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Original Article

The Use of "FetalKickApp" for Counting Fetal Movement in Pregnant Women: A Case Study of The University of Port Harcourt Teaching Hospital, Nigeria

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Abstract

Background: The global stillbirth rate is 13.9 stillbirths per 1000 births, with most stillbirths being recorded in developing countries. Most cases of stillbirth are preceded by reduced fetal movement. Early detection of reduced fetal movement is a key element in reducing the number of stillbirths. Therefore, a "FetalkickApp" that is a self-monitoring digital health tool, assists a pregnant woman to count, record, and send her fetal movement count to her health care provider without the use of mobile data or internet.

Methodology: This study is a longitudinal pilot study involving 25 pregnant women with single fetuses between 28 and 38 weeks of gestation. The mobile application monitor was used to record the number of fetal movements for 4 weeks. A 5-point Likert scale questionnaire is used to assess the use of the application, interface experience, satisfaction with the design, and function of the application without internet.

Results: The mean age of the women is 31.2 (±4.5) years, and the mean gestational age is 29.5 (±2.4) weeks. The results obtained show that the majority of the women (72%) had good knowledge of fetal movement. About two-thirds (64%) of the women agreed that the FetalkickApp is helpful in counting their fetal movement. Forty-four per cent (44%) of the women strongly agreed that the application is easy to use, and 68% of the women agreed that the FetalkickApp's effectiveness is satisfactory.

Conclusion: The FetalkickApp is independent of the internet, which means that it could be used everywhere. The interface and design of the application are simple and could be operated by any individual concerned.

Keywords: fetal, pregnancy, kicks, app, stillbirths, smartphone

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Introduction

Fetal movement is any discrete roll, kick, swish, or flutter, which evolves into a pattern of stronger gross movements as the gestational age increases.[1] It is usually first perceived by the mother around the 18th to 20th week of gestation.[2] The movement of the fetus in utero is an indicator of fetal well-being.[3,4] Reduced fetal movements have been reported in 5% to 15% of all pregnancies and occur before stillbirths in 50% of cases.[5,6,7] The global stillbirth rate is 13.9 stillbirths per 1000 births, with the majority of the stillbirths occurring in developing countries.[8,9] The stillbirth rate in sub-Saharan Africa is 21.7 stillbirths per 1000 births.[8] A study in Port Harcourt, Southern Nigeria, reported a higher stillbirth rate of 30.5 stillbirths per 1000 births.[10] In about 50% cases, the cause of the stillbirths was unknown.[11]

Fetal movement counting can identify possible fetal compromise through maternal detection of reduced fetal movement, enabling timely reporting to health professionals, thereby preventing stillbirth.[1,12,13] This involves using a fetal kick chart to systematically quantify and monitor maternal perceptions of fetal activity over a defined period of time.[14,15,16] The method is simple, non-invasive, cheap, readily available, and helps the mother participate in the care of her baby.[13,17]

However, there is no generally accepted definition for reduced fetal movement[1,3,18,19,20], and certain conditions, such as maternal anxiety, maternal activity, maternal positions, anterior placenta, and fetal sleep, may lead to a false maternal perception of reduced fetal movement without actual fetal compromise.[18,21] Therefore, maternal perception of reduced fetal movement may require further diagnostic screening, such as cardiotocography and ultrasonography.[1,19,20]

There are several types of fetal kick charts, and most of these kick charts in our environment would require the woman to have a pen and paper to document the fetal movements and call her doctor or visit the hospital when the number of fetal movements does not meet the required set number.[22,23,24]. The 'FetalKickApp' is a self-monitoring digital health tool developed by CyberFemmeHubs LLC, Angela R Wells and Software Developers. It is an offline application designed for use in a low-resource community where internet service is a luxury. The application allows a pregnant woman to monitor her fetal kicks using a smartphone. The number of kicks within the specified period gives her an alert when the set alarm limits are reached. The application records the pattern of fetal movement over time, and the pregnant woman sends the saved fetal movement to her doctor via text, voice or any social media platform.

