

REVIEW ARTICLE

Evaluation of Mobile Apps for Health Promotion of Pregnant Women With Preeclampsia : A Literature Review

Nia Desriva^{1,2}, Tukimin Bin Sansuwito³, Regidor III Dioso³

¹ Ph.D in Health Science, Faculty Medicine, Lincoln University College, Wisma Lincoln, No. 12-18, SS 6/12, 47301 Petaling Jaya, Selangor Darul Ehsan, Malaysia.

² Midwifery, Faculty of Health, Institut Kesehatan And Technology AL Insyirah, Parit Indah, No 38, Pekanbaru, 28289 Riau, Indonesia

³ Faculty of Nursing, Lincoln University College, Wisma Lincoln, No. 12-18, Jalan SS 6/12, 47301 Petaling Jaya, Selangor Darul Ehsan, Malaysia.

ABSTRACT

To promote the health of pregnant women, determine the present status of preeclampsia (PE). The enquiry was organised as follows: formulation of information to be extracted, analysis of outcomes, discussion, and presentation of evaluation. two smartphones were used: an iPhone 8 with iOS version 10.2.1 and a Samsung Galaxy S8 with Android. with the following keywords: preeclampsia, eclampsia, and health promotion for pregnant women diagnosed with preeclampsia. The study's inclusion criteria were satisfied by eleven applications. With Android, all functions were available, but with iOS and Android, only one feature was available. Only one of the eleven apps dealt with the clinical care of PE, while the other six concentrated on the characteristics of PE. beyond a reasonable doubt that the applications offer vital information that can assist in easing the concerns and doubts that pregnant women might have.

Malaysian Journal of Medicine and Health Sciences (2025) 21(SUPP3): 236-240. doi:10.47836/mjmhs.21.s3.35

Keywords: Mobile application, Smartphones, Health promotion, Pregnant women, Preeclampsia

Corresponding Author:

Bd. Nia Desriva, SST,M.Kes

Email: niadesriva.nd@gmail.com

Tel :+628126847796

INTRODUCTION

Professionals and patients alike are making heavy use of health-related ICTs, which are helping to shape and advance the health care industry. With the evolution of health care, there exist technologies that organise and arrange informational data, allowing for The ability to store, process, share, and access information in real time or at a later time. Their objective is to address health demands in diverse regions. Professionals' clinical decision-making can be aided by these ICTs, which in turn help improve patient-specific treatment protocols and standards (1).

Consequently, there are mobile technology like smartphones, tablets, and computers; along with these, there is the usage of mobile applications (2). Technological advancements and the proliferation of mobile applications are already shaping a new paradigm in health care, one in which individuals' health records are more important than ever (2). Research highlights the potential of these apps and the data they produce to improve health outcomes, lessen health risks, and shed light on the factors that contribute to good health (3,4). A revolutionary potential for health care has been

demonstrated by the fact that mobile phones have the ability to put the power of communication, internet connection, and advanced settings in the hands of both medical professionals and patients. The majority of mobile health applications made it possible to promote health outside of the settings where health services are provided, and they also contributed to self-management and communication initiatives, so it is evident that the notion of mobile health (mHealth) has grown in the previous ten years (5).

The primary objective of mHealth Apps is to enhance the well-being of patients by offering diverse functionality and distinct designs (6). These technological options play a crucial role in enhancing the well-being of individuals with diverse diseases, including PE. Preeclampsia is a highly significant health issue that impacts pregnant women. This issue arises in around (2) to 8% of pregnancies globally and leads to higher rates of illness and death among mothers and infants In women who were previously not hypertensive, this condition is typically marked characterised by high blood pressure (systolic BP ≥ 140 mmHg or diastolic BP ≥ 90 mmHg) and proteinuria (> 300 mg/24h). These symptoms typically manifest after 20 weeks of gestation. The presence of proteinuria is not necessary for the disease to arise (7).

In light of this, the following overarching research question emerged: which public-facing mobile applications exist for the most popular operating systems

that promote the health of pregnant women and deal with PE. The objective of this study was to evaluate the various PE applications that are now available for the most widely used operating systems, with the goal of promoting maternal health in an era where the number of publicly accessible smartphone apps continues to rise.

