which app should someone use depends of the data wanted to be gathered from the monitoring.

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