Most fetal movement counting applications are designed for developed countries and often fail to meet the specific demands in Africa, and studies evaluating their user interface, customer satisfaction, and their role in the improvement of health care services in developing countries are lacking. This pilot study assessed the use of the "FetalKickApp" in counting fetal movement, user satisfaction, and the function of the application without internet. The rest of the paper is divided into materials and methods, results, discussion, conclusion, and references.

Materials and Methods

The workflow for the study was:

Development of the mobile application named "FetalKickApp";
Obtaining ethical clearance;
Testing the "FetalKickApp";
Administering the questionnaire to assess the level of knowledge on fetal movement;
Informing the pregnant women on how to use the application;
Analysed the use of the FetalkickApp using the Likert scale

The training and the use of the FetalkickApp are displayed in Fig. 1 and Fig. 2, and the weekly data monitoring is shown in Fig. 3.

Figure 1

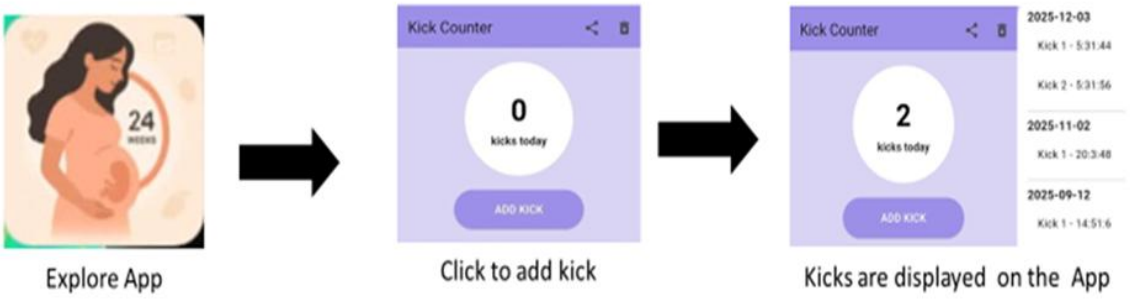

Figure 2

Figure 3

Pilot Study

This study was a longitudinal pilot study among women attending the antenatal clinic at the University of Port Harcourt Teaching Hospital. The study participants were pregnant women who were receiving antenatal care at the University of Port Harcourt Teaching Hospital. The inclusion criteria were pregnant women with single fetuses between 28 and 38 weeks of gestation who had a smartphone. Pregnant women <20 weeks of gestation and women with multiple gestations were excluded.

The sample size was calculated from a retrospective study at the University of Port Harcourt Teaching Hospital, which reported a total of 344 intrauterine fetal deaths from 2,284 unbooked deliveries, giving a prevalence of 15.1%.[10] The sample size for the actual study was calculated as follows: $(1.96^2 \times 0.151 \times 0.849)/ 0.05^2 = 196.96$. The sample size for the pilot study was calculated using 10% of the sample size of the actual study: 196.96/10 = 19.69 ≈20. Therefore, 25 pregnant women who met the inclusion criteria were randomly selected as follows: The folder numbers of the women who met the criteria were entered into a random number generator application (Random Generator by Apps n Blue; version 2.2.13) to randomly select 2 women for the study each clinic day. The process continued for 12 weeks (5th of August 2025 to the 28th of October 2025) to achieve the desired sample size of 25 women. All participants completed the study.

The Questionnaire, Training, and Ethical Clearance

A structured interviewer-administered questionnaire was used to assess the level of knowledge on fetal movement. The questions were (1) What is fetal movement? (2) When does a woman begin to feel fetal movement? (3) Can fetal movement be absent when a baby is healthy? (4) Why is fetal movement important? (5) What factors can affect fetal movement? (6) How do I monitor fetal movement? (7) What would you do when you have concerns about your fetal movement? (8) Can a smartphone be used to count fetal movement? The women were graded based on the percentage of correct answers (good knowledge ≥ 60% and poor knowledge <60%).

