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Effect of Antenatal Education on Knowledge and Utilization of Facility Based Delivery Services among Pregnant Women in Mpika District

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Abstract

Background: Maternal mortality remains a significant public health concern in Zambia, particularly in rural areas. In Mpika District, the utilization of facility-based delivery services is still low (76%) and home deliveries account for 24 percent. Moreover, the pattern of utilization of delivery services is not known. The aim of this study therefore was to evaluate the effectiveness of comprehensive health education on knowledge and utilization of maternal health services among antenatal mothers in Mpika District. **Objective:** To ascertain the effect of antenatal education on knowledge and utilization of facility-based delivery services among pregnant mothers in two health facilities in Mpika District. **Methods & Materials:** A quasi-experimental design using a pre-post design was employed, comparing a study group receiving comprehensive health education with a control group receiving standard care. Data were collected from 276 pregnant women in their second trimester for both the intervention (141) and control (135) groups. Data were collected using a structured questionnaire and analyzed using descriptive and inferential statistics. **Results:** The respondents were pregnant women aged between 16 years up to 42 years with a significant proportion (8% - 11%) of teenagers (less than 18 years old) in both the control and intervention groups indicating a concern for teen pregnancies in rural areas (Mean age: 24.5, SD: 5.2). The mean age is significantly different from 30 years ($p < 0.001$), indicating that the respondents were relatively young. The study findings also provide information that there were low levels of formal education among respondents (4% - 5%) and their husbands (4% - 12%). Primary education is the most common level of education among respondents (56% - 58%) and their husbands (41%) (Mean

years of education: 6.5, SD: 2.1). The study findings showed significantly higher knowledge on danger signs among the study group compared to the control group as follows: Antepartum danger signs (73% vs 63%, $p < 0.04$), Postpartum danger signs (89% vs 49%, $p < 0.001$). The results also showed significantly higher utilization of facility-based delivery services among the study group compared to the control group *i.e.* Attended more than three Antenatal visits (85% vs 64%, $p < 0.001$), Home deliveries (00% vs 4%, $p < 0.001$). The study group also received significantly more health education sessions than the control group (86% vs 29%, $p < 0.001$). **Conclusion & Recommendations:** The findings of this study demonstrate the positive impact of comprehensive health education on knowledge and utilization of maternal health services among antenatal mothers in Mpika District. The findings show significant improvements in knowledge of danger signs, birth planning, and complication readiness as well as increased utilization of antenatal and delivery services. The study underscores the importance of health education in enhancing maternal health outcomes and reducing maternal and neonatal mortality. The study has also shown that routine health education may not have much impact on knowledge and utilization of MCH and delivery services. There is need to integrate comprehensive health education into antenatal care and prioritize health education as an integral component of antenatal care. There is also need to focus on improving knowledge of danger signs and birth planning through targeted and scheduled health education.

Keywords

Knowledge, Antenatal Education, Facility Based Delivery Services

1. Introduction

Access to skilled care and facilities providing emergency obstetric care and newborn care is critical to reducing maternal mortality in Zambia. For instance, 42% of women in Zambia still deliver at home under the supervision of unskilled birth attendants whereas neonatal and maternal mortality is estimated at 27/1,000 and 252/100,000 live births respectively [1]. This is because delivering in a health facility provides an opportunity to receive high-impact obstetric, neonatal, and emergency care interventions, resulting in improved, maternal, and neonatal health outcomes [2].

Institutional delivery service is one of the key and proven interventions to reduce maternal deaths. It ensures safe birth, reduces both actual and potential complications and maternal deaths and increases the survival of most mothers and newborn [3]. Many adverse health outcomes are associated with non-utilization of facility-based delivery services which may be due to behavioural risk factors. In Mpika District, some behaviours by women, such as use of African syntocinon, tobacco smoking, avoidance of certain foods basing on myths, alcohol drinking and home

deliveries are common and are known to be key determinants of population health. Maternal survival is also related to maternal behaviour of delivery and childbirth [3]. Despite the availability of delivery services, many women in Mpika District still give birth at home following traditional belief and customs. A large prospective study in Mumbai slums found "custom" as the most common reason for home birth [4]. In western Uganda, women continue to deliver at home even when experiencing pregnancy complications. They adhere to traditional birthing practices and believe that pregnancy is a test of endurance [5]. In Timor-Leste, previous experience of uncomplicated home birth has led many women to view birth as a normal non-medical event and choose home for subsequent deliveries. According to the stage theory of behaviour change, individuals pass through a series of stages before changing their behaviours. "Precontemplation" and "contemplation" are the initial stages in which individuals recognize the problem and assess "pros" and "cons" of the intended change before making preparation for actual action [6].

In other words, behavioural change starts with recognition of the underpinning health problem. In the context of delivery service use, women and her family should be aware of the negative consequences and danger signs during pregnancy and childbirth. Recognition of potential problems is relevant, because pregnancy and childbirth are often regarded as normal life events that do not require professional help [7].

In our study, the Trans-Theoretical Model (TTM) of behavior change was applied to guide the design and implementation of our comprehensive health education intervention. The theory was integrated as follows:

Pre-contemplation Stage: Raising Awareness: the researchers provided information about the benefits of facility-based delivery services, highlighting the risks associated with home deliveries and the importance of skilled birth attendance.

Contemplation Stage: Weighing the Pros and Cons: the researchers facilitated discussions and sharing of experiences among participants, encouraging them to weigh the advantages and disadvantages of facility-based delivery services during the intervention stage.

Preparation Stage: Building Skills and Confidence: Participants were equipped with the necessary skills and knowledge to access and utilize facility-based delivery services, including birth planning and navigating the healthcare system by giving them brochures which they were moving with and kept at home.

