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POLISH JOURNAL OF PHYSIOTHERAPY

OFICJALNE PISMO POLSKIEGO TOWARZYSTWA FIZJOTERAPII

THE OFFICIAL JOURNAL OF THE POLISH SOCIETY OF PHYSIOTHERAPY

NR 2/2023 (23) KWARTALNIK ISSN 1642-0136

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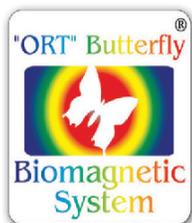
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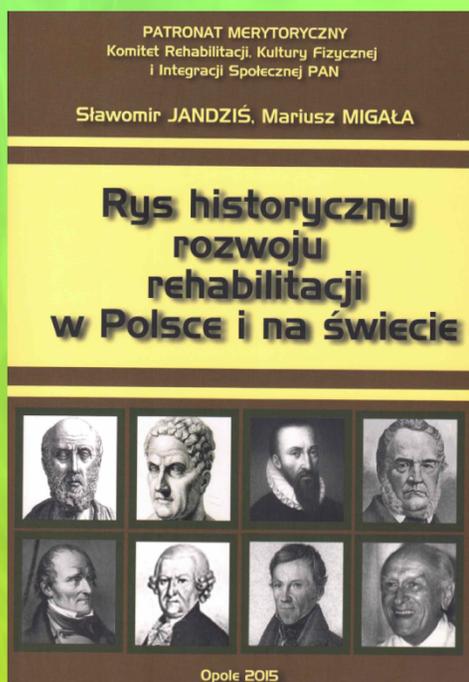
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Development and validation of an e-health module – PregEx to support antenatal exercise and education

Opracowanie i validacja modułu e-zdrowie – PregEx w celu wspierania ćwiczeń i edukacji

Janani C.^(B,E), B. Sathya Prabha^(A,C,D,E,F)

Faculty of Physiotherapy, Sri Ramachandra Institute of Higher Education and Research, Porur, Chennai, India

Abstract

Background. Pregnancy, childbirth, and motherhood are major life phases in a woman's life. During these phases, not only do women experience physiological changes but they are also adjusting to their new roles and responsibilities as mothers. The World Health Organization has declared that the benefits of e-health should be considered among the fundamental components of any strategy and most important programs for the collection of pregnancy healthcare information. Hence this study aimed to develop an e-health module to support antenatal exercise and education for pregnant women.

Aim. To develop and validate an e-health module to support antenatal exercise and education.

Methodology. The development of an e-health module was prepared using the structured antenatal exercise protocol. Face and content validation was done by expert opinion and feedback on the application was obtained. Feedback from the usability evaluation was used to revise the app. The application was named as PregEx. The developed application (PregEx) was validated among fifty antenatal mothers. They were instructed to follow up on antenatal exercises and education and were on follow-up for 2 weeks. Then the feedback on the mobile application was collected from the mothers using a mobile application rating scale (MARS).

Results. The overall quality mean scores of the MARS scale was 4.08 ± 0.39 . The ratings of MARS app specific responses had shown about 80% were on awareness creating, 90% were knowledge oriented, 71% of the mothers found this app as a help-seeking and satisfaction and about 67% felt it improves the mothers on behavior change.

Conclusion. The mobile app (Preg Ex) was user-friendly and feasible for antenatal mothers to understand easily and practice antenatal exercise and education.

Keywords

mHealth app, mobile application, educational applications, pregnant women, Pregnancy exercises and antenatal care

Streszczenie

Wprowadzenie. Ciąża, poród i macierzyństwo to ważne etapy w życiu kobiety. Podczas tych etapów kobiety nie tylko doświadczają zmian fizjologicznych, ale także dostosowują się do nowych ról i obowiązków jako matki. Światowa Organizacja Zdrowia zadeklarowała, że korzyści płynące ze korzystania z modułu e-zdrowie należy uznać za jeden z podstawowych elementów każdej strategii i najważniejszych programów zbierania informacji dotyczących opieki zdrowotnej w ciąży. Dlatego badanie to miało na celu opracowanie modułu e-zdrowie, który wspierałby ćwiczenia przedporodowe i edukację kobiet w ciąży.

Cel. Opracowanie i zatwierdzenie modułu e-zdrowie w celu wspierania ćwiczeń i edukacji przedporodowej.

