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Original Research Article

Assessment of the effect of maternal health education on danger signs recognition among women in Ifako Ijaiye, Lagos State

Halimah Nuhu Sanda[1]*, Nazeef Mohammed[2], Musa Zakka[2], Usman Iliyasu[2], Aliyu Ibrahim Shehu[2], Abba Rabi'u Hussain[2], Usman Bashir[3], Ibrahim Ibrahim Kurba[4], Musa Isma'il[5], Aisha Aliyu Ibrahim[6], Aisha Aliyu Abulfathi[7]

[1]Clinton Health Access Initiative (CHAI), Nigeria
[2]Department of Community Medicine, Federal University of Health Sciences, Azare, Bauchi, Nigeria
[3]Department of Community Medicine, Bayero University Kano, Nigeria
[4]Department of Human Physiology, Federal University of Health Sciences, Azare, Bauchi, Nigeria
[5]Department of Paediatrics, Federal University of Health Sciences University Teaching Hospital, Azare Bauchi, Nigeria
[6]Department of Family Medicine, Murtala Muhammed Specialist Hospital, Kano, Nigeria
[7]Department of Community Medicine, University of Maiduguri Teaching Hospital, Borno, Nigeria

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***Correspondence:**
Dr. Halimah Nuhu Sanda,
E-mail: hansboudib@gmail.com

ABSTRACT

Background: Maternal mortality remains a significant challenge in low- and middle-income countries, particularly in Nigeria. Maternal mortality is often attributed to various factors, including delays in seeking care due to a lack of awareness regarding danger signs during pregnancy and childbirth. This study aimed to assess the effect of maternal health education on danger signs recognition among women in Ifako Ijaiye, Lagos State, Nigeria.
Methods: A pre-test post-test quasi-experimental design was employed, involving 80 women of reproductive age (40 in the intervention group and 40 in the control group). Participants' baseline knowledge of maternal danger signs was assessed using structured questionnaires. The intervention group received a training package on maternal danger signs. Follow-up assessments were conducted one-month post-intervention to measure changes in knowledge.
Results: The mean age of participants was 34.2±7.6 in the control group and 30.4±6.8 in the intervention group. Most participants had secondary education, were self-employed and married. At baseline, there was no significant difference in the mean number of danger signs recongnized between the groups (mean difference=0.225, t (78)=0.565, p=0.574). Post-intervention, the intervention group showed a significant increase in the recognition of maternal danger signs (mean difference=3.70, t (78)=7.13, p=<0.001), with 90% of the intervention group recognizing six or more danger signs compared to 30% at baseline.
Conclusions: The maternal health education intervention significantly improved the recognition of maternal danger signs among women in Ifako Ijaiye.

Keywords: Effect, Knowledge, Maternal health education, Quasi-experiment, Recognition of danger signs

INTRODUCTION

Maternal mortality has been a very sensitive global health challenge, especially in low- and middle-income countries.[1] In the year 2020, the Maternal mortality ratio (MMR) data of 223 per 100,000 live births worldwide was alarming, indicating a serious gap in achieving the Sustainable Development Goals (SDG) target of reducing

the ratio to about 70 per 100,000 live births by the year 2030.[1] The overwhelming majority (99%) of maternal mortality transpired in low- and middle-income countries (LMICs), with sub-Saharan Africa (SSA) representing nearly 66% of the total, equating to 200,000 deaths.[2] Despite advancements in healthcare delivery, Nigeria struggles with maternal death that remains unacceptably high.[3] According to the World Health Organization and the United Nations Maternal Mortality Estimation Inter-Agency Group (MMEIG), Nigeria alone contributes 33% of the maternal deaths in SSA, which is approximately 65,000 maternal deaths.[4,5] The findings from the Nigerian Demographic and Health Survey reveal that there has been only limited advancement in diminishing maternal mortality.[6]

According to the survey, the MMR was reported as 512 deaths per 100,000 live births in 2018.[7] Although this figure represents a slight improvement from the 2016 ratio of 576 deaths per 100,000 live births, recent data from 2020 indicated a significant setback, with the MMR doubling to 1,047 deaths per 100,000 live births.[8,9] The MMR is reported to be ten times higher than the targeted goal set by the Sustainable Development Goals.[10] These indicators underscore the necessity for focused interventions to address the persisting maternal health challenges in the country. Maternal mortality is often attributed to various factors, including delays in seeking and accessing healthcare services, inadequate quality of care and a lack of awareness regarding danger signs during pregnancy and childbirth.[11] These factors are especially relevant in densely populated urban areas like Ifako Ijaiye, Lagos State, where healthcare infrastructure may struggle to meet the needs of the growing population.