This research is important because it will help determine whether commercially accessible tools are reliable and provide accurate information to improve pregnant women's health and well-being.

MATERIALS AND METHODS

The purpose of this descriptive study was to assess mobile applications that deal with PE and are available on the iOS and Android platforms. The target audience is pregnant women and the general public. From April through June of 2018, the search was carried out. Actually, everything needed to carry out the evaluation—goals, sample selection, App inclusion/exclusion criteria, data extraction definition, analysis, discussion, and presentation—had already been planned. The review involved a thorough search of the major operating systems' virtual stores: the Play Store (Android, Google) and the App Store (iOS, Apple). Two devices were utilised for this: an iPhone 8 running iOS 10.2.1 and an Android-compatible Samsung Galaxy S8. Preeclampsia, eclampsia, and health promotion options for pregnant women who have preeclampsia were the three distinct terms that were utilised in the search conducted by each online retailer.

Apps for mobile devices that support the health of pregnant women who are participating in physical education were included. We did not include applications that were written in languages other than English, Portuguese, or Spanish, as well as those that required a login or an additional device.

With regard to the needs of the study, the applications were evaluated by means of a specialised synoptic framework that was designed for the purpose of evaluating applications that were pertinent to the management of enuresis; however, no validation procedure was mentioned for this instrument (8) This is comprised of ten components, of which only six were incorporated into this investigation, and it evaluates functional characteristics such as design, usability, language, instructions, security, and transference. The other elements were not utilised since they were specific to enuresis (two items) and connected to the stories and impressions (two items). There are six different elements, and each one gets a score that ranges from one to five. Because of this, the App evaluation receives a score that falls anywhere in the range of six to thirty points. It is important to point out that the ratings that customers have given to the applications, which extend from

one to five stars, have also been validated. In order to make the process of data collection and analysis more manageable, the authors developed a chart based on these criteria.

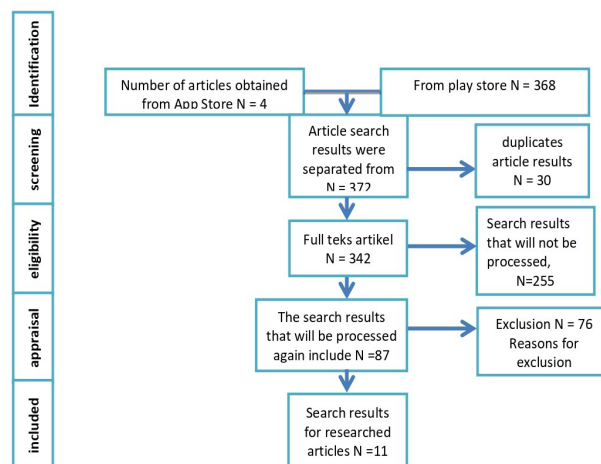


Figure 1: The following chart depicts the criteria used to evaluate smartphone apps

RESULTS

The procedure presented yielded 11 Apps for analysis (Figure 1), which are reported in Table I. Applications were downloaded straight to the respective devices. Of the 342 results, 331 were excluded for the following reasons: magazines (n=5); a login was required to access the App (n=31); intended for use by health professionals (n=25); available only in languages other than English, Portuguese, or Spanish (n=194); and did not address the health promotion needs of pregnant women with PE (n=76). Eleven apps were considered for the study. All of them were present on the Android operating system, with only one available on both the Android and Apple operating systems. Eight applications earned user ratings, while three were not classified. Ratings ranged from one to five stars, with the highest ranked five-star option available in both operating systems. The following chart depicts the criteria used to evaluate smartphone apps (Chart 1 and Table I). From this chart, each App was evaluated, along with their individual scores, as shown in Table 1.

The applications that were selected for review are shown in Table I, together with information on their sizes, download counts, ratings, and notes. Furthermore, the categories that the applications are made for, the dates of the most current updates, and the results of the chart's criterion evaluation are presented in this table. It was determined that there was no association between the scores gained by the users and the scores obtained in the test of the applications ($p = 0.80$). In addition, the data were categorised in order to provide a more precise description of the applications. These three categories—Health Promotion of Pregnant Women, Management of Physical Education, and Characteristics of Physical Education—were developed, and they will be discussed

in more detail below.