Metodologia. Moduł e-zdrowie został opracowany przy użyciu ustrukturyzowanego protokołu ćwiczeń przedporodowych. Validacja treści została przeprowadzona na podstawie opinii ekspertów. Uzyskano informację zwrotną na temat aplikacji. Informacje zwrotne z oceny użyteczności zostały wykorzystane do wprowadzenia zmian w aplikacji. Aplikacja została nazwana PregEx. Opracowana aplikacja (PregEx) została przetestowana przez pięćdziesiąt matek w okresie przedporodowym. Kobiety zostały poinstruowane, aby kontynuować ćwiczenia i edukację przedporodową. Uczestniczki były objęte obserwacją przez 2 tygodnie. Następnie zebrano od matek opinie na temat aplikacji mobilnej za pomocą skali ocen aplikacji mobilnych (MARS).

Wyniki. Ogólna średnia ocen jakości w skali MARS wyniosła $4,08 \pm 0,39$. Oceny konkretnych odpowiedzi MARS wykazały, że około 80% dotyczyło budowania świadomości, 90% było zorientowanych na wiedzę, 71% matek uznało tę aplikację za narzędzie do szukania pomocy i satysfakcji, a około 67% uważało, że poprawia zachowania matek.

Wniosek. Aplikacja mobilna (Preg Ex) była przyjazna dla użytkownika i łatwa do zrozumienia dla matek w okresie przedporodowym oraz ułatwiała wykonywanie ćwiczeń i edukację przedporodową.

Słowa kluczowe

aplikacja mHealth, aplikacja mobilna, aplikacje edukacyjne, kobiety w ciąży, ćwiczenia w ciąży i opieka przedporodowa

Introduction

Pregnancy, childbirth and motherhood are major life phases in a woman's life. During these phases, not only do women experience physiological changes but they are also adjusting to their new roles and responsibilities as mothers. With the changes in their personal relationships, social, and sometimes cultural practices, pregnancy is a time of increased uncertainty and anxiety for many women. As such, pregnant women are likely to seek information to manage their health status and for their child's health benefits. These periods present opportunities for health care providers to promote healthy lifestyle behaviors [1]. Perinatal morbidity and mortality are significant public health issues with an enduring impact on the health and well-being of women and their families. Millions of pregnant women now download and use mobile applications to access, store, and share health information. However, little is known about the consequences. An investigation of their impact on perinatal health outcomes is particularly topical [2]. Medical Information Technology may be understood as an interdisciplinary study of the conception, design, development, adoption, and use of Information Technology (IT) innovations for healthcare provision, management, and planning. Concerning the use of IT in reproductive health, the aim of the diverse range of currently available applications (apps) is to assist in family planning, antenatal, intrapartum and postpartum care, along with neonatal and infant healthcare [3].

With the advent of new digital technologies, Internet-based tools have become important sources of health information. In recent years, mobile devices have gained value among other digital technology tools for finding health information anywhere and at any time. Mobile health (mHealth) is defined as "a medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants, and other wireless devices". mHealth has many potential benefits in health behavior interventions. Its strengths lie in its ease of access and user-friendliness, resulting in its widespread adoption worldwide. As the mobile app was becoming user-friendly to pregnant women, they can easily understand the antenatal exercise through images or videos which is displayed in the app and they can be able to watch the exercise repeatedly. By using e-health antenatal care the mother can avoid frequent traveling to the clinic. Furthermore, pregnant women using the apps will have timing flexibility, save money, and feel less embarrassment. mHealth apps have shown their effectiveness in the self-management of pregnancy, improving healthcare delivery, improving cholesterol levels, improving mood and energy levels of pregnant women and fewer hospital visits among the high-risk pregnancy groups. mHealth apps may include some features such as audio guidance for exercises, which contributes to their effectiveness in improving compliance among pregnant women. Limitations and concerns of mHealth apps need to be addressed when pregnant women download the apps, such as its content accuracy, risk of confidentiality breaches, privacy, security, lack of central regulation and professional involvement in their developments. A study of seeking health information online showed that almost half of the patients searched for online health information before obtaining information from their doctors. Easily accessible patient information made available via

app technology reaches the patients and may contribute to improved pregnancy planning and outcome in women with pre-existing diabetes [4].

During the pandemic process, telemedicine and telenursing applications have been used to meet the need for healthcare throughout the world and skills in this area have been developed (ACOG, 2020; Nanda et al., 2020). Especially in pregnancy and postpartum follow-up and care, telehealth programs have been created, and widely used (Dashraath et al., 2020; Rochelson et al., 2020). Similarly leading international institutions, such as the American College of Obstetricians and Gynaecologists (ACOG) and the Royal Australian and New Zealand College of Obstetricians and Gynaecologists recommend the use of telehealth applications in maintaining the prenatal and postnatal care of women with pregnancy (ACOG, 2020; RANZCOG, 2020) [5].