Delayed recognition of danger signs during pregnancy has been a critical aspect contributing to maternal mortality, childbirth and postpartum stages.[11] Danger signs, such as severe vaginal bleeding, blurred vision, swollen hands/face, prolonged labour and high fever, often signal complications that require prompt medical attention.[11] According to the World Health Organization (WHO), a deficiency in understanding and recognition of these warning signals is a contributing factor to delays in seeking necessary healthcare.[12,13] Given the inherent risks associated with pregnancy, it is essential to inform women about potential indicators of obstetric complications throughout the stages of pregnancy, delivery and the postpartum period, as this information is crucial in empowering women and their families, enabling them to make timely decisions to seek assistance from skilled birth attendants.[14]

The persistent gap in danger signs recognition among women remains a significant concern, despite efforts to improve maternal healthcare in Nigeria.[15] A study conducted in Nigeria noted that women with low literacy levels lack significant awareness of warning signs during pregnancy, childbirth and the postpartum period.[16] The lack of awareness and understanding of these signs contributes to delay healthcare-seeking, thereby increasing the risk of adverse maternal outcomes. The consequences of delay in recognition of maternal danger signs are maternal morbidity and mortality as shown by data, worldwide, nearly 800 women die from maternal complications every day, with low-income countries accounting for nearly 99% of cases and half specifically in Sub-Saharan Africa.[16] Maternal danger signs collectively contribute to approximately 75% of maternal fatalities occurring during pregnancy, labor and post-childbirth. Although Nigeria had introduced the integrated Maternal, Newborn and Child Health IMNCH week to improve the situation, addressing this gap is imperative for mitigating the high maternal mortality rates in the region.

Therefore, the general objective of the study is to assess the effect of maternal health education on danger signs recognition among women in the intervention and control groups in Ifako Ijaiye, Lagos State, Nigeria.

The specific objectives are to describe the socio demographic characteristics of women in the intervention and control groups in Ifako Ijaiye, to establish the baseline knowledge of maternal danger signs among women in the intervention and control groups in Ifako Ijaiye, to determine the effect of maternal health education intervention on the knowledge of maternal danger signs among women in Ifako Ijaiye, Lagos State.

METHODS

Study area

Ifako Ijaiye, Lagos State is situated in the south-western region of Nigeria. Lagos State, it is characterized by its relatively small landmass, yet it stands out as the most densely populated state in Nigeria.[18] Additionally, it serves as the economic hub of Nigeria, hosting numerous entry points, particularly through its various ports. Estimated to be about 13.7 million people, Lagos State is segmented into twenty (20) LGAs, with sixteen (16) of them situated in the metropolitan region (representing 85% of the population) and the remaining four (4) designated as suburban LGAs.[19]

Ifako Ijaiye is a metropolitan LGA estimated to represent 4.62% of the total population in Lagos State. Ifako Ijaiye exemplifies the complex interplay of urbanization, population density and healthcare disparities.[20] Rapid urbanization has strained healthcare resources, leading to challenges in service delivery and accessibility.[20] Ifako Ijaiye serves as a microcosm, reflecting broader issues faced by urban areas in Lagos State and underscoring the need for targeted interventions. In 2016, Ifako Ijaiye was identified as one of the LGAs where the majority of women lack access to maternal health education that is required before and during pregnancy.[21]

Population of the study

The study population comprised all women of reproductive age (WRA) in Lagos State including both pregnant women and non-pregnant women. According to available data, WRA (refer to as women between the age of 15 and 49 years), is estimated to be 28% of the Lagos state population.[21] Therefore, the sampling frame comprises WRA from Ifako Ijaiye LGA.

Sample size determination

A minimum of 80 participants was obtained using sample size (n) calculation method for testing the hypothesis that takes into consideration the standard deviations (SD) of the two groups (Intervention and Control group), the desired level of significance (Zα/2), the desired power (Zβ) and the expected effect size (d2) as shown below35:

$n=2SD2(Z\alpha/2+Z\beta)^2/d^2$ ----------(1)

Assumptions,

SD=Assumed value of 1.25 for each group

Zα/2=Z0.05/2=Z0.025=1.96 (from Z table) at a type 1 error of 5%. In other words, this is the critical value for a two-tailed test at the desired level of significance (α).