Table 1: Evaluate smartphone apps

Criteria	Question	Evaluation				
		1	2	3	4	5
Design	Is the design attractive?	Very poor		Satisfactory		Excellent
Usability	Is it easy to use and install the App?	Very difficult	Difficult	Neither	Easy nor difficult	Very easy
Language	In which languages is the App available?	Only 1	-	Only 2	-	More than 2 languages
Instructions	How would you rate the instructions?	None	Poor	Moderate	Good	Excellent
Security	Evaluate the security and privacy of this App.	None		Moderate		Excellent
Transference	Capacity and facility of transferring data to another device?	Incapable	Difficult	Neither easy nor difficult	Easy	Very Easy

The signs and symptoms, diagnosis, prevention, epidemiology, and consequences of PE were all covered in length in each and every one of these articles. Due to the fact that reading and navigating the app was straightforward and instructional, these were designed to serve the objective of giving pregnant women with instructions; nevertheless, they may also be utilised by medical experts. Icons, Dimensions, download size, accompanying remarks, quantity of assessments, and the date of the last update are all different between App (7) and App (10), despite the fact that both apps contain the same material. It is essential to take such differences into consideration. Given that App (10) has been available for a longer period of time, it is noteworthy that it has had a greater number of downloads and ratings. The sizes of applications varied from 6.6 megabytes to 26 megabytes across all platforms. The date of the most recent The updates differed significantly across different applications, with certain earlier updates (such as App10 with an update on September 29, 2015) and others being more current (like App5 with an update on March 16, 2018) being the most recent. As far as design and usability are concerned, the applications were simple to comprehend, and they made use of terminology that is typical of the everyday lives of women and of society in general. In addition, the definitions of technical words were explained wherever they were introduced.

DISCUSSION

The smartphone, being a convenient and affordable

device with internet access and a wide range of subject-specific applications, provides a novel opportunity to improve individuals' ability to obtain health-related information. It also facilitates the dissemination of knowledge on preventive care, which individuals should take responsibility for there are more than 165,000 mHealth Apps available to customers (9).

The present availability and usage of mHealth Apps, which can be downloaded from the Apple Store (Apple) and Google Play (Android), are comparable to the findings of a study conducted in 2013. At that time, the majority of these apps were focused on well-being, diet, and exercise. Around 25% of these efforts are dedicated to disease and treatment management, highlighting the growing interest in using applications for managing chronic diseases. Furthermore, over 50% of mHealth applications persist in having restricted functionality, mostly for the purpose of disseminating information (10) Pregnant women suffering from hypertension issues may experience advantages from utilising mHealth applications. Information and Communication Technology (ICT) can be utilised to assist in the process of diagnosing, monitoring, managing, and practicing self-care for medical conditions. It also facilitates communication between patients and healthcare providers, aids in education, and empowers patients to take control of their own healthcare (11).

PE can develop in women who are over 40 years There are several reasons why a person may be at risk for developing PE, such as having a family history of the condition, experiencing PE during a previous pregnancy, having high blood pressure, renal disease, diabetes mellitus type I or type II, being obese, undergoing in vitro fertilisation (IVF), or having other medical disorders. Apps pertaining to hypertensive disorders, particularly PE, highlighting its risk factors, have been on the rise, which is concerning because this is a major public health issue that causes morbidity in both mothers and their unborn children. This is why it's crucial to implement strategies that improve control, identification, recognition, and medical treatment (12).