WHO has suggested that antenatal exercise and education can be delivered via e-health, but there is a dearth of literature regarding e-health antenatal care in India. Currently, e-health is increasingly used in health interventions to improve antenatal health outcomes. Participants who use antenatal exercise and education apps will have greater relief from pain and discomfort during pregnancy than those who undertake general antenatal check-ups and care during their pregnancy period. The World Health Organization has declared that the benefits of e-health should be considered among the fundamental components of any strategy and most important programs for the collection of healthcare information in the 21st century. The World Health Organization (WHO) has also emphasized the promotion of health literacy for pregnant women as a primary population [6]. Maternal health literacy is very important in pregnant mother's understanding of prenatal risks because the mothers' understanding of risks may affect their desire to follow pregnancy advice. The mobile medical system constructed by mobile Internet can effectively remind patients with gestational diabetes and transmit data automatically [7].

Internet usage has been steadily increasing and the available online information for pregnant women today is immense. Lack of awareness of the benefits of antenatal exercise programs is a major drawback among the pregnant women population in India. Adherence and follow-up of antenatal exercise programs is a tasking job. Currently, mobile application-based education would be a superior way of option for antenatal mothers. Hence the development of a mobile application with structured antenatal exercises and education would help pregnant mothers to improve their maternal and fetal development.

Aim and objectives

To develop an e-health module to support antenatal exercise and education.

To validate the e-health module on antenatal exercises and education.

Materials and methods

This study was approved by the Ethics Committee of Sri Ramachandra Institute of Higher Education and Research. (CSP/22/APR/109/311).

Study setting

The study is conducted in the Out Patient Department (OPD),

Department of Obstetrics and Gynaecology, Sri Ramachandra hospital.

Research design: Cross-sectional study.

Sampling method: Convenient sampling.

Study population: South-Indian pregnant women.

Duration: 3 months.

Sample size: 50 samples.

Inclusion criteria

- Pregnant women aged over 21 years
- Had smartphones with handling skills
- Any parity of 20 weeks of gestation and above
- Able to understand and read English.

Exclusion criteria

- Pregnant women with chronic medical problems.
- Conditions with which the pregnant woman is not advised to do any exercises.

Phase-1

- The e-health module was prepared using the structured antenatal exercise protocol. The e-health module consists of information regarding the following main user interfaces: (1) the main login page, (2) knowledge about pregnancy, (3) changes during pregnancy – physical and physiological, labor outline, (4) common pregnancy discomforts, (5) antenatal exercises (6) healthy lifestyle during pregnancy, (7) nutrition tips, (8) labor coping techniques (9) early postnatal exercises and lactation care.
- The application content was circulated for content validation

and feasibility from 10 experts- 8 experts (MPT -Women's Health) practicing women's health physical therapy and 2 gynecologists. Face and content validation is done by expert opinion and feedback on the application was obtained. Feedback from the usability evaluation was used to revise the app. The content which has got agreement 80% and above for validation is considered for app development. The application is named as PregEx. (Figure 1)

Phase-2

- The developed application (PregEx) was validated among antenatal mothers from the OPD, Department of obstetrics and gynecology, Sri Ramachandra Institute of Higher Education and Research. A written informed consent was obtained from the participants. 50 mothers were recruited as per the inclusion and exclusion criteria. Mothers were given the application link at the first session of the antenatal exercises supervised session.
- They were instructed to follow up on antenatal exercises and education and were explained the application details and exercise adherence. They were on follow-up for 2 weeks. Then the feedback on the mobile application was collected from the mothers using a mobile application rating scale (MARS) (Figure 2).

Statistical analysis

The data were statistically analysed through SPSS version 24.0. Demographic details such as age, height, weight, BMI, occupation, medical history, and education were analysed. To describe the data and feedback analysis, descriptive Statistics and frequency distribution were used and compared.