Zβ=Z0.20 =0.842 (from Z table) at 80% power

d=effect size (difference between mean values) assumed to be 0.8

Using OpenEpi software (Version 3), the sample sizes for both the intervention and control groups were computed by entering the parameters. The parameters considered for the calculation included an assumed standard deviation of 1.25 for the outcome variable in each group, a critical value for a two-tailed test at the 0.05 level of significance, a desired power of 0.842 and an effect size of 0.8. The formula applied in the software assumes an equal 1:1 distribution of sample sizes between the intervention and control groups. The resulting sample sizes for both the treatment and control groups, as determined by the calculations, were estimated to be 40 women of reproductive age (WRAs) each.

Sampling techniques and selection criteria

A multistage sampling method was employed to select a sample of 80 women of reproductive age (WRA) across two communities in Ifako Ijaiye LGA, with equal allocation to intervention and control groups (40 each). This multi-stage sampling method used the probability sampling techniques to ensure representation and feasibility. In the first stage, Ifako Ijaiye was selected by a simple random sampling technique from the 20 LGAs in the state

In the second stage, two wards were selected by simple random sampling technique from the listed wards obtained from the LGA health department in Ifako Ijaiye. In the third stage, streets were selected from the list of streets by simple random sampling technique using a balloting method.

Finally, a systematic sampling technique where sample frame over sample size= nth value of 10 and so every 10th household was selected from the list of the streets by considering thee inclusion criteria where pregnant and non-pregnant women between 15 and 49 years residing in the selected communities (Gbinmirin and Iju-Obawole) in Ifako Ijaiye.

Households where there are no women of reproductive age were excluded from the study. This sampling technique was employed to ensure a match in key characteristics as much as possible between the two groups. The sampling frame of the selected communities was obtained from Ingress Health Partners, one of the partners implementing an ongoing Safer childbirth initiative (Project Aisha) in Lagos State. The two selected wards, Gbinmirin and Iju-Obawole, are geographically distinct communities within Ifako Ijaiye, with no shared community structures or regular social overlap, thereby minimizing the risk of contamination between the intervention and control groups.

Research instrument

The research instrument consisted of a structured questionnaire and an intervention package as the primary tools. The questionnaire was adapted from the community survey questionnaire initially developed by Ingress Health Partners (IHP) and the Health Strategy and Delivery Foundation (HSDF). Modifications were made to align with the specific local context and objectives of this study.

The questionnaire comprised two sections: Section A aimed at gathering socio-demographic characteristics, while Section B was tailored to assess their knowledge of maternal danger signs. The intervention consisted of structured educational sessions covering the following maternal danger signs: severe vaginal bleeding, severe headache, blurred vision, swollen hands/face, high fever, prolonged labour and reduced fetal movement. Materials included illustrated flip charts and take-home leaflets adapted from ingress health partners and sessions were delivered by trained facilitators using a participatory approach. Draft copies of the questionnaire and intervention package timeline were made available with the researcher's supervisor, who provided clarity on the validity and reliability of the instrument.

Enrollment, data collection and follow-up

The data collection process was divided into three phases namely the pre-intervention phase, intervention phase and

post intervention phase. In the pre-intervention phase, two groups of participants (Intervention Group and a Control Group) were enrolled into the study. Informed consents were obtained from eligible participants prior to their enrollment into the study. Subsequent to obtaining informed consent, two research assistants were trained to conduct face-to-face administration of a structured questionnaire with each participant at their dwellings. Demographic information and baseline knowledge level of maternal danger signs were established. Furthermore, an appointment for an in-person training session was scheduled for only the intervention group of participants.

During the intervention phase, an in-person training package was delivered to the intervention group only. The training package involved educating participants on maternal danger signs using the adapted educational materials from Ingress Health Partners. The training session was in batches (15-20 participants per batch) based on availability of participants with each training session lasting 2-3 hours per batch. The training venue was at a location central to the dwellings of participants. Incentives such as transportation allowance and refreshment were provided for participants during the training session.

One month after the training package, a follow up visit was scheduled to both groups of participants (intervention and control group) at their dwellings representing the post intervention phase where the same questionnaire was re-administered to gather information on knowledge level of maternal danger signs.

