

The effect of text-messaging on the utilisation of health facilities among pregnant women during delivery in Cross River State, Nigeria

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Submitted: 8th June 2023

Accepted: 19th January 2024

Published: 30th June 2024

[ID](#): Orcid ID

Abstract

Objective: Uptake of skilled care during delivery is associated with positive maternal and neonatal health outcomes. Studies reveal Nigeria accounts for a significant percentage of global maternal deaths, which have been associated with poor skilled attendants at delivery. Text messaging has proven to be effective in promoting health facilities' utilisation in Nigeria. Therefore, this research assessed the influence of text messaging intervention on the utilisation of health facilities during delivery in Cross River State

Methods: Quasi-experimental research design was employed. A sample size of thirty per LGA in two LGAs was used. Participants were purposively selected and grouped into text messaging and Control Groups). The experimental group received text briefs three times per week for four weeks, while the control group received regular ANC sessions. A structured and validated questionnaire with Cronbach's alpha coefficients ranging from 0.76 to 0.81 was used for data collection. Data were analyzed using descriptive and inferential statistics at a 5% level of significance.

Results: At baseline, the proportion of women who utilised HFs during delivery was 13.3% (experimental group) and 33.3% (control group). Furthermore, at the 8th-week follow-up, there was a significant difference ($p < 0.05$) in T-M (76.7%), compared with CG (33.3%) with an increase of 63.4% for the T-M compared to CG (3.3%, $p > 0.05$).

Conclusion: T-M intervention improved the utilisation of HFs during delivery among PW. The study recommends that health workers should incorporate mobile T-M intervention strategy which has proven to be a useful tool during ANC.

Keywords: Delivery, Health facilities, Health facility utilisation, Pregnant women, Text-messaging intervention

Plain English Summary

Quasi-experimental research design was employed. A sample size of 30 was determined using a Power formula from 228, 222 pregnant women attending antenatal clinics in primary health centres in two Local Government Areas (LGAs) in Cross River State. The text messaging group (T-M) received Health Facilities (HF) text briefs three times per week for four weeks, while the control group (CG) received regular ANC sessions. A structured and validated questionnaire was used for data collection at baseline and 8th-week follow-up. The response rate for all groups was 100%. Data were analyzed using descriptive and inferential statistics (t-test) at a 5% level of significance. At baseline, the proportion of pregnant women who utilized HFs during delivery was T-M - 13.3%, and CG - 30%. There was a significant difference in the proportion of pregnant women who utilised HFs for delivery at 8th-week follow-up (T-M 76.7% compared with CG 3.3%), but there was no significant change in HF utilization of CG (3.3%, $p > 0.05$) between baseline and 8th-week follow-up.

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The result of this study has provided empirical evidence that text-messaging intervention had positive effects on the utilisation of HFs among pregnant women during delivery and interventions through theory are successful in influencing behaviour change.

Introduction

Receiving maternal health care services is crucial for positive maternal and neonatal health outcomes (1), and to reduce maternal deaths (2). Unfortunately, poor pregnancy and childbirth-related problems remain challenging for mothers in poor and less-developed countries (2). Every day, women die due to pregnancy and delivery complications, with a higher proportion of deaths in low-income countries, even though most fatalities are avoidable (3). In 2015, developed regions had a maternal mortality rate of 16 per 100,000 live births, while developing regions had 230 per 100,000 live births (3).

Despite receiving ante-natal care from skilled personnel, some women still resort to unskilled obstetric services during delivery due to low trust in healthcare facilities (4). However, studies have proven that home births can pose significant risks to the mother and the child during the post-delivery period (5, 6). In contrast, skilled birth attendance during delivery contributes to better pregnancy and childbirth outcomes by detecting and managing complications during the ANC period, delivery, and postnatal period (7).

In Cross River State, improving health facility utilisation during delivery can significantly reduce poor pregnancy outcomes resulting from complications among pregnant women. However, despite increased ANC visits, health facility utilisation during delivery by pregnant women remains low in Cross River, with health facility utilisation rates for delivery at 58% and 63% for 2020 and 2021, respectively, according to data from Programme Assessment for Performance Management and Action (PAPA) and Lots Quality Assurance Sampling (LQAS) (8, 9).