Action Stage: Taking Action: The participants were supported in taking concrete steps towards utilizing facility-based delivery services, including making birth plans and attending antenatal care sessions.

Maintenance Stage: Ongoing Support: Ongoing support and reinforcement was provided to participants who had adopted facility-based delivery services, encouraging them to maintain their new behavior.

Termination Stage: Long-term Behavior Change: The researchers aimed to promote long-term behavior change by ensuring that participants had the neces-

sary knowledge, skills, and support to maintain facility-based delivery utilization.

By applying the Trans theoretical Model (TTM) of behavior change framework, the researchers designed an intervention that addressed the specific needs and concerns of participants at each stage of change, ultimately promoting the adoption and maintenance of facility-based delivery services.

2. Methods

The methodology in this study was organized under the following headings: Research Paradigm, the research design, research setting; study population, sample selection, inclusion and exclusion criteria, sample size, data collection tools, data collection technique, validity and reliability, pre-test and ethical consideration. The aim of the study was to ascertain the effect of antenatal education on the knowledge and utilization facility-based delivery services among pregnant mothers in two health facilities in Mpika District.

2.1. Research Philosophy/Paradigm

The study was guided by the Ontological philosophy with the utilization of the positivism paradigm as the quantitative research method. The perspective taken helped the researchers to investigate the existence of a relationship between two variables rather than the reason behind it *i.e.* Health education and utilization of delivery services by Antenatal mothers in Mpika District.

2.2. Research Design

This study adopted a quasi-experimental design of two groups of pre and post intervention among mothers attending antenatal clinic in two health facilities in Mpika District. A quasi experimental study is aimed at evaluating the interventions but do not use randomization.

Non-Equivalent Control Group Design will be employed.

In this design both the control group and an experimental group were to be compared. The groups were chosen and assigned out of convenience rather than through randomization.

The researchers determined the knowledge levels of antenatal mothers at the start of the program (pre intervention) and then again after the program (post intervention).

One group (experimental group) was given specific Health Education on specific topics *i.e.* importance of utilizing facility delivery services, birth preparedness and complication readiness. The other group was exposed to the routine Health Education by the facility staff. The group who did not receive the specific Health Education was our control group. The two groups were compared at the start of the program and at the end in respect of knowledge levels, utilization of facility-based delivery services and pregnancy outcomes.

The study included 3 phases namely pre-intervention, intervention and post intervention. In the pre-intervention phase, research assistants were recruited and

trained on how to collect data. These comprised of health workers who are nurses and midwives working in targeted health facilities. Health education materials such as posters and pamphlets were developed by the researcher. The researchers also visited the study areas to seek for permission to conduct the study. Baseline data was collected and analyzed at this stage. The intervention phase followed thereafter. The decision to decide on which health facilities should serve as the intervention and control group was determined by the maternal and child health services utilization outcomes as recorded by health facilities in Mpika District. During the intervention phase, the respondents were divided into the intervention and control groups. The intervention group received specific health information on importance of utilizing facility delivery services, birth preparedness and complication readiness and the control group received information on different topics by the health providers. The intervention was for 45 minutes' duration conducted four times during the antenatal period at 16, 24, 28 and 32 weeks. The post intervention phase was done by the researchers and the research assistants at 36 and 38 weeks of gestation using the same data collecting too used in the pretest phases.

2.3. Study Setting

The study was conducted in Mpika District at Kamwanya Health Centre and Chibansa Clinic. Mpika is one of the 8 Districts in Muchinga Province of the Republic of Zambia. Mpika is approximately 647 km away from Lusaka the capital city of Zambia, 177.7 km away from Chinsali the Provincial headquarters of the Muchinga Province and 210 km from Kasama the provincial capital for Northern Province. The major roads that connect the district to the rest of the country and beyond is the Great North Road and Kasama is through M1. Most parts of Mpika are rural and most of the health facilities are hard to reach.

2.4. Study Population

The study population consisted of pregnant women in the second trimester for both the intervention and control groups. Controls were matched to the intervention group by age, parity and level of education.

2.5. Inclusion and Exclusion Criteria

All pregnant women who have had given birth at least once and in the second trimester of pregnancy were included. Those who have had not given birth before, none residents who stay outside the study area, and those who refused to participate in the study were excluded.

2.6. Sample Selection

In this study, Proportionate sampling technique was employed. Proportionate sampling technique was applied in deciding the representative sample which was drawn from each facility because they did not contribute equal number to the total

population. This method involved getting a proportional sample from the study and control groups which were representative basing on their characteristics. In this study the researchers employed a proportionate sampling technique to select participants from two health facilities.

The proportionate sampling technique was used to ensure that the sample was representative of the population attending the two health facilities. The researchers also calculated the sample size based on the expected number of antenatal mothers attending the health facilities during the study period. In order to avoid bias, the control and intervention groups were matched by age to ensure that both groups had similar age distributions. The participants were also grouped by parity (number of previous births) to account for potential differences in health outcomes and behaviors. The matching was also considered by level of education to control for potential differences in health literacy and access to health information. The researchers used a systematic sampling technique to select participants from the sampling frame, ensuring that every nth participant was selected. We applied predefined inclusion and exclusion criteria to ensure that the sample was representative of the population and to minimize selection bias.

By using a proportionate sampling technique and matching the control and intervention groups by key variables, we aimed to minimize bias and ensure that the study findings were representative of the population.