The women were taught how to download and use the FetalkickApp. The women were taught the Cardiff method of fetal movement counting[22] (≥ 10 movements in 12 hours). Each woman was asked to count her fetal kicks for a period of 12 hours a day and share their weekly data of fetal kicks with the research team. The women were followed up for 4 weeks. A 5-point Likert scale questionnaire was used to assess the use of the application after 4 weeks. The comments on the Likert scale questionnaire were: (1) The FetalkickApp was helpful in counting fetal kicks, (2) The FetalkickApp interface was easy to use, (3) The FetalkickApp design was satisfactory, (4) The application worked without internet, (5) You are likely to recommend the FetalkickApp. The responses on the Likert scale questionnaire were: (1) strongly agree, (2) agree, (3) undecided, (4) disagree, and (5) strongly disagree. The women were also asked to recommend additional features they would love the FetalkickApp to have besides counting fetal movement. The relationship between knowledge of fetal movement and the use of the FetalkickApp was evaluated. The analysis of the data was done using the Statistical Product and Services Solutions version 25.0. The comparison of means was done using the Student's T-test. The confidence interval was at 95%, and the significance was at p-value <0.05.

Ethical clearance for this study was obtained from the Ethics Review Committee of the University of Port Harcourt Teaching Hospital on the **11th of July 2025**. The protocol number is **UPTH/ADM/90/S.1/VOL.XI/1972.**

Results

Demographic characteristics

The mean age of the participants was 31.2 (±4.5) years, and the mean parity was 1.2 (±1.6). The mean gestational age was 29.5 (±2.4) weeks as presented in Table 1. Nineteen women (76%) had a tertiary level of education according to Fig. 4. One woman had hypertension in pregnancy, and 4 women had diabetes mellitus in pregnancy.

Table 1: Demographic characteristics of the women

Variable	Mean	SD	95% CI
Age (years)	31.2	4.5	29.3-33.0
Parity	1.2	1.6	0.5-1.9
GA (weeks)	29.5	2.4	28.5-30.5

NB: GA= Gestational age, SD= Standard Deviation, CI=Confidence Interval

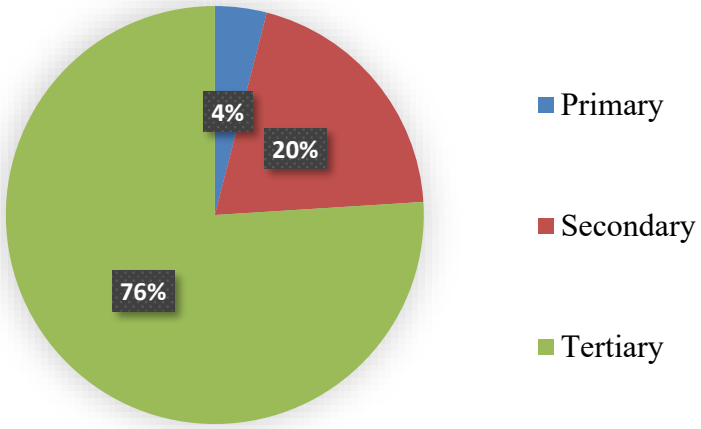

Fig 4: Pie Chart showing the level of education of the participants

Knowledge of fetal movement

Sixteen women (72%) had good knowledge of fetal movement as shown in Fig. 5. Seventeen women (68%) got the knowledge of fetal movement from a health care provider, 5 (20%) from social media, and 3 (12%) from family and friends. Thirteen (54%) women were aware that a smartphone application can count fetal movement, but none of these women had ever used any smartphone applications to count their fetal movement. There was no significant association between knowledge of fetal movement and the demographic characteristics of the women, as seen in Table 2.