To improve health facility utilisation during delivery, text-messaging interventions are necessary to increase utilisation and uptake demand for health services during pregnancy and

immediately after delivery. Mobile phone is the fastest-growing technology worldwide. There have been recommendations for using mobile phones as an additional tool in healthcare delivery and as a means to boost the utilisation of health facilities for delivery (4). Sustainable Development Goal 8 also highlighted the need to make use of new technologies available, especially those related to information and communication to improve healthcare delivery. An increase in delivery in PHCs using text messaging as a reinforcement and reminder was reported and research required on the use of text

messaging only as an intervention on the utilisation of health facilities for delivery among pregnant women was recommended (4). As of January 2021, Nigeria registered approximately 187.9 million mobile connections (10). The number of mobile connections corresponded to approximately 90 per cent of Nigeria's total population (10). Thus, mobile technology can be utilised for education, intervention, and follow-up as obtained in other parts of the world (11, 12, 13, 14).

Results from a recent study by (4), on factors influencing pregnant women's utilisation of maternal health care services (MHS) for delivery in Ogun State, Nigeria showed that follow-up with the women by weekly mobile phone communications led to an apparent increase in the use of MHC and decrease in the use of other facilities. It was observed that the use of the mobile telephone by pregnant women to communicate with their health providers improved patronage of trained skilled birth attendants thus supporting the potential of its ability to enhance the utilisation of health facilities especially when it is purposefully used to reinforce health education (15). Thus, this study will evaluate text message interventions on the utilisation of health facilities among pregnant women during delivery in Cross River State using the Health Belief Model. The results of this study will help in understanding the need to utilize health facilities during delivery among pregnant women and strengthen existing strategies to provide quality healthcare services in Primary Health Centres.

Methods

Study design

A quasi-experimental design was utilised to determine the effectiveness of the text-messaging intervention on pregnant women's health facilities utilisation during delivery in Cross River State.

Study area

The study was conducted in one of the 36 states of Nigeria, which is Cross River State, located in the South-South geopolitical zone. This state comprises 18 LGAs and is politically divided into three senatorial zones - southern, central, and northern - each with six LGAs. Cross River State's 2022 projected population is estimated at 4,564,450 and mainly composed of the Efik and Ekoi people, with three major languages: Efik, Bekwarra, and Ejagham, and several dialects

including French spread across the senatorial districts.

The state has a total of 1047 health facilities, these comprise 195 private, 14 secondary, two tertiary, and 575 PHCs, with at least one PHC Center in each ward in the LGA.

Study population

The studied group comprises pregnant women aged 15 to 49 years across all senatorial districts. Following the Women of Reproductive Age (16), guidelines, this age range was selected.

Inclusion criteria

- Pregnant women in their 3rd trimester
- Pregnant women who were making their 2nd or more ANC visits to the selected health facilities
- Pregnant women who were pregnant for at least the second time
- Pregnant women aged 15 to 49 years who have a telephone
- Pregnant women aged 15 to 49 years who are registered for ANC in a primary health care clinic
- Pregnant women aged 15 to 49 years who have visited the PHC at least once
- Pregnant women who gave their consent to be part of the study

Exclusion criteria

- Pregnant teenagers who are not up to 15 years
- Pregnant women aged 15 to 49 years who are not in their 3rd trimester.
- Pregnant women who do not have telephones
- Pregnant women who are pregnant for the first time
- Pregnant women who did not give their consent to be part of the study

Sample size

The sample size was determined using the Power formula, (16) for the computation of sample size.

The prevalence rate for utilisation of health facilities during delivery among pregnant women from the 2018 NDH survey was 53% (17). Thus, the sample size was determined using the prevalence

$$N = \frac{(Z\alpha + Z\beta)^2 \times P_0(1-P_0)}{(P_1 - P_0)^2}$$

N = Sample size

Z α = Standard normal deviation at 95% confidence interval; 1.96

Z β = Standard power at 80% confidence interval; 0.84 (Power to detect changes in the outcome variable and avoid type II error)

P₀= prevalence (at 53%) for utilisation of health facilities for delivery in Cross River State from the 2018 NDH survey.