2.7. Sample Size Calculation

The sample size was estimated using a formula by Kish and Leslie (1965) for cross-sectional studies which compared two independent samples (Intervention vs. control group).

$$n = \frac{P(1-P)Z^2}{d^2}$$

where, n = Number of respondents needed;

p = Estimated proportion of antenatal mothers accessing Health facility services. In this study, 50% which is worst scenario was to be used since there is no study done on Effect of antenatal education on knowledge and utilization of facility-based delivery services among pregnant women in Mpika District to our knowledge;

Z is 1.96 (the Z score corresponding to 95% confidence interval);

d = Maximum error the researchers is willing to allow = 0.05.

$$n = \frac{0.5(1-0.5)Z1.96^2}{0.05^2} = \frac{0.5(0.5)1.96^2}{0.05^2} = \frac{0.25X1.96^2}{0.05^2}$$
$$= \frac{0.25X3.8416}{0.05^2} = \frac{0.9604}{0.0025} = 384.16$$

This study was to assume 384 as a minimum sample size.

The sample size however consisted of 141 participants from the study group and 135 participants from the control group.

2.8. Data Collecting Tool

Semi structured interview questionnaire with both closed and open ended questions was developed by the researcher. The purpose of using such a variety of questions was to ensure that participants were free to answer in the manner appropriate to them. The semi-structured interview questionnaire was developed after thorough literature review in order to be able to adopt concepts from other recommended tools which have previously been used and approved by other researchers. The structure of the interview schedule comprised of four sections:

Section A: was designed to elicit information on the respondents' socio-demographic data.

Section B: knowledge of delivery services, danger signs and complication preparedness.

Section C: Utilization of health institutions.

Section D: Health Education.

2.9. Validity

In this study, validity was ensured by employing strategies that dealt with threats to validity like appropriate selection of study design, random selection of study participants, and use of a pilot study to pre-test the research instruments.

2.9.1. Internal Validity

Construct and internal validity was ensured by carrying out extensive literature review which guided the designing of the data collection tool to ensure that only relevant questions pertaining to the study variables were included in the data collection tool. Adjusting for other variables during analysis ensured validity of findings.

2.9.2. External Validity

External validity was ensured with probability sampling procedures, enabling study participants (controls) and study units stand equal chances of being included in the study. As such, findings are generalizable to all the pregnant women in the district. In addition, the questionnaire was translated into the local language, translated back into English and same questions were be asked to each respondent in the same sequence.

2.10. Reliability

Reliability of the study was measured by testing the research tools before the main study during the pre-intervention stage which was done in a similar environment with similar characteristics. Reliability was also measured by using Cronbach's alpha to calculate the reliability coefficient. Indexes of internal consistency ranged from 0.00 to 1.00.

2.11. Data Collection

Data was collected using face to face interviews. Individual interviews were conducted in private rooms for a period of 30 - 45 minutes. The data collection was

done in twelve (12) weeks and in three major phases of pre intervention, intervention, and post intervention sessions.

2.12. Data Analysis

Trained research assistants were used to collect data. Every questionnaire was cross-checked for completeness after the interview. After data collection, data was analyzed using SPSS version 23 software. Before conducting the analysis data was sorted and coded before entering it into a password protected SPSS. Descriptive analysis was done to calculate mean and standard deviation and proportions for categorical variables. Normality of continuous variables were tested statistically by the Shapiro will test and graphically by qq-plots. Categorical variables, numbers and percentages are to be reported then chi-square tests or fishers exact test were to be used to check associations. A confidence interval of 95% with margin errors of 5% (0.05) was used to determine statically significance. Less than 0.05 was regarded statistical significance. Linear Logistic Regression tests (univariate and multivariate analyses) was used to determine the factors associated with the dependent variable. Multivariate Logistic Regression was also used to control for confounding variables and to come up with independent contributing factors to utilization of delivery services. Significant level was set at 0.05% with 95% confidence interval.

2.13. Pilot Study

Pilot study was conducted in a setting with similar characteristics with the actual study setting. The sample for the pilot study consisted of 30 respondents with the same characteristics as the study sample at a different site. The pre-test informed the researchers whether the questions were understood in the same way by the respondents and if they are answerable and appropriate. This gave the researchers an idea of the time respondents took to answer the questionnaire and whether they understand the instructions, and if its format was suitable for the population

2.14. Ethical Consideration

Ethical clearance was obtained from UNZABREC and the National Research Authority before conducting the study. Written permission to conduct the study was obtained from the Provincial and District Directors of the health facilities of the study sites. Permission was also sought from the sisters the in-charges of the two health facilities where the data was collected. Written Informed consent was obtained from the study participants before interviews.

3. Results

The purpose of this study was to evaluate the effectiveness of health education on knowledge and utilization of maternal health services among antenatal mothers in Mpika District. A quasi-experimental design was employed, comparing a Study Group receiving comprehensive health education from the researchers and his

team members with a Control Group receiving standard care from nurses and midwives working in the respective clinics. The study aimed to address the knowledge gap in maternal health education and its impact on health outcomes. This analysis presents the findings of the study, highlighting the differences in knowledge and service utilization between the Study and Control Groups during the post intervention phase.

3.1. Socio-Demographic Data

The respondents' demographic Characteristics such as age, education level of the respondent and the husband, marital status, work status are presented in Table 1 below:

Table 1. Respondents' socio-demographic data (n = 276).