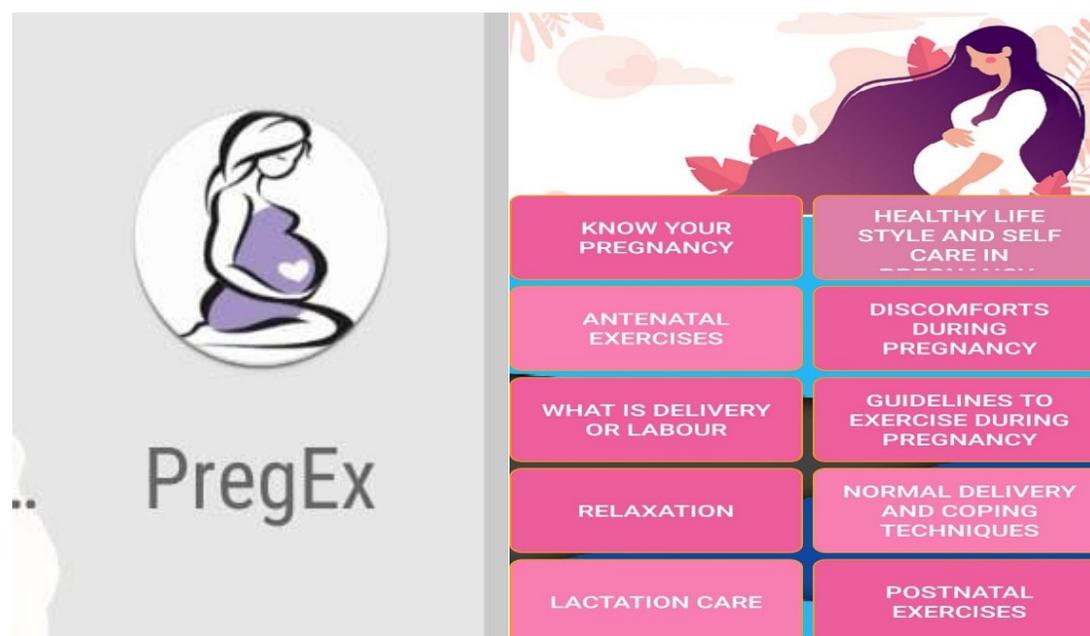


Figure 1. Main screens of the PregEx

Results

The age of the participants ranged from 21 years and above of any parity. The participant's age has a mean of 26.784 ± 3.9 , height was 158.76 ± 5.9 , weight was 65.87 ± 9.2 , and BMI was 26.118 ± 3.8 . (Table 1) The total study sample consists of 50 (N = 50) antenatal mothers.

The majority of the women were homemakers (60%) and 40% were working mothers, 10% had high school level education and 50% had completed their college degree and 40% had completed their postgraduation or more. 55% of women were prime gravida mothers and 45% of mothers were multi gravida mothers. (Figures 3–5)