P₁= 80% (desired level of outcome variable on utilisation of health facilities during delivery)

$$N = \frac{(1.96+0.84)^2 \times 0.53(1-0.53)}{(0.8-0.53)^2}$$

$$N = \frac{(2.8)^2 \times 0.53(0.47)}{(0.8-0.53)^2}$$

$$N = \frac{(7.84 \times 0.2491)}{0.0729}$$

N = 27

Ten percent (10 %) of the minimum sample size was added to take care of attrition which gave a final sample size of 30 participants per group.

Sampling technique

For this study, pregnant women were selected using a multi-stage sampling technique. Through balloting, two senatorial districts (Southern Cross River and Central Cross River) were chosen from the three available in Cross River State. From each of the two selected senatorial districts, one LGA was chosen by ballot and divided into experimental and control groups. For the study period, two PHCs were selected per LGA to ensure the required sample size of 30 pregnant women in their 3rd trimester per LGA and intervention group. Finally, eligible pregnant women were chosen at random from the antenatal register per PHC after enlisting all potential respondents who met the inclusion criteria for the study.

Text messaging intervention

The intervention was designed to run in four phases. The baseline information obtained in Phase 1 was used to review the contents of the intervention. In the 2nd phase, text-messaging interventions were implemented for four weeks. The third phase measured the immediate post-intervention on the independent variables and the fourth phase measured the outcome of the intervention at the 8th-week follow-up. Outcome variables were observed for changes at the 8th-week follow-up if changes were significant enough to conclude the intervention was effective.

The text-messaging intervention was solely administered to pregnant women after ANC sessions while the control received their usual ANC. The text messages were designed to equip pregnant women with adequate knowledge to promote the utilisation of health facilities during delivery.

Mode of intervention

The researcher facilitated the programme herself with the use of the module developed for the training and engaged four research assistants to send the text messages as scheduled to the participants. The research assistants interpreted the questionnaire to the participants in local

languages where necessary and supported in collation of data.

The text messaging group received text messages only. The text messages were short one-way text messages for 3-days in a week during the intervention period. The construct of a health education training module developed by the researcher was used to draft full-text messages targeted at improving health facility utilisation for delivery. To confirm the fidelity of the message, each of the messages sent by the research assistants was also forwarded to a separate phone maintained by the researcher to ensure network functioning.

The "delivery report" function of the mobile phone was used to verify and record whether the message had been delivered to the clients. In the event of an undelivered message after 24 hours, the message was resent. Three messages were sent per week at the agreed time of day chosen by clients during the initial engagement. Correct phone number use and comprehension of the message in English were confirmed during the initial recruitment and briefing session.

Sources and types of data

The study made use of primary data collected from four PHCS from two LGAs. The data collected include socio-economic characteristics such as age, current gestational period, marital status, the income of pregnant women and spouses, educational attainment of pregnant women and spouses, parity, and number of ANC and utilisation practices of health facilities during delivery by pregnant women.

Outcome variables

An increase in the utilisation of health facilities during delivery among pregnant women will lead to a reduction in the complications and maternal deaths among pregnant women constituted the outcome variables in the study. Practices were operationalized in the instrument that asks questions about their place of delivery. The variables were measured on a 5-point scale. Each item was scored Yes = 1, No = 2 while others specify = 0, and the negative statement was reversed. Practices scores were classified based on the 50th percentile into 3, those who scored between 0- 1.67 were regarded as having low utilisation practices, while those who scored 1.68-3.34 were regarded as having moderate utilisation practices, and those who scored 3.35– 5.0 were regarded as having high utilisation practices

Instrumentation

The instrument was a structured, participant-administered questionnaire that sought information on the socio-demographic

characteristics, knowledge of normal and danger signs associated with pregnancy, labour, and puerperium, perception of the use of health facilities during delivery and utilisation of health facilities among pregnant women during delivery. The instrument was drafted in English only, interviewing technique was used for participants with difficulty in reading and writing. Item validity was carried out to ensure the alignment of each item and the variables for measurement.