	Age in years	Control group	Study group	Frequency	Percentage
Age	<18 Years	11	10	21	8
	19 - 24 years	42	48	90	33
	25 - 36 years	46	48	94	34
	37 - 42 years	36	35	71	25
	Total	**135**	**141**	**276**	**100**
Education Level	No formal Education	6	5	11	4
	Primary Education	76	82	158	57
	Secondary Education	52	53	105	38
	Tertiary Education	1	1	2	1
	Total	**135**	**141**	**276**	**100**
Marital Status	Single	15	15	30	11
	Married and living together	88	89	177	64
	Married and separated	1	1	2	1
	Cohabiting	31	36	67	24
	Total	**131**	**141**	**276**	**100**
Husband Education Level	No Formal education	5	7	12	4
	Primary Education	55	58	113	41
	Secondary Education	66	67	133	48
	Tertiary Education	9	9	18	7
	Total	**135**	**141**	**276**	**100**
Working Status	Not Working	134	135	269	97
	Working	1	6	7	3
	Total	**135**	**141**	**276**	**100**

Continued

Number of Children	1 Child	8	11	19	7
	2 Children	26	51	77	28
	3 Children	50	28	78	28
	4 and more children	51	51	102	37
	Total	**135**	**141**	**276**	**100**

Table 1 shows that 8% (11) of the respondents from the control group were less than 18 years of age and 7% (10) of the respondents from the study group were aged less than 18 years of age. 31% (42) controls were aged between 19 - 24, while 34% (48) of the respondents from the study group were aged 19 - 24 years. The other 34% (46) were aged between 25 - 36 years and 34% of the respondents group were also aged between 25 - 36 years. The other 27% (36) controls and 25% study participants respectively were aged between 37 - 42 years. The table also provides information that 4% (6) controls and 4% (5) from the study group did not have formal education and 4% (12) had husbands without formal education, 56% (76) of the control group attended primary education and 58% of the study group had primary education. 41% (113) from the two groups had husbands who attended primary education. There were 39% (52) of the controls who had attained secondary school education and 38% (53) from the study group had secondary education while 48% (133) had husbands with secondary education from both groups. 1% (2) attended tertiary education and 7% (18) had husbands who attained tertiary education. The table also shows that most (65%) of the control respondents were married and living with husbands and so were 63% of the study group. Of the two groups 11% were single mothers and the other 23% (31) of the controls were cohabiting and 26% of the study participants were also cohabiting. There were, 97% (269) did not have formal work while 3% (10) never had formal work. Concerning number of children, slightly more than half (51%) of participants in the study group have 2 or more children and participants with 4 or more children were more common in both control (18%) and study groups (18%).

3.2. Knowledge on MCH Services and Danger Signs in Pregnancy and Post Parturm

In Figure 1, the study results showed that about 6% (8) from the control group didn't mention any antepartum danger signs while all of the respondents from the participant group mentioned at least more than one danger sign. On the other hand, only 63% (85) from the control group were able to mention all the danger signs in pregnancy compared to 73% (102) from the study group.

Figure 2 demonstrates that about 27.4% (37) of the controls didn't know any of the intrapartum danger signs compared to 2% (3) of the respondents from the study group who didn't mention any danger sign. The study results also show that 76% (108) of the respondents from the study group were able to mention all the

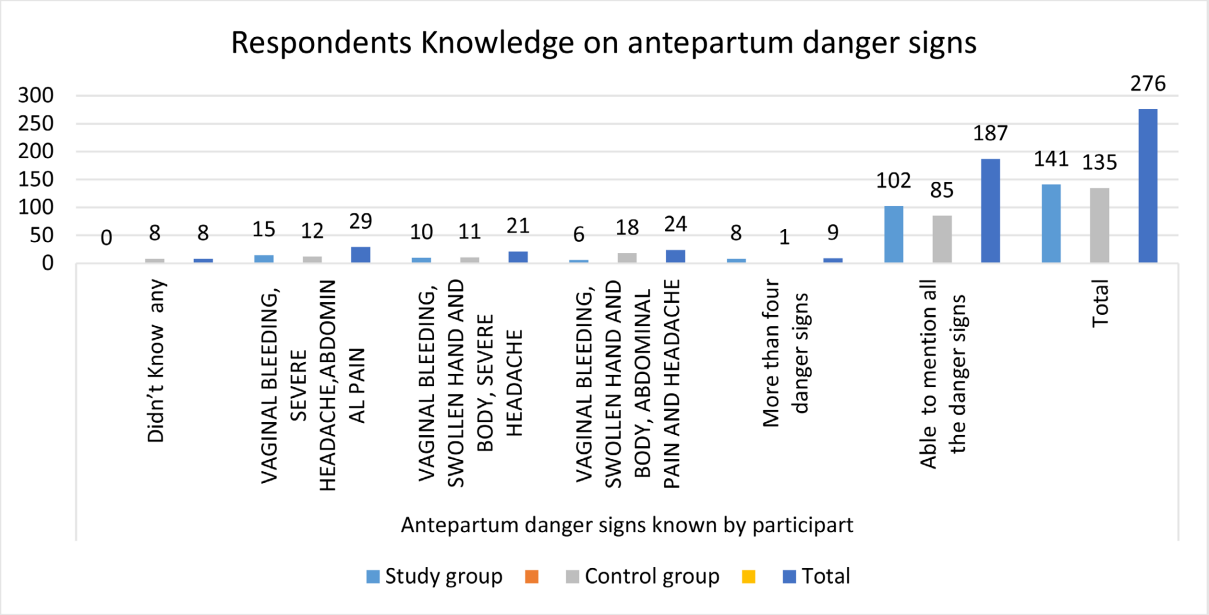

Figure 1. Respondents knowledge on antepartum danger signs.