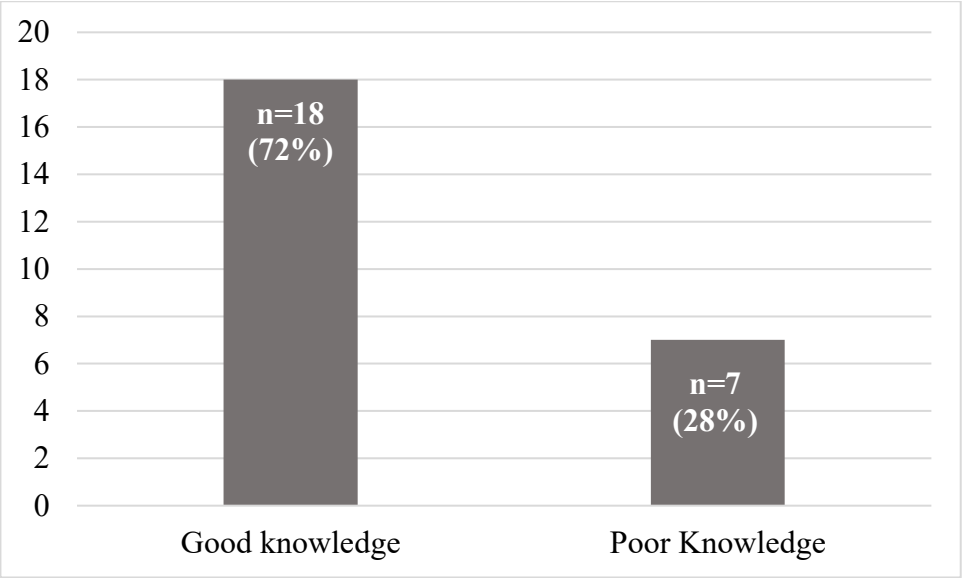

Fig. 5: Bar chart showing the knowledge of fetal movement

Table 2: Demographic characteristics and knowledge of fetal movement

	Good knowledge Mean (±SD)	**Poor knowledge Mean (±SD)**	**p-value**	**95% CI**
Age (years)	31.1 (±4.5)	31.3 (±4.7)	0.932	4.0 - 4.4
Parity	1.5 (±1.7)	0.4 (±1.1)	0.085	2.3 - 0.1
GA (weeks)	29.3 (±1.8)	30.0 (±3.6)	0.050	1.5 - 2.9
SD-Standard deviation; GA- Gestational age; CI- Confidence interval				

The Deployment of the Fetal Kick App

Sixteen (64%) women agreed the FetalkickApp was helpful in counting their fetal movement, 11(44%) women strongly agreed the application was easy to use, and 17(68%) women agreed the application design was satisfactory. All the participants were able to use the application without internet, and more than 72% (18 women) agreed they would recommend the application to others, as presented in Table 3 and Fig. 6. The most common additional feature that the women wanted to be added to the application is a food guide, according to Fig. 7.

Table 3: Summary of the Likert Scale on the use of the fetal kick App						
Statements	SA	A	UD	D	SD	Total (n)
Helpful in counting fetal kicks	4(16%)	16(64%)	2(8%)	2(8%)	1(4%)	25(100%)
The interface is easy to use	11(44%)	9(36%)	3(12%)	1(4%)	1(4%)	25(100%)
Design is satisfactory	3(12%)	17(68%)	1(4%)	1(4%)	3(12%)	25(100%)
Worked without internet	7(28%)	12(48%)	6(24%)	0(0%)	0(0%)	25(100%)
Likely to recommend App	3(12%)	18(72%)	2(8%)	1(4%)	1(4%)	25(100%)
NB: SA=Strongly agree; A=Agree; UD=Undecided; D=Disagree; SD=Strongly disagree						