Ten of the 11 apps that were evaluated provided useful information; app number five contained a calculator as well. App 6 was the only one lacking data, however the user enters her The app provides a means to monitor vital signs, including systolic and diastolic blood pressure as well as weight and height. "Consult the doctor when the SBP and DBP of the pregnant woman is elevated." is the only alert in App 6. Other apps lack the ability to do more targeted actions. Some crucial behaviours that these apps should display include: finding a hospital or basic health facility, exercising to stay fit, quitting smoking, and overcoming alcohol withdrawal. A total of 36 apps (76.6% of the total) had many functions in the prior research, while 11 apps (23.4% of the total) had a single purpose. This finding is consistent with the

data shown elsewhere; providing information was the most common function (80.9%). Because of their low cost, health apps make it easier for people to obtain information about healthy habits, lifestyle choices, diseases, and treatments..(8,13,14,15) Hence, possessing information empowers women to identify indications and symptoms, thereby enabling early detection and treatment, which can avert complications and decrease both illness severity and death rates (16). Furthermore, it is crucial to highlight that the utilisation of ICTs to promote a healthy lifestyle can serve as a potent and beneficial resource for pregnant women suffering from hypertensive illnesses Women predominantly utilise health applications that pertain to pregnancy, childbirth, and the care of children. A survey revealed that a higher percentage of women who have given birth for the first time (53.9%) utilise mobile applications, in contrast to women who have given birth multiple times (46.1%) (15).

Nevertheless, it is important to assess the credibility and accuracy of the information provided by the apps included in this study, particularly for first-time mothers who may have concerns about their pregnancy. Not all of the apps cited their sources, and only a small number of them were created by experts in the field (14).

Considering the audience and their geographical location is crucial while developing technology. Some locations, especially those in rural or isolated areas, still lack the means to purchase technology or have access to the internet. Hence, it's crucial to make sure that rural residents are making the most of the services and information they have access to (17).

It is possible to improve economic conditions, quality of life, and inequality in rural areas by providing them with a range of apps and ICT services. Many services fall under this category, including eHealth, e-Agriculture, e-Banking, and voice and SMS services that depend on internet and telephone technologies. People living in rural areas need access to accurate information in their native languages and timely updates in a variety of fields, including agriculture, healthcare, education, finance, and emergency preparedness. Therefore, it is essential to launch telemedicine awareness and education campaigns in outlying areas (17).

A significant obstacle in Brazil is the establishment of land-based networks in distant and inaccessible regions, particularly in the northern parts, due to topographical constraints and the existence of extensive forested areas. Another illustration pertains to the socioeconomic circumstances wherein individuals are incapable of affording Internet services or fail to uphold payment arrangements. Therefore, public policies aimed at rural development should focus on expanding terrestrial networks, prioritising the provision of high-quality services. Additionally, these policies should include

incentives for the general population to reduce access costs for end users and improve the availability of equipment like smartphones for purchase or rental. When taking into account the sociocultural circumstances of our community, it is imperative to create applications in Portuguese (17).

mHealth Apps have the potential to have a significant and meaningful effect in several health-related contexts, such as managing chronic diseases, addressing mental health issues, supporting education, and empowering patients. Mobile apps are mostly used to handle diabetes mellitus, which is the most prevalent ailment. Furthermore, it is worth mentioning the proliferation of applications specifically designed for pregnancy and hypertension conditions. Hence, to execute digital interventions utilising the suggested solutions, it is important to undergo clinical validation and evaluation of their outcomes. This step is essential for facilitating the incorporation of prototypes and protocols into health systems, with the aim of enhancing present clinical practice (14).

It is important to note that the research identified limits in the searches, specifically in the variations of apps across different smartphones, which can vary depending on the operating system and system updates. Another significant constraint is that the questionnaire utilised to assess the Apps, while comprehensible, has not yet undergone translation and validation into Portuguese. Thus, in this study, the researchers conducted a modification of the questionnaire.

CONCLUSION

It was feasible to confirm that the apps contain crucial information that can allay the fears and uncertainties that pregnant women could have. In addition, prenatal education on hypertensive disorders, particularly PE, is important for pregnant women to learn about their risk factors and make any necessary adjustments. Early detection and better clinical management can be achieved if pregnant women are able to recognise their symptoms and seek medical attention promptly.