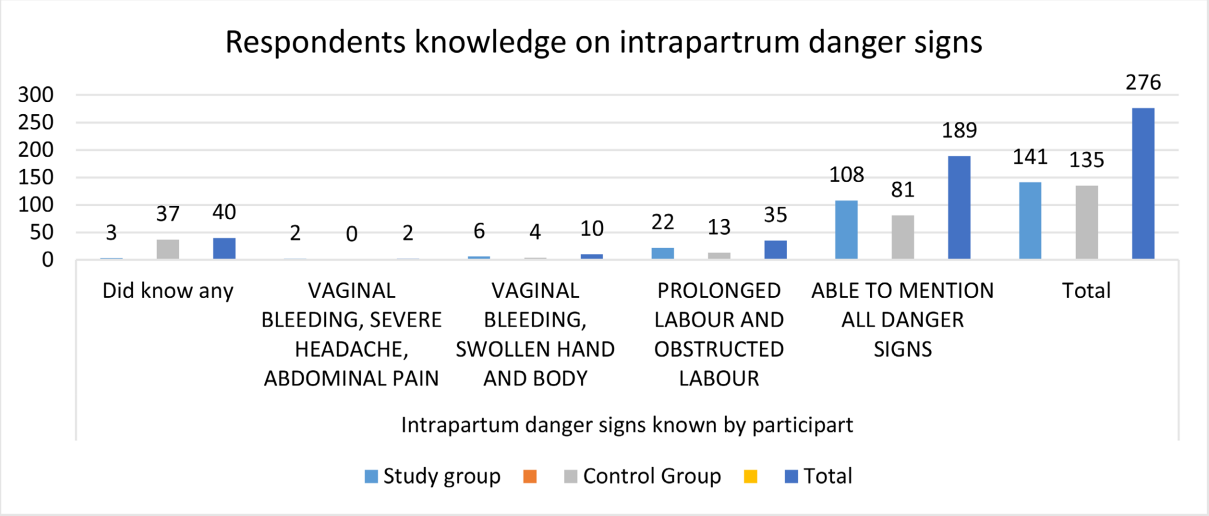

Figure 2. Respondents knowledge on intrapartum danger signs.

intrapartum danger signs compared to 60% (81) of the control group respondents.

Figure 3 demonstrates that majority (89%) of the participants from the study group were able to mention all the postnatal danger signs compared to 49% (64) from the control group respondents.

Figure 4 shows that 42% (57) of the control group had low knowledge levels on delivery services compared to 17% (24) of the study participants. On the other hand, most (105) of the respondents from the study group displayed moderate level of knowledge on delivery services compared to 50% (67) of the respondents from the control group. Only 8% of the respondents from the study group and 9% of respondents from the control group displayed high levels of knowledge on delivery services.

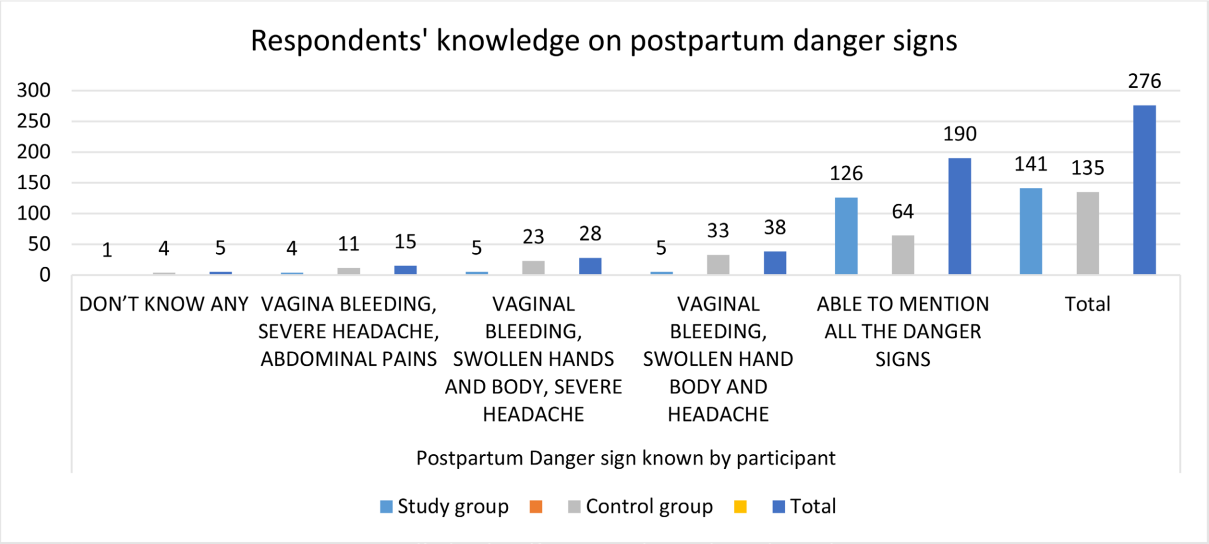

Figure 3. Respondents' knowledge on postpartum danger signs.