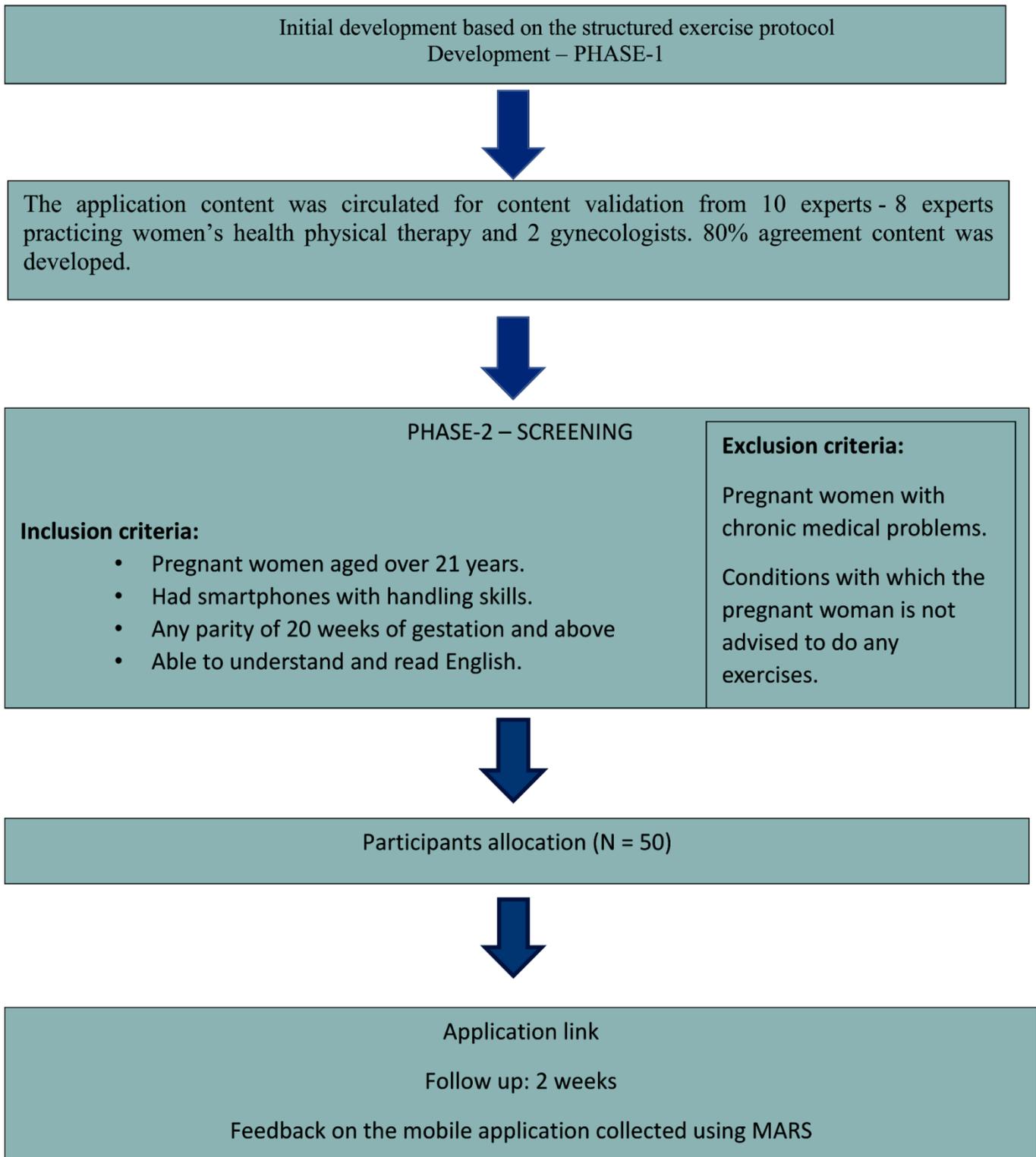


Figure 2. Methodology Cross-sectional/Feasibility study flowchart

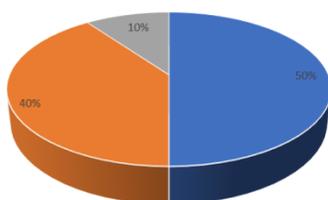
The scores of the MARS scales responses for the component, explained as engagement mean score was 3.89 ± 0.48 , functionality, aesthetics, and information mean were (4.29 ± 0.40 , 4.152 ± 0.46 , 4.044 ± 0.53) and the overall quality mean score was 4.08 ± 0.39 . (Figure 6)

For all the included data sets, the MARS rating was conducted

by the physiotherapist. The MARS app-specific rating responses from participants included only maximum gradings. Maximum gradings were given on 4 and 5, about 80% were on awareness creating, 90% were knowledge-oriented. (Table 2) In the analysis of the star ratings on the PregEx application, 50% of the participants responded as very good for the app (Table 3).

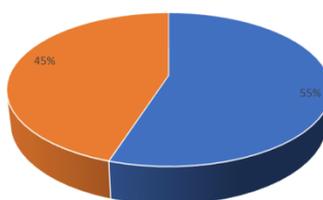
Table 3. Baseline characteristics

Variables	Mean (SD)
Age [years]	26.784 (3.997)
Height [cm]	158.765 (5.969)
Weight [kg]	65.875 (9.280)
BMI [kg/m ²]	26.118 (3.880)