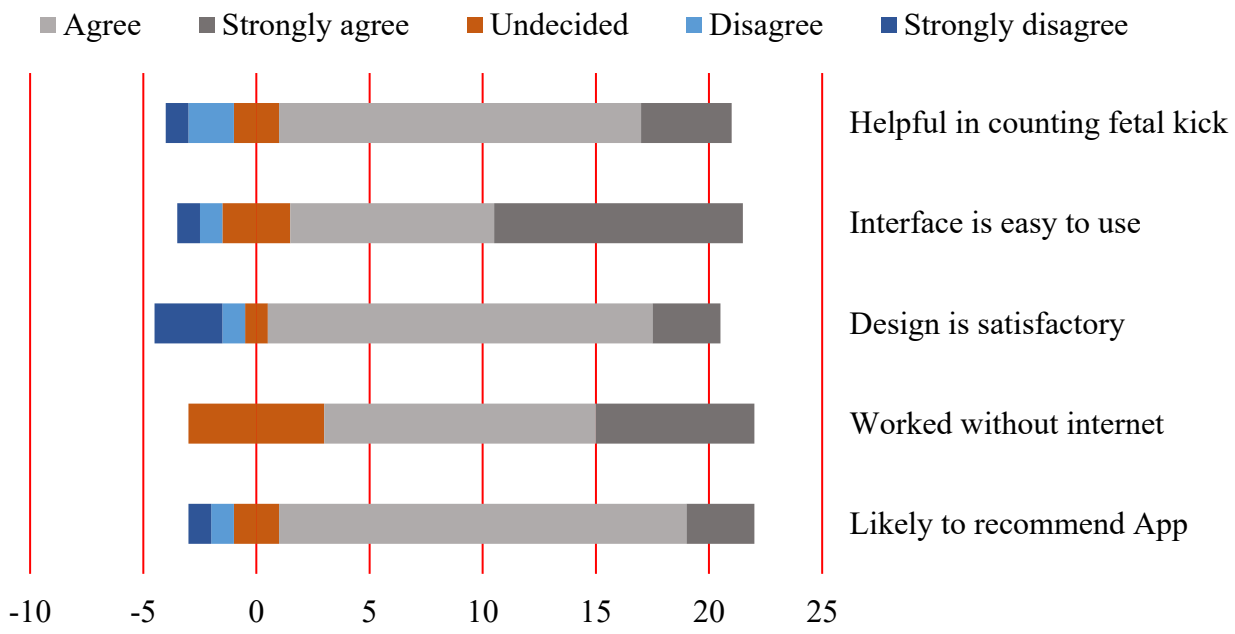

Fig 6: Bar chart comparing the response to the use of the fetal Kick app

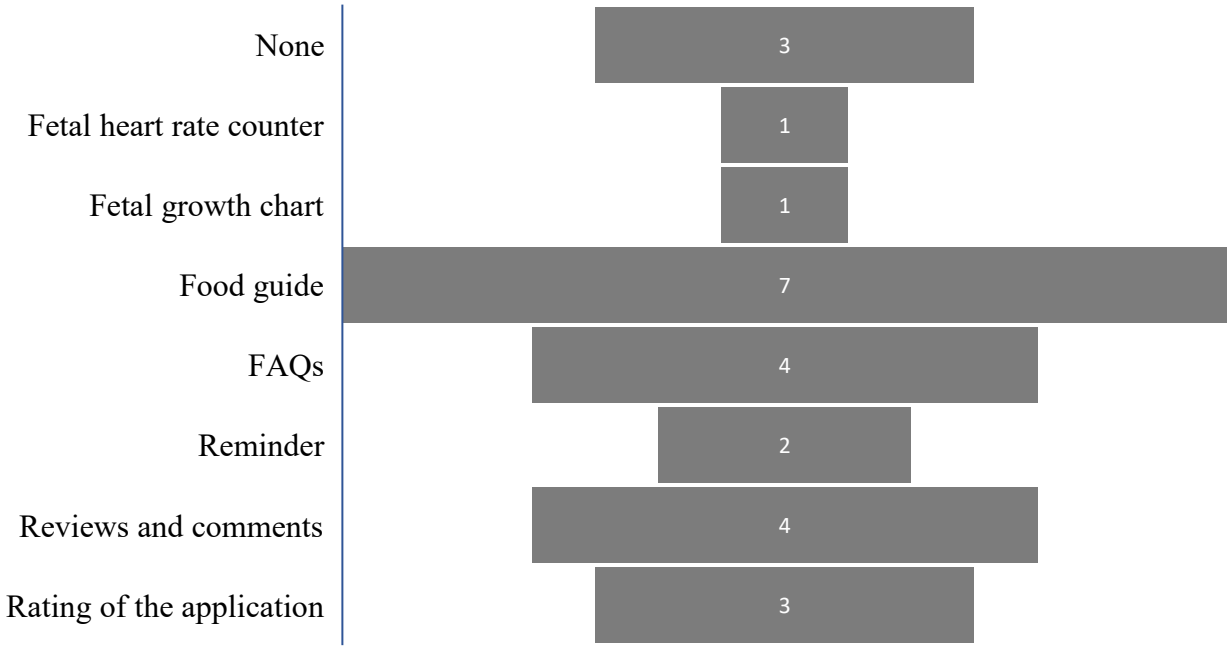

Fig. 7: Funnel chart showing recommendations by the women

Discussion

Table II shows that more than two-thirds of the women had good knowledge of fetal movement, and the common source of their knowledge of fetal movement was from a health care provider. This is in line with the study carried out by Pollock et al[25] in Australia, where >50% of women got the knowledge of fetal movement from a healthcare provider. Women who have had at least one previous pregnancy are more likely to have a better understanding of fetal movement from their past pregnancy experience.[1] In this study, the mean parity was 1.2 (±1.6), which explains why the study population had a good knowledge of fetal movement. The pattern of fetal movement becomes more obvious as the gestational age increases. However, the gestational age in this study was not significantly associated with good knowledge of fetal movement.

Although more than half of the women were aware that smartphone applications can be used to count fetal movement, none of the women in this study had previously used a phone application for fetal movement counting as compared to a study conducted in Egypt, where a fetal movement counting application was used by pregnant women in semi-urban areas to successfully monitor their fetal activities, improve their knowledge of antenatal care and promote a better pregnancy outcome.[26,27]

According to Fig. 7, most of the participants were satisfied with the FetalkickApp design and features, but requested additional features. such as a growth chart, food guide, frequently asked questions and fetal heart rate counter. Adding these features to the application comes with some challenges that may defeat the core aim of the application. A frequently asked question feature may require an internet connection for updates, measurement of fetal heart rate requires a Doppler device, and universal fetal growth may not be suitable for our environment since growth charts are affected by genetics and environment.[28] A review of smartphone applications used in pregnancy showed that most of the applications appear to follow