A test re-test was conducted. Ten per cent of the questionnaire was pre-tested among pregnant women at PHC Main Avenue, Calabar South, and the same was done a week later among a set of pregnant women who were not necessarily taking part in the main study but were part of the study population. The Cronbach's Alpha value for the questionnaire was 0.852. The items in the questionnaire were strengthened by incorporating items in the literature review. Twelve of the draft questionnaires were piloted among pregnant women to confirm clarity, and feedback from the pilot study was incorporated into the instrument. The data obtained was subjected to Cronbach's Alpha reliability analysis to test its internal consistency and after necessary adjustment, the Cronbach values ranged from 0.76 to 0.81 for all constructs in the questionnaire which shows the good fit of the instrument.

Method of data analysis

The study used both descriptive and inferential statistics, including means, standard deviations, standard errors, paired t-tests, and ANOVA. A significance level of 0.05 was set, and any p-values below this were considered significant. The data were analyzed using a repeated measure design with three measures per subject: baseline, immediate post-intervention after 4 weeks, and at the 8th-week follow-up period.

Results

The study gathered data from both intervention and control groups during the baseline, post-intervention after 4 weeks, and 8th-week follow-up stages. To validate the hypothesis which states that there is no significant difference in the level of practice of the pregnant women on utilisation of health facilities during delivery between baseline and the 8th-week follow-up period, independent sample t-tests and ANOVA were utilised with a significance level of 5%. The hypotheses were deemed valid if the p-value was less than 0.05.

Sociodemographic characteristics

The pregnant women in the text-messaging and control groups had a mean age of 21.70±6.65 years and 21.33±7.15 years, respectively, at

baseline. Their ages range from 18 to 41 years. More than 90% (table 1) of pregnant women were Christians. The marital status distribution showed more than 80% are married. Greater than 50% of pregnant women earn between 16,000 to 30,000 Naira, the same as their spouses. In terms of education level, most of the pregnant women >60% (table 1) and their spouses were secondary school graduates. Ethnically, most of the pregnant women were Efik and Yakurr and had at least two children in all groups.

The age group of the pregnant women was 18-49 years which is similar to the age of women of reproductive age recommended by WHO. The similarity in the age group is because these age groups are considered to be within the childbearing or reproductive age. Across the two groups, there were more pregnant women of Efik origin because Efik is the most predominant tribe in Cross River State.

Table 1: Socio-demographic Characteristics of Respondents in Text-messaging and Control Groups

Variables	Text messaging group (n =30), n (%)	Control group (n=30), n (%)
Age (in Years)		
15-24	9 (30.0)	8 (26.7)
25-34	21 (70.0)	18 (60.0)
35-44	0 (0.0)	4(13.3)
Mean \pm SD	21.70 \pm 6.65	21.33\pm7.15
Religion		
Christianity	28 (93.3)	28 (93.3)
Muslim	2 (6.7)	2 (6.7)
Marital Status		
Single	12 (40.0)	4(13.3)
Married	17 (56.7)	25 (83.4)
Separated	1 (3.3)	1 (3.3)
Income Level		
<15,000	9 (30)	9 (30.0)
16,000 - 30,000	18 (60)	19 (63.3)
31,000-50,000	3 (10)	2 (6.7)
>50,000	0 (0.0)	0 (0.0)
Spouse Income Level		
<15,000	3 (10)	4 (13.3)
16,000 - 30,000	24 (80)	18 (60)
31,000-50,000	2 (6.7)	8 (26.7)
>50,000	1 (3.3)	0 (0.0)
Education level		
Below Secondary	10 (33.3)	7 (23.3)
Secondary	14 (46.7)	20 (67.7)
Tertiary	16 (20.0)	3 (10.0)
Spouse Level of Education		
Below Secondary	4 (11.3)	2 (6.7)
Secondary	12 (40.0)	19 (63.3)
Tertiary	14 (46.7)	9 (30.0)
Ethnicity		
Efik	19 (63.3)	10 (33.3)
Yakurr	2 (11.3)	11 (36.7)
Others*	9 (30.0)	9 (30.0)
Parity		
One	8 (26.7)	10 (33.3)
Two	12 (40.0)	14 (46.7)
More	10 (33.3)	6 (20.0)

Others* include Bekwarra and French

Distribution of Pregnant Women's Utilisation of Health Facilities Practices during Pregnancy and Delivery at the baseline, immediately after the

intervention after 4 weeks, and during the follow-up period

The study evaluated pregnant women's utilisation of health facilities practices during

pregnancy and delivery as the number of antenatal care sessions attended, TBA patronage, place of delivery, use of individual birth preparedness plan and willingness of pregnant women to utilize the PHC in subsequent deliveries.