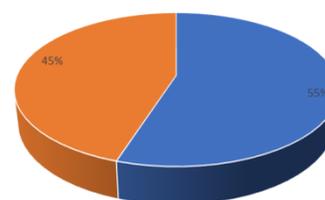
■ UG ■ PG ■ Schooling

Figure 3. Baseline characteristics of participants: educational status



■ Primip ■ Multip

Figure 4. Baseline characteristics of participants: obstetric history



■ Primip ■ Multip

Figure 5. Baseline characteristics of participants: Occupational status

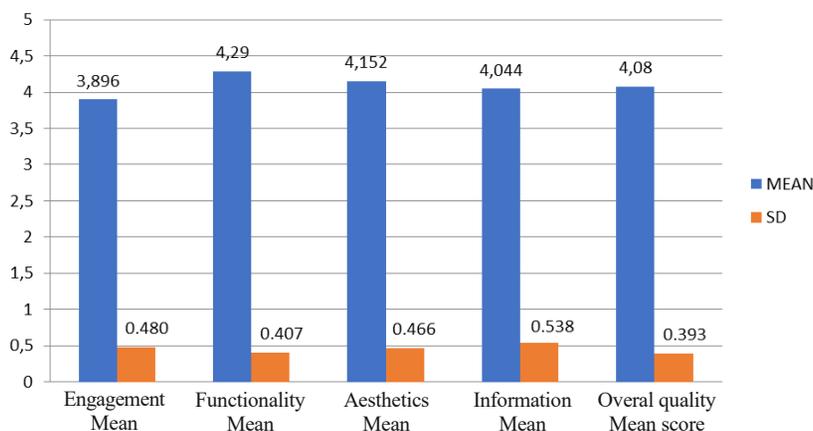


Figure 6. MARS Scale responses

Table 2. MARS - app-specific rating responses

App-specific responses [Ratings]	Awareness [%]	Knowledge [%]	Attitudes [%]	Intension to change [%]	Help-seeking [%]	Behaviour change [%]
3	20	10	15	10	13	16
4	40	40	35	40	16	18
5	40	50	50	50	71	67

Table 3. Analysis of star rating on PregEx application

Star rating	3 ★	4 ★	5 ★
Responses of participants N = 50 (%)	10%	40%	50%

Discussion

The purpose of the study was to develop and validate an e-health module to support antenatal exercise and education. Few of the highly rated pregnancy smartphone apps were generally of low to moderate quality [8, 9]. This study systematically descri-

bed app quality which includes knowledge about pregnancy, physical and physiological changes during pregnancy, labor, common pregnancy discomforts, antenatal exercises, healthy lifestyle during pregnancy, nutrition tips, labor coping techniques and early postnatal exercises.

The quality and the impact of antenatal exercises and education were assessed using the mobile application rating scale (MARS) [10]. The overall quality mean score was 4.08 ± 0.39 . Mean scores of the MARS scales responses had shown the application quality and user satisfaction (Figure 6).

In the present study revealed that the application's content clarified doubts and had quality information and that the guidelines of the tool contributed during the gestational period, being associated with satisfaction regarding the use of this technology (Tables 2, 3).

The MARS rating was conducted by the physiotherapist. The MARS app-specific rating responses from participants revealed as maximum grading was loaded on 4 and 5 which conveys a highly positive response. 80% of responses were on awareness creation, 90% were knowledge-oriented, 85% mirrored attitudes. 90% of users mentioned that PregEx app had led them to an intention to change path, 71% for help-seeking and satisfaction and about 67% stated that there is an improvement in behavior change (Table 2).

Clinicians and women expressed satisfaction and ease of use of the mHealth platform with some technological challenges around wireless connectivity. Antenatal contact was higher with the use of the app compared with a matched historical sample. The mHealth platform is a new comprehensive tool for the health care of women with gestational diabetes and may provide an effective new avenue to enhance multidisciplinary care in the face of COVID-19 disruptions and challenges to traditional care pathways [11]. Pregnant women who used the application attended a greater number of consultations when compared to nonusers. The application showed to be an effective health technology to improve adherence to prenatal care [12].

Similarly, Sultan Özkan Şat et al. 2021 conducted a cross-sectional study on the use of mobile applications by pregnant women and levels of pregnancy distress during the coronavirus pandemic. They stated that the Mobile health applications appear to be usable for prenatal follow-ups because mobile applications are common among pregnant women of the newer era [13].

Monique van Beukering et al. 2021 stated that a blended care intervention, which consists of a training session for obstetrical caregivers and the personalized advice provided by a specifically developed mHealth application, increases the percentage of advice on work adjustments given by midwives and obstetricians to pregnant workers [14].

Gabriela Frid et al. 2021 conducted a systematic search, evaluation, and analysis of features on mobile health apps for Pregnant Women. They concluded that their search yielded many high-scoring apps, but few contained all desired components and features. This list of identified and rated apps can lessen the burden on pregnant women and providers to find available apps on their own [15].

The findings of the present study had shown that objectivity of the mobile application rating scale (MARS) was good. The participants who used the PregEx app showed positive results in the app's usability and is user-friendly for pregnant mothers. (Tables 2, 3) Thus, the developed mobile application with video instruction has been more beneficial for supplementing in-person exercise instruction for clients to access and practice exercise for pregnant women.

Limitations of the study

Follow-up is of short period and only supported for android version mobile phones.

Conclusion

The mobile app (PregEx) was user-friendly and feasible for antenatal mothers to understand easily and practice antenatal exercise and education.

Adres do korespondencji / Corresponding author

B.Sathyaprabha

E-mail: sathya.b@sriramachandra.edu.in

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