commercial interests with no validated standards.[29] Therefore, in accommodating these requested features, validated features peculiar to FetalkickApp should not be compromised.

Internet penetration in Africa is 38-43%, standing below the global average of 68%.[30] This is a major contributing factor to the limited use of the internet for health information on the continent.[30,31] Other limitations to internet use in Africa are slow internet, cost of data, lack of internet literacy and lack of devices that use the internet.[32] To address the challenge of the internet, the FetalkickApp was designed to work independently of the internet. From the study, all the women were able to use the FetalkickApp without the internet. This is an important feature aimed at making the application usable in Africa, where more than 50% of the population lives in rural and semi-urban areas with little or no internet coverage.[30] This gives the FetalkickApp deployment across Africa a major boost.

Conclusion

FetalKickApp has been able to serve as a reliable healthcare tool that assists pregnant women in getting an accurate count of fetal kicks. Its interface is easy to use with a simple design outlook. In Nigeria, where it has been used for a pilot study, the outcome shows that it has the potential to greatly assist pregnant women in getting an accurate count of fetal movements and transmit such to the qualified professionals for review and quick intervention. Having mothers and babies alive in good health conditions is the benefit of using the FetalKickApp. This application is transferable and should be publicised and extended to other nations where maternal care lacks suitable healthcare technology. The ability of the FetalkickApp to function effectively independent of the internet makes it very suitable for low-resource communities where the internet is not readily available, and mobile data is expensive. The study intends to add features such as: dietary guide, gestational age calculator, fetal growth charts, body mass index calculator, reminders and alarms, and provide answers to frequently asked pregnancy questions.

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