Though, most of the pregnant women, 56.7% (table 2) have attended ANC sessions up to 4 times during pregnancy in the text-messaging group, only 10.0% of pregnant women in the text-messaging group, and 16.7% in the control group have ever attended up to eight ANC sessions as recommended by WHO for pregnant women

(Table 2). The result showed that patronage of TBAs is high across all groups; 76.7% of pregnant women in the text-messaging and 80.0% in the control groups (Table 2). At baseline, the majority of expectant mothers do not opt for the PHC facility for childbirth, 40.0% of pregnant women in both groups gave birth to their last baby in TBA homes. The results showed that most ($\geq 70\%$) pregnant women do not have an individual birth preparedness plan, only 20.0% of pregnant women in the text-messaging group, and 30.0% in the control group have had a birth preparedness plan.

Table 2: Baseline Data of Pregnant Women's Utilisation of Health Facilities Practices during Pregnancy and Delivery

Variables	Text Messaging group (n=30), n (%)	Control (n=30), n (%)
The number of ANC attended		
0	7 (23.3)	10 (33.3)
4	17 (56.7)	8 (26.7)
8	3 (10.0)	5 (16.7)
Others	3 (10.0)	7 (23.3)
Patronized a TBA in the last 6 weeks		
No	7 (23.3)	6 (20.0)
Yes	23 (76.7)	24 (80.0)
Place of Delivery		
PHC	4 (13.3)	9 (30.0)
Church	8 (26.7)	6 (20.0)
Private Hospital	3 (10.0)	3 (10.0)
Teaching Hospital	3 (10.0)	0 (0.0)
TBA	12 (40.0)	12 (40.0)
Have an individual birth preparedness plan		
No	24 (80.0)	21 (70.0)
Yes	6 (20.0)	9 (30.0)
Willing to utilize the PHC in a subsequent delivery		
No	20 (66.7)	18 (60.0)
Yes	10 (33.3)	12 (40.0)

Utilisation of Health Facilities Practices during Pregnancy and Delivery among Pregnant Women at 8th-week Follow-up

Table 3 shows the comparison of the baseline, immediate post-intervention and 8th-week follow-up mean scores for the group that received text messaging, it was found that the intervention had a significant impact on pregnant women's practices regarding the utilisation of health facilities during delivery. The mean scores showed a clear difference between the three time points, with a p-value of 0.000. On the other hand, the control group did not show statistically significant differences ($P=0.047$)

The pregnant women's utilisation of health facilities practices during pregnancy and delivery was measured using a 5-point rating scale which assessed information on utilisation practices of health facilities for delivery as the number of ANC

sessions attended, TBA patronage, place of delivery, use of individual birth preparedness plan and willingness of pregnant women to utilize the PHC in subsequent delivery. With a mean score of 1.87 ± 1.24 , pregnant women in the text-messaging intervention group showed high utilisation practices compared to the control groups.

The mean score of 1.87 ± 1.24 for the text-messaging Intervention group suggests that this group is demonstrating higher utilisation practices compared to the control groups in the study. This might suggest that text-messaging interventions could be effective for promoting health facility utilisation among pregnant women.

Additionally, it's also essential to consider the standard deviation (± 1.24), which is a measure of the variability or dispersion of the scores. The higher the standard deviation, the more varied the scores are in the result. In this case, a standard deviation of 1.24 on a 5-point scale is

relatively high, indicating there is a fair amount of variation in the responses. This variability could reflect differing personal circumstances, attitudes, and behaviours among the women in the text-messaging intervention group.