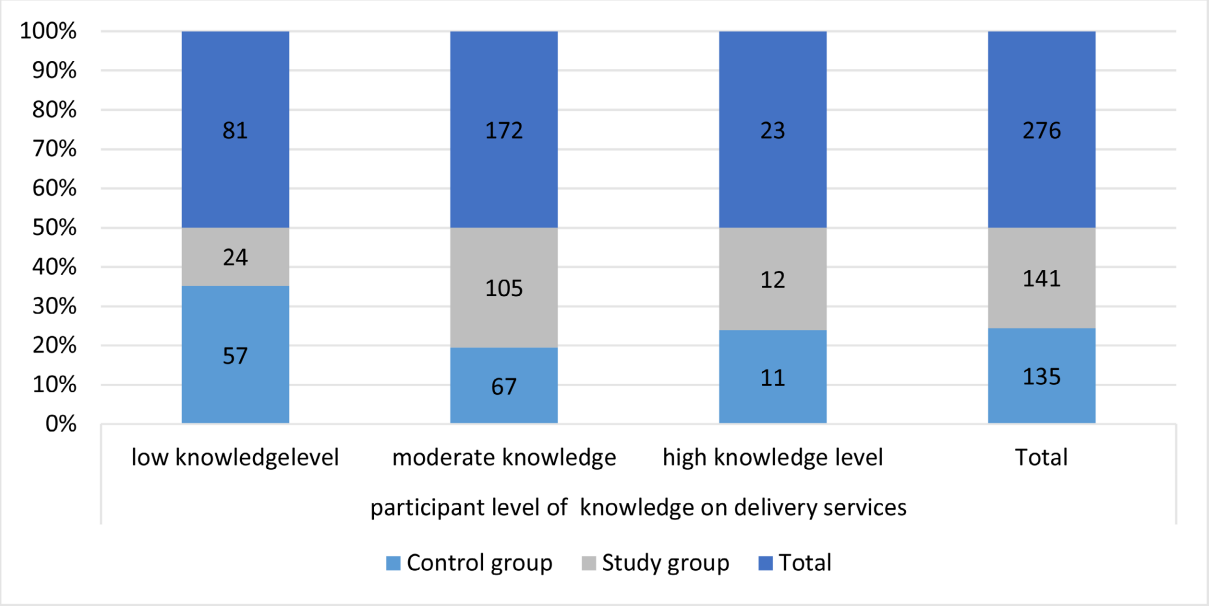

Figure 4. Respondents' level of knowledge on delivery services.

3.3. Utilization of MCH/Delivery Services

In Figure 5, the study findings show that majority (127) of the respondents from the study group have had utilized more than one MCH services during the study compared to 57% (77) from the control group. Whilst postnatal services were the least utilized by both groups.

Figure 6 below shows that 9% (12) of the respondents from the control group made only one antenatal visit and 14% (19) made a maximum of two visits while none of the respondents from the study group made less than three visits. On the other hand, 64% (86) of the controls made 4 or more visits while 85% (120) of the respondents from the study group made 4 or more visits.

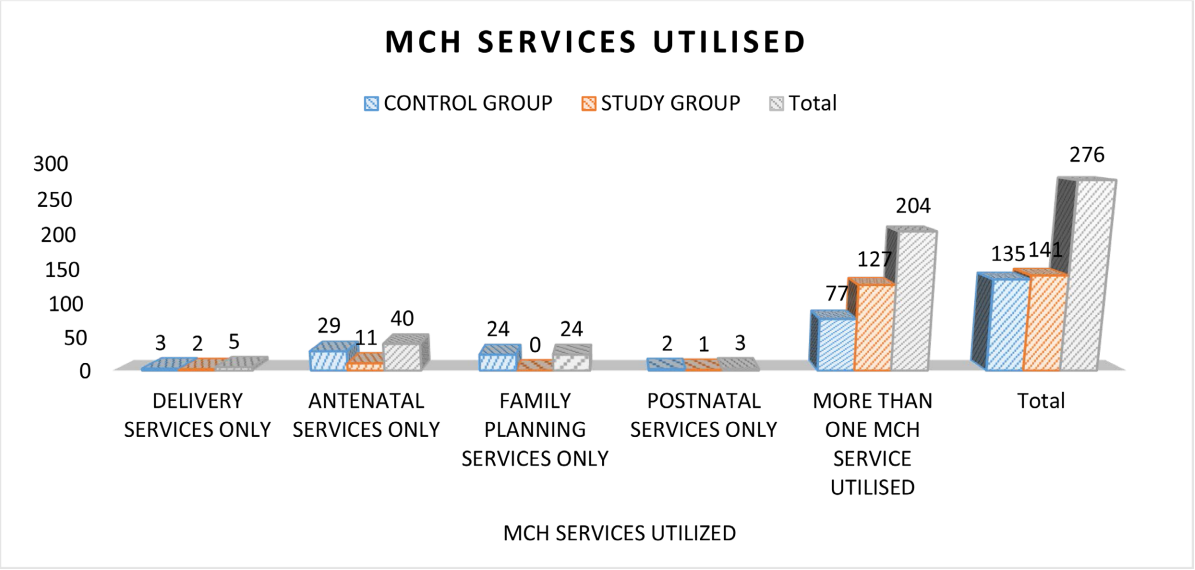

Figure 5. Responses on MCH services utilized by respondents.

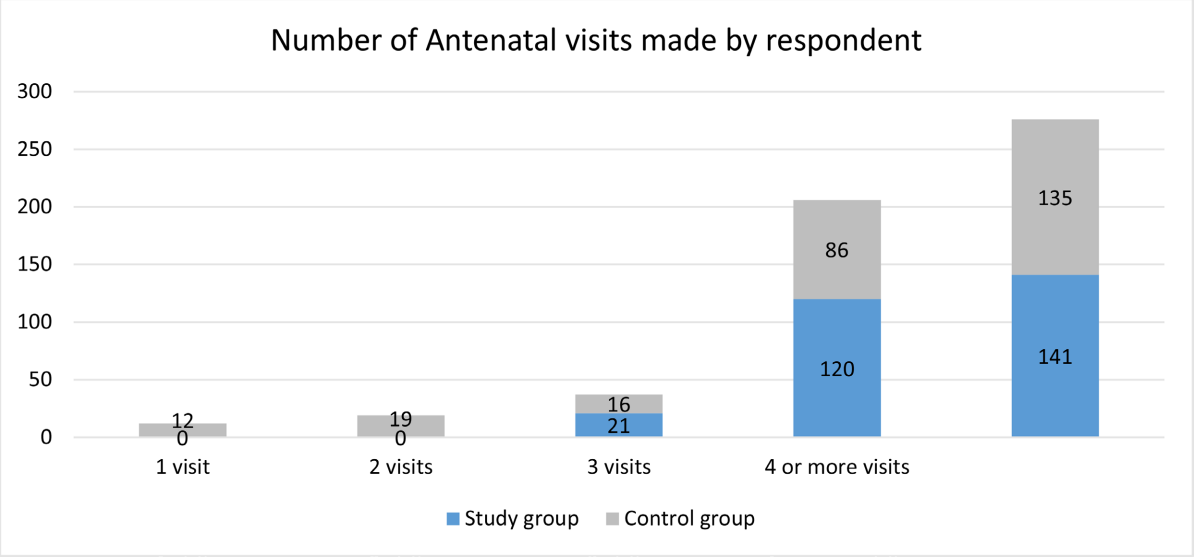

Figure 6. Responses on number of antenatal visits made by respondents.