REFERENCES

1. Roberts S, Chaboyer W, Hopper Z, Marshall AP. Using technology to promote patient engagement in nutrition care: A feasibility study. *Nutrients*. 2021;13(2):1–14.
2. Banos O, Villalonga C, Garcia R, Saez A, Damas M, Holgado-Terriza JA, et al. Design, implementation and validation of a novel open framework for agile development of mobile health applications. *Biomed Eng Online* [Internet]. 2015;14(2):S6. Available from: <http://www.biomedical-engineering-online.com/content/14/S2/S6>
3. Harari Y, Shawen N, Mummidisetty CK, Albert

- M V., Kording KP, Jayaraman A. A smartphone-based online system for fall detection with alert notifications and contextual information of real-life falls. *J Neuroeng Rehabil* [Internet]. 2021;18(1):1–13. Available from: <https://doi.org/10.1186/s12984-021-00918-z>
4. Marciano L, Vocaj E, Bekalu MA, La Tona A, Rocchi G, Viswanath K. The Use of Mobile Assessments for Monitoring Mental Health in Youth: Umbrella Review. *J Med Internet Res*. 2023;25(1).
5. Ibrahim MS, Mohamed Yusoff H, Abu Bakar YI, Thwe Aung MM, Abas MI, Ramli RA. Digital health for quality healthcare: A systematic mapping of review studies. *Digit Heal*. 2022;8(2):1–20.
6. Zakerabasali S, Ayyoubzadeh SM, Baniyadi T, Yazdani A, Abhari S. Mobile health technology and healthcare providers: Systemic barriers to adoption. *Healthc Inform Res*. 2021;27(4):267–78.
7. Garovic VD, Dechend R, Easterling T, Karumanchi SA, Baird SMM, Magee LA, et al. Hypertension in Pregnancy: Diagnosis, Blood Pressure Goals, and Pharmacotherapy: A Scientific Statement From the American Heart Association. *Hypertension*. 2022;79(2):E21–41.
8. Whale K, Beasant L, Wright AJ, Yardley L, Wallace LM, Moody L, et al. A smartphone app for supporting the self-management of daytime urinary incontinence in adolescents: Development and formative evaluation study of URApp. *JMIR Pediatr Parent*. 2021;4(4).
9. Ana FA, Loreto MS, José LMM, Pablo SM, María Pilar MJ, Myriam SLA. Mobile applications in oncology: A systematic review of health science databases. *Int J Med Inform*. 2020;133(1):1–19.
10. Murray A, Lyle J, Lyle J. Patient Adoption of mHealth. In: IMS Institute for Healthcare Informatics [Internet]. 2018. p. 1–63. Available from: www.theimsinstitute.org
11. Rivera-Romero O, Olmo A, Muñoz R, Stiefel P, Miranda ML, Beltrán LM. Mobile health solutions for hypertensive disorders in pregnancy: Scoping literature review. *JMIR mHealth uHealth*. 2018;6(5).
12. Chen S, Wang Y, Wang Y, Wei Y, Li Y, Li Z, et al. Pregnancy Outcomes in Females with Stage 1 Hypertension and Elevated Blood Pressure Undergoing In Vitro Fertilization and Embryo Transfer. *J Clin Med*. 2023;12(1):8–17.
13. Frid G, Bogaert K, Chen KT. Mobile health apps for pregnant women: Systematic search, evaluation, and analysis of features. *J Med Internet Res*. 2021;23(10):1–7.
14. Tsigas EZ. The Preeclampsia Foundation: the voice and views of the patient and her family. *Am J Obstet Gynecol* [Internet]. 2022;226(2):S1254–S1264. e1. Available from: <http://dx.doi.org/10.1016/j.ajog.2020.10.053>
15. ITU. Telecommunications/ICTs for rural and remote areas [Internet]. 2021. 1–106 p. Available from: <https://www.itu.int/pub/D-STG-SG01.05.1-2021>
16. Gholami K, Norouzkhani N, Kargar M, Ghasemirad H, Ashtiani AJ, Kiani S, et al. Impact of Educational Interventions on Knowledge About Hypertensive Disorders of Pregnancy Among Pregnant Women: A Systematic Review. *Front Cardiovasc Med*. 2022;9(June).
17. Development P, World ITUT. Creating the smart society: Social and economic development through ICT applications. 2017. 6–8 p.