Table 3: Comparison of Pregnant Women's Utilisation of Health Facilities Practices during Pregnancy and Delivery at Baseline, Immediate Post-intervention after 4 weeks, and at the 8th-week follow-up period

The practice of the utilisation of health facilities during Delivery on a 5-point rating scale	Text-messaging (n=30), n (%)	Control (n=30), n (%)	P-Value
Baseline			
Low (0-1.67)	2 (6.7)	3 (10.0)	0.047
Moderate (1.68-3.34)	27 (90.0)	26(86.7)	
High (3.35-5.0)	1 (3.3)	1 (3.3)	
Mean + SD	1.87 \pm 1.24	1.65 \pm 1.68	
Immediate Post Intervention after 4 weeks			
Low (0-1.67)	0 (0.0)	3 (10.0)	<0.001
Moderate (1.68-3.34)	3 (10.0)	25 (83.3)	
High (3.35-5.0)	27 (90.0)	2 (6.7)	
Mean + SD	4.20 \pm 1.48	1.67 \pm 1.80	
8th-Week follow-up			
Low (0-1.67)	0 (0.0)	3 (10.0)	<0.001
Moderate (1.68-3.34)	0 (6.6)	25(83.3)	
High (3.35-5.0)	30 (93.0)	2 (6.7)	
Mean + SD	4.79 \pm 1.01	1.67 \pm 1.80	

The P-value obtained by ANOVA; Significant at <0.05

Based on the interaction plot in the control group, it was observed that pregnant women's utilisation practices had increased from the baseline to post-intervention periods. However, there was no significant change in the utilisation of health facilities during pregnancy and delivery between

the post-intervention and 8th-week follow-up period, as shown in Figure 1.

Estimated Marginal Means of Utilisation Practices

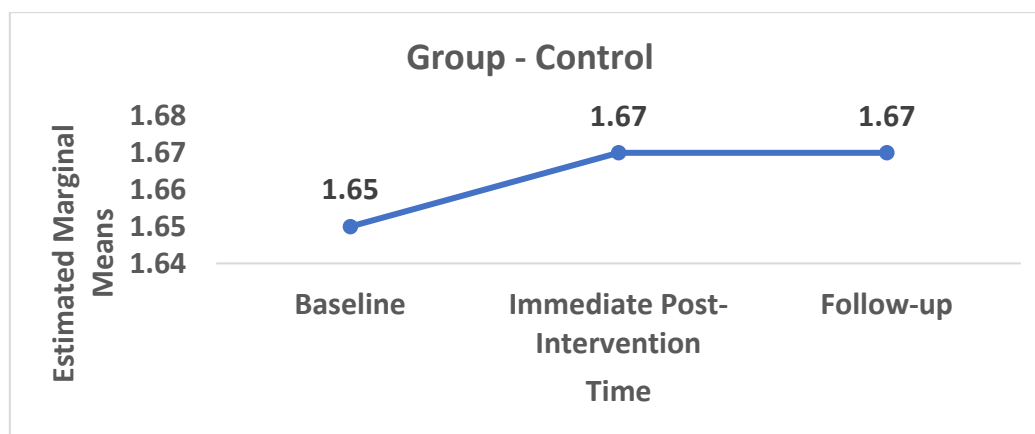


Figure 1: Plot showing the Change in the Pregnant Women's Level of Utilisation of Health facilities during Pregnancy and Delivery in the Control group across the Timeline

The interaction plot in the Text-Messaging group showed that the pregnant women's level of utilisation practices increased over time. There was a significant increase in the level of utilisation of health facilities during pregnancy and delivery between the baseline and immediate post-

intervention. There was an increase between the post-intervention and follow-up period, however, this was not statistically significant (as shown in Figure 2).