Figure 7 shows that all the respondents from the study group delivered from hospital/clinic compared to the participants from the control group where 4% (6) of the respondents delivered from home.

Figure 8 shows that majority of the respondents from both groups (controls = 84%, study group = 94%) were delivered by midwives' while 6% of the controls were delivered by other people such SMAGS and relatives.

3.4. Health Education

Figure 9 below shows that 41% (60) of the respondents from the study group received more than 5 - 6 health education sessions compared to 21% (30) of the control group and 45% (64) of the study participants received more than 6 sessions

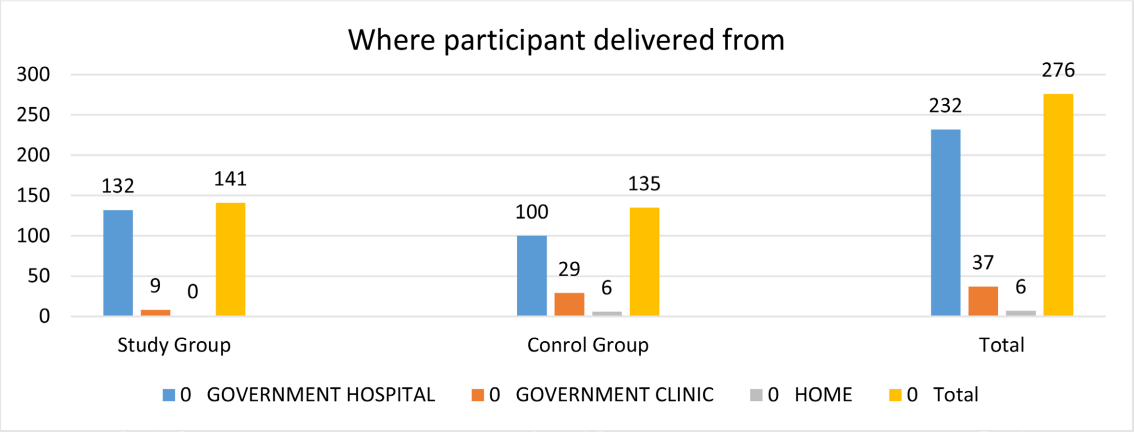

Figure 7. Responses on where respondent delivered from.

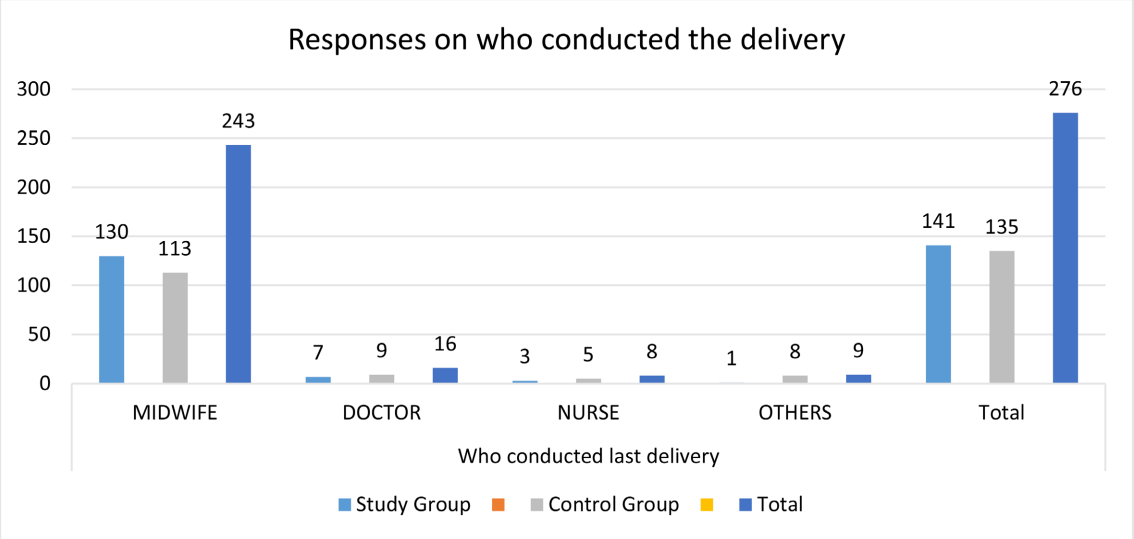

Figure 8. Respondent's response on who conducted the delivery.