Data analysis

The study employed SPSS version 21 and Python version 3.12.1 as the primary analytical tools for data processing and analysis. SPSS was the principal statistical software for rigorous analysis, while Python was also applied to complement this framework by offering enhanced flexibility in facilitating rapid triangulation of findings derived from SPSS outputs.

To enhance comparability of the two groups, the study employed a Propensity score matching (PSM) technique to conduct matching algorithm before estimating the intervention effect. The analysis explored demographic variables and outcome variables according using frequency distributions, averages and percentages. Hypotheses testing involved the use of paired t-tests and independent t-tests set at a conventional significance level of 5% ($p<0.05$), to ascertain the statistical significance of observed differences within the two groups in the dataset.

Ethical approval

Approval for the study was obtained from the ethical review committees of Lagos State Primary Health Care Board (LSPHCB) and Lagos State Ministry of Health (LSMoH). Prior to commencing data collection, participants received a detailed explanation of the study's purpose and each participant provided written informed consent. To maintain confidentiality, the data collection tool excluded full names of participants and utilized auto-generated IDs as the main identifiers.

RESULTS

Across the 80 Women interviewed (40 each in both the control and intervention group) as shown in Table 1, the mean age was 34.2 years (standard deviation of 7.6) in the control group and 30.4 years (standard deviation of 6.8) in the intervention group. This suggests that the intervention group has similarities with the control group. The standard deviation also indicates that the age variation is similar in both groups.

Education levels are similar between the two groups, with secondary education being the most common. Secondary level of education shows 57.5% in the control group and 77.5% in the intervention group.

While the intervention group consists of a higher percentage of participants with secondary education level, the control group has a higher percentage of participants with primary education (25%) compared to the intervention group (5%). Participants with tertiary education level were more evenly distributed in both groups (17.5% of control and 15% of intervention).

Similarly, both groups have a high percentage of self-employed and married individuals. Self-employed women represented 92.5% of the control group and 87.5% of the intervention group. The control group has fewer unemployed participants (2.5%) compared to the intervention group (7.5%). As expected, almost all the participants are married in both groups (97.5% in the control group and 95% in the intervention group).

Furthermore, the proportion of pregnant women is slightly higher in the control group (15% in the control and 10% in the intervention group. Knowledge was classified into 2 categories; Participants with 6 or more danger signs mentioned and Participants with less than 6 danger signs mentioned. In the entire sample (n=80) at the pretest stage (Baseline), 28.7% of women know 6 or more danger signs, while 71.3% know less than 6 danger signs as shown in Table 2.

This indicates that the majority of women have limited knowledge about maternal danger signs at baseline. In the control group (n=40), 27.5% of women know 6 or more danger signs and 72.5% know less than 6 danger signs. In the intervention group (N=40), 30.0% of women know 6 or more danger signs and 70.0% know less than 6 danger signs.

The data suggest that most of the women in both the control and intervention groups have limited knowledge

of maternal danger signs, with over 70% in each group knowing fewer than 6 danger signs.

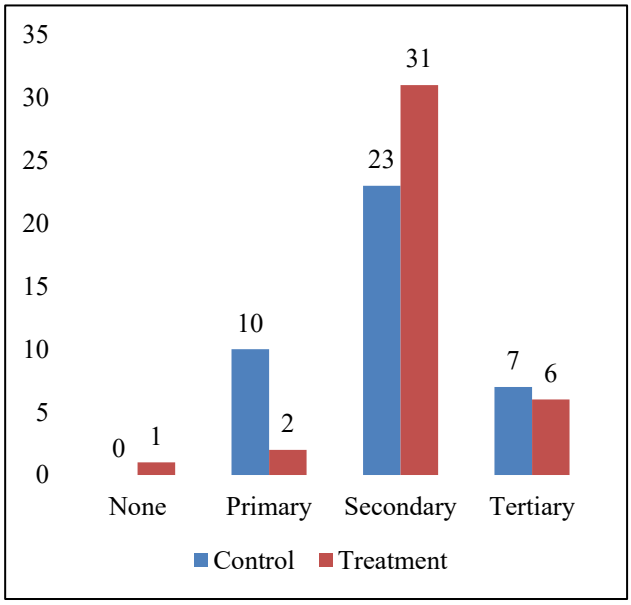

Figure 1: Bar chart of educational level of the control and the intervention groups in Ifako Ijaiye community.