Estimated Marginal Means of Utilisation Practices

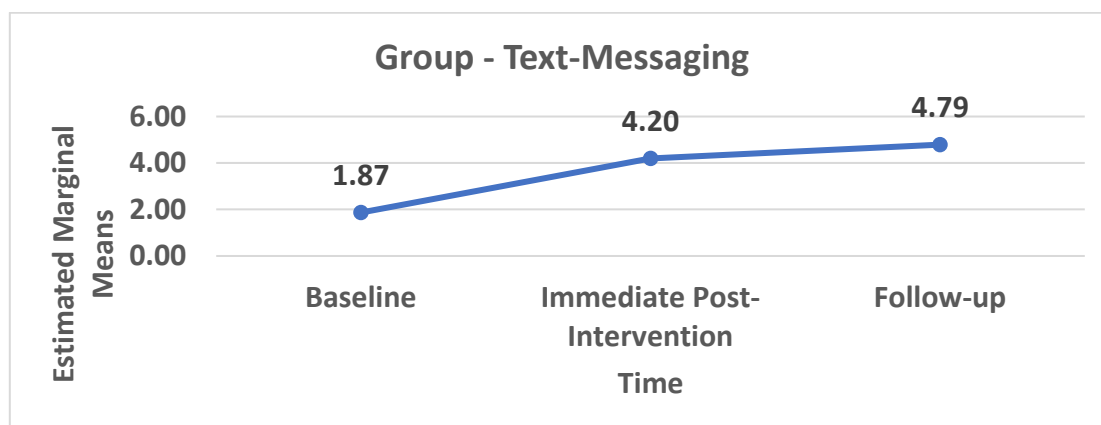


Figure 2: Plot showing the Change in the Pregnant Women's Level of Utilisation of Health facilities during Pregnancy and Delivery in the text messaging Intervention group across the Timeline

Discussion

The study revealed low utilisation of health facilities among pregnant women during delivery at baseline. This indicates that the willingness to utilize the PHC for subsequent delivery is low among pregnant women across all groups. This is similar to a study in Cross River State, Nigeria by (18), on the utilisation of health institution services for childbirth among mothers which revealed that only fifty-two per cent of the respondents utilized the health facilities for delivery. A similar study by (19), to examine the non-institutional delivery among women of reproductive age in Nigeria revealed that 56.8% of women preferred to have their children outside health institutions.

The study revealed that the majority of pregnant women attend ANC sessions up to 4 times but few rarely up to 8 times at baseline as recommended by WHO. This suggests that while some level of ANC engagement is present, it does not meet the ideal level of frequency. This is similar to the finding of (20), where 84.6% of the respondents attended ANC up to 4 times.

The Traditional Birth Attendant (TBA) patronage is very high (70-80%) across the two groups. The study revealed that the majority of pregnant women deliver their babies at TBA homes rather than health facilities at baseline. This is similar to the findings of (21), where the choice of birth for most women is in TBA homes due to some reasons such as services being cheaper, TBA services being more culturally acceptable in the environment and distance is not a barrier to pregnant women. Furthermore, the study revealed that cheap service cost and cultural acceptability of TBAs are the major reasons why most pregnant women do not deliver in the health facilities at baseline. This is similar to the findings of (21), and (22), that lack of funds determines women's choice of TBA as a point of delivery.

The study revealed that only 26.7% of pregnant women are willing to deliver in the PHC in subsequent deliveries at baseline. This is similar to the findings of (23), where nearly one-third of women used traditional birth attendant services for their recent birth.

It was also observed that a significant proportion of women from all groups (40-53.4%) delivered their last baby in TBA homes rather than PHC facilities. This may reflect a preference for TBAs, lack of access to PHCs, or other systemic barriers to health facility utilisation. This is at variance with a similar study by (2), on the utilisation of delivery services in Sagamu, Southwestern Nigeria showed that the places of delivery were Government facilities (54.8%), private hospitals (24.5%) TBAs (13.5%) and spiritual healing homes (5.6%).

The majority of pregnant women across the two groups did not have an individual birth preparedness plan, indicating a potential area for intervention and education, while the willingness to use PHC facilities for future deliveries is relatively low across all groups (26.7-40%). This could be a reflection of the previous data points (high TBA patronage and delivery at TBA homes), indicating a systemic or cultural preference for TBAs over formal healthcare facilities. This finding is in line with the review of (24), who found that barriers such as distance, lack of transportation, and financial constraints can limit the willingness of pregnant women to utilize PHC facilities.

Findings from the study show a significant difference in the practices related to the utilisation of health facilities during pregnancy and delivery among the two groups at immediate post-intervention after four weeks. The mean score for the text-messaging group was 4.20, with a standard deviation of 1.48. This result shows that the text-messaging intervention had a positive

effect. The control group, which presumably received no specific intervention, had a considerably lower mean score of 1.67 with a standard deviation of 1.80. This emphasizes the effectiveness of the interventions in promoting better health facility utilisation practices.