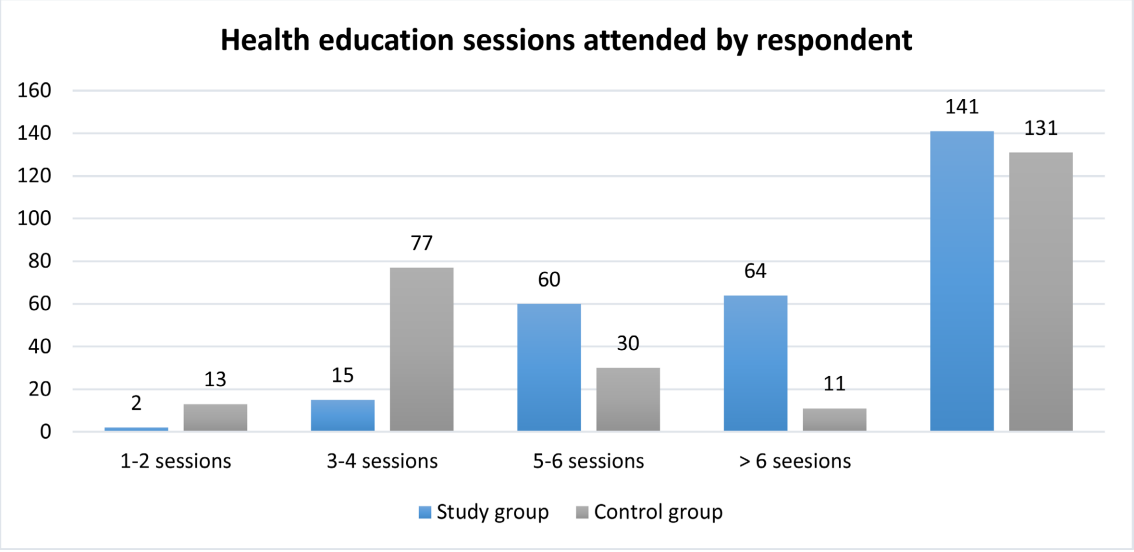

Figure 9. Responses on number of health education sessions attended by respondent.

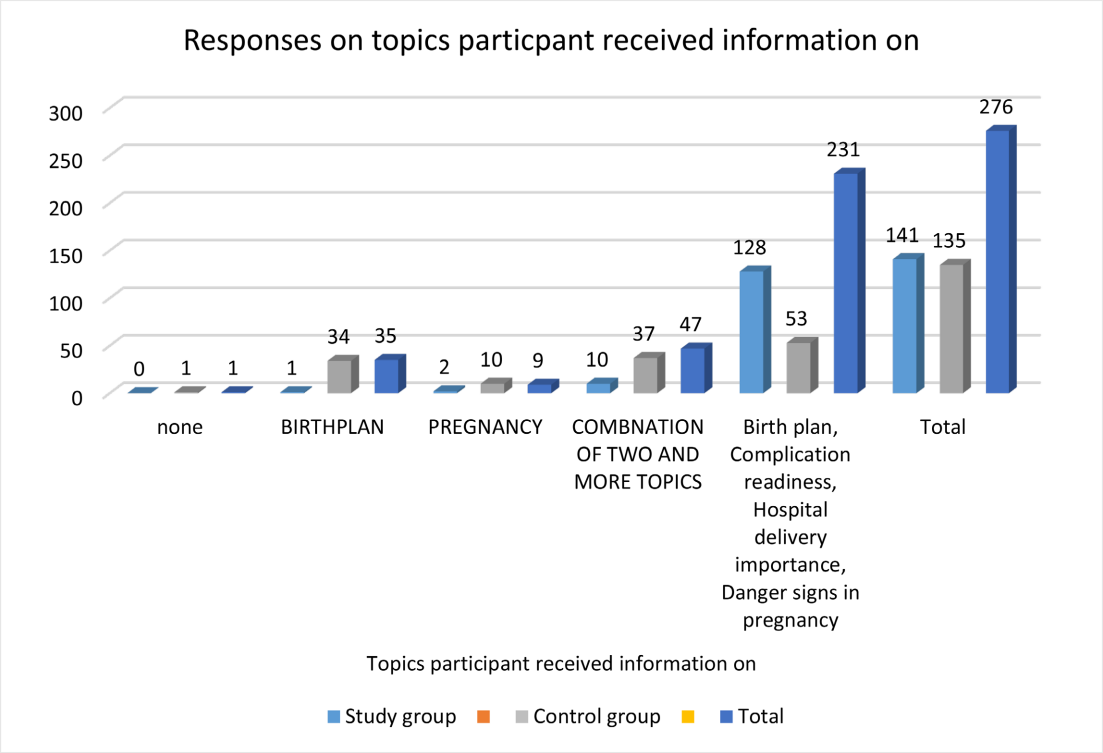

Figure 10. Responses on topics respondent received information about.

compared to 8% (11) of the controls. Most (57%) of the respondents from the control group received 3-4 sessions of health education.

Figure 10 results above show that only 39% (53) of the controls received information on the four topics (birth plan, complication readiness, importance of hospital delivery and danger signs) compared to 91% (128) of the study participants.

4. Discussion

4.1. Socio-Demographic Characteristics of Study Participants

The Demographic characteristics of the respondents which were relevant to the study and essential for interpretation included; age, education level of the respondent and the husband, marital status, work status and parity. The respondents were pregnant women aged between 16 years up to 42 years with a significant proportion (8% - 11%) of teenagers (less than 18 years old) in both the control and intervention groups indicating a concern for teen pregnancies in rural areas. 31% (42) of the control group participants were aged between 19 - 24, while 34% (48) of the respondents from the intervention group were aged 19 - 24 years. The other 34% (46) were aged between 25 - 36 years and 34% of the respondents from the intervention group were also aged between 25 - 36 years. The other 27% (36) of the control group and 25% the intervention group participants respectively were aged between 37 - 42 years (Mean age: 24.5 years (SD: 5.2). The mean age is significantly different from 30 years ($p < 0.001$), indicating that the respondents are relatively young. The similar age distribution between the control and inter-

vention groups suggests that the groups are comparable in terms of age, which is an important factor in health education and healthcare utilization. The higher percentage of respondents in the 19 - 24 age range in the intervention group (34