Furthermore, Pared samples test (Table 3) also showed that the participants' mean number of danger sign mentioned was 4.76±1.77 across the entire sample (80) at the pretest stage indicating a limited knowledge of maternal danger signs. The participants' mean number of danger signs in the control group was 4.65±1.62 and 4.88±1.9 in the intervention group with a mean difference of 0.225 as seen in Table 2.

The intervention group had a slightly higher average baseline score compared to the control group. The difference in the mean scores (0.225) suggests that the intervention group scored, on average, 0.225 higher than the control group. The t-value of 0.565 and the corresponding p-value of 0.574 indicate that the difference in the baseline scores between the intervention and control groups is not statistically significant. The p value is higher than the common significance level of 0.05, suggesting that the observed mean difference at baseline could easily be due to random chance rather than a true difference between the groups. The baseline mean number of maternal danger signs recognized among women in the control group was 4.65 (±1.63), whereas the intervention group had a mean of 4.88 (±1.92), yielding a mean difference of 0.225. This indicates that, initially, there was no significant difference in the baseline knowledge of maternal danger signs between the two groups. The statistical analysis confirmed this (Table 4), showing no significant difference between the control and intervention groups at baseline (mean difference=0.225, t (78)=0.565, p=0.574).

Post-intervention, the mean number of maternal danger signs recognized among women showed a significant increase in the intervention group compared to the control group (Figure 1 and Table 2, 4). The post-intervention mean was 4.93 (±1.53) in the control group and 8.63 (±2.91) in the intervention group, resulting in a significant mean difference of 3.70 (Table 4). This difference was statistically significant (mean difference=3.70, t (78)=7.13, p<=0.001), indicating that the observed improvement in the intervention group was not due to chance but rather the educational intervention they received. Further analysis of the frequency distribution of knowledge levels revealed a significant improvement in the intervention group. Initially, only 12 participants (30%) in the intervention group recognized 6 or more danger signs. Post-intervention, this number increased to 36 participants (90%) (Table 2). In contrast, the control group showed minimal change, underscoring the effectiveness of the intervention.

Table 1: Socio-demographic characteristics of participants across control and intervention groups in Ifako Ijaiye community.

Demographic Characteristics		Control (n=40)			Intervention (n=40)		
Variables	**Category**	**Freq.**	**%**	**Mean Age (SD)**	**Freq.**	**%**	**Mean Age (SD)**
Level of education	None	0	0.0	NA	1	2.5	49
	Primary	10	25.0	41	2	5.0	34
	Secondary	23	57.5	31	31	77.5	29
	Tertiary	7	17.5	34	6	15.0	35
Occupation	Private employed	2	5.0	33	2	5.0	37
	Self-employed	37	92.5	35	35	87.5	30
	Unemployed	1	2.5	18	3	7.5	31
Marital status	Married	39	97.5	34	38	95.0	31
	Separated	1	2.5	26	0	0.0	NA
	Single	0	0.0	NA	2	5.0	22
Pregnant at time of interview	No	34	85.0	35	36	90.0	30
	Yes	6	15.0	30	4	10.0	31
Mean age (SD)	Total (n)	40	100%	34.2 (±7.6)*	40	100%	30.4 (±6.8)*

*Statistically significant.

Table 2: Frequency distribution of knowledge of maternal danger signs among women in Ifako Ijaiye.

		Control		Intervention		Total	
		Freq.	%	Freq.	%	Freq.	%
Pre-test knowledge (Baseline)	Know 6 or more danger signs	11	27.5	12	30.0	23	28.7
	Know less than 6 danger signs	29	72.5	28	70.0	57	71.3
	Total	40	100.0	40	100.0	80	100.0
Post-test knowledge (post-intervention)	Know 6 or more danger signs	13	32.5	36	90.0	49	61.3
	Know less than 6 danger signs	27	67.5	4	10.0	31	38.7
	Total	40	100.0	40	100.0	80	100.0

Table 3: Pre-test and post-test knowledge of maternal danger signs among women in Ifako Ijaiye (paired samples test).

	N	Mean	Std. deviation	Correlation	Mean difference	t-value	Degrees of freedom	P value
Pre-test (Baseline)	80	4.76	1.774	0.690	2.013	8.329	79	<0.001
Post-test (post-intervention)	80	6.78	2.964	—	—	—	—	—

Paired samples test – 0.05 Significance levels.

Table 4: Pre-test and post-test knowledge level of maternal danger signs among women in the control and intervention groups (independent samples test).

	Groups	N	Mean	Std. deviation	Degrees of freedom	t-Value	Mean difference	P value
Pretest score (baseline)	Control	40	4.65	1.626	78	0.565	0.225	0.574
	Intervention	40	4.88	1.924	—	—	—	—
Post-test score (post-intervention)	Control	40	4.93	1.526	78	7.130	3.700	< 0.001
	Intervention	40	8.63	2.906	—	—	—	—
Difference (post-pre)	Control	40	0.275	0.640	78	12.156	3.475	< 0.001
	Intervention	40	3.750	1.691	—	—	—	—

Independent samples test – 0.05 significance levels.

DISCUSSION

The findings of this study reveal a concerning baseline level of knowledge regarding maternal danger signs among women in both the control and intervention groups. At pretest, over 70% of participants in each group knew fewer than six maternal danger signs. The mean number of danger signs mentioned across the entire sample was 4.76±1.77, which is significantly below the borderline score of six, indicating limited knowledge. This aligns with existing literature, particularly studies conducted in sub-Saharan Africa (SSA), which consistently report low levels of awareness of maternal danger signs, with prevalence rates of good knowledge below 50%.[4,17,19,32,36] This study's findings are consistent with a study in Gbagada, Lagos State, which reported that less than 35% of women demonstrated good knowledge of danger signs during labour and postpartum periods.[25] The lack of significant difference at baseline (mean difference=0.225, t (78)=0.565, p=0.574) between groups indicates that observed post-intervention differences can be confidently attributed to the intervention. This is similar to a quasi-experimental study conducted in Alimosho in Lagos State, which reported no significant baseline difference in knowledge between groups.[23]

The post-intervention results provide robust evidence of the effectiveness of maternal health education. The mean difference increased from 0.225 at baseline to 3.70 post-intervention (t (78)=7.13, p<0.001), confirming the improvement was attributable to the educational intervention and not chance. These findings align with a quasi-experimental study in Anambra State founded that maternal health education significantly improved pregnant mothers' health knowledge.[33] And a study in Alomosho, Lagos State, which demonstrated positive effects on knowledge and utilization of health facility delivery services.[34] The results extend the evidence base from international studies, including one in Tanzania where maternal health education raised knowledge of infant screening for sickle cell disease and a study in Enugu, Nigeria, where training mothers improved knowledge of danger signs in sick newborns and positively influenced healthcare-seeking behaviour.[7,36]

Limitations

Several limitations should be considered when interpreting the findings of this study. First, the study was conducted within a specific geographical area of Ifako-Ijaiye LGA, Lagos State, which may limit the generalizability to other settings. Second, the knowledge assessment was through self-reported responses, making the study susceptible to recall bias and social desirability bias. Third, the study evaluated knowledge outcomes shortly after the intervention (one month) and did not assess long-term knowledge retention. Fourth, the study focused primarily on knowledge acquisition and did not assess whether improved knowledge translated into actual behavioral changes, such as improved healthcare-seeking practices or antenatal care utilization. Fifth, as a quasi-experimental study, complete control of all potential confounding factors was not possible and unmeasured external influences may have contributed to the observed outcomes. Despite these limitations, the study provides valuable evidence on the effectiveness of maternal health education in improving women's knowledge of maternal danger signs.

CONCLUSION

This study demonstrated that maternal health education is an effective strategy for improving women's knowledge of maternal danger signs. At baseline, participants in both the intervention and control groups exhibited poor knowledge of maternal danger signs, with the majority unable to identify six or more danger signs. The absence of a statistically significant difference between the two groups at pretest confirmed their comparability and strengthened the validity of the intervention assessment.

Following the educational intervention, women in the intervention group showed a significant improvement in their knowledge of maternal danger signs compared with those in the control group. The substantial increase in the mean number of danger signs recognized and the higher proportion of women demonstrating good knowledge indicate that the maternal health education package was successful in enhancing awareness and understanding of pregnancy-related danger signs. These findings reinforce existing evidence that structured maternal health education can empower women with the knowledge needed to recognize early warning signs of obstetric complications and seek timely healthcare services. The study therefore, concludes that maternal health education is a practical, feasible, and evidence-based intervention for improving maternal health knowledge among women of reproductive age. Integrating regular maternal health education into routine community and facility-based maternal healthcare services has the potential to contribute significantly to improved maternal health outcomes and the reduction of preventable maternal morbidity and mortality.

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