These results suggest that text-messaging intervention can indeed enhance the utilisation of health facilities during pregnancy and delivery. This result corroborates the findings of others (4, 25), who found that mobile health (mHealth) interventions, such as text messaging, can significantly improve antenatal care attendance and facility delivery in low- and middle-income countries.

In the same vein, table 3 indicates a substantial improvement in the utilisation of health facilities during pregnancy and delivery among pregnant women in the text-messaging group, from baseline to the 8th-week follow-up period. At the baseline, the text-messaging group had a mean score of 1.87 with a standard deviation (SD) of 1.24. However, 8 weeks post-intervention, the mean score improved significantly to 4.79 with a slightly lower SD of 1.01.

This marked increase in the mean score suggests a higher utilisation of health facilities for pregnancy and delivery in the post-intervention period. Additionally, the reduction in the standard deviation from baseline to post-intervention indicates that the scores became more concentrated around the mean, demonstrating a more consistent response among the participants to the intervention. This result is similar to the result of (26), which shows that mobile phone text message reminders could significantly improve skilled attendance at delivery.

Study limitations

The study has a few limitations as mentioned below:

a. The findings of the results may be peculiar to only pregnant women who attended ANC who may have different practices of utilisation of PHC for delivery compared to other pregnant women who do not have close access to health facilities. Hence, the ability to generalize these findings among all pregnant women may be limited.

b. The responses on utilization practices of health facilities for delivery were based only on self-reporting practices.

c. The outcome from the few (60) pregnant women used for the study will be difficult to use to generalize these findings.

Conclusion

In Nigeria, the improper use of healthcare facilities during delivery among expectant mothers remains a leading cause of maternal and childhood illnesses and fatalities. This issue is

partly due to insufficient awareness of the severity and consequences of not seeking assistance from skilled birth attendants and healthcare facilities during childbirth. An estimated 22% of the country's population constitutes women of reproductive age, with approximately 5% estimated to be pregnant (27). It is expected that these women use healthcare facilities during delivery. However, in Cross River State, only 53% have reported doing so. This puts pregnant women at risk of complications like child loss, and death of the mother among others. It is crucial to educate expectant mothers about the risks associated with using non-medical delivery facilities and unsafe birthing locations. This knowledge will lead to increased utilisation of healthcare facility practices, ultimately improving maternal and infant health outcomes (28).

The text-messaging intervention is appropriate for pregnant women as they will use the information provided to make evidence-based decisions about the place of choice during delivery. The results proved that this method is effective to be deployed in practice regarding the utilisation of health facilities during delivery.

The results from the research found that well-planned and executed text messaging rooted in theory has the potential to bring about a change in the practice of health facilities' utilisation for delivery among pregnant women. The impact of the intervention was evident from the outcome variables observed during the follow-up period. The study recommends that health workers should leverage text messaging which has proved to be a useful tool to improve the utilisation of healthcare facilities during delivery to reduce the maternal mortality rate in Cross River state.

List of Abbreviations

ANC	Antenatal Care
ANOVA	Analysis of Variance
BUHREC	Babcock University Health Research Ethics Committee
LGA	Local Government Area
PHC	Primary Health Clinics
UNFPA	United Nations Population Fund
UNICEF	United Nations Emergency Fund
WHO	World Health Organization

Declarations

Ethics approval and consent to participate

Approval was obtained from the Cross River State Ministry of Health Ethics Review Committee with approval number CRSMOH/RP/REC/2022/232. All participants gave informed consent, and confidentiality was strictly maintained.

Consent for publication

All authors gave their final approval of the version to be published.

Availability of data and materials

All data and materials used in the study are available on request

Competing interests

The authors of this paper state that they do not have any known financial interests or personal relationships that could be perceived as influencing their work

Funding

There are no funders to report for this submission.

Authors' contributions

CE and CA made substantial contributions to the conception of this paper. CE drafted the manuscript. All authors made substantial contributions to the design of the paper, critically revised it and gave their final approval of the version to be published. All authors attest they meet the criteria for authorship.

Acknowledgement

We would like to express our gratitude to the research assistants who participated in this study. Additionally, we extend our appreciation to the Ministry of Health, Cross River State for approving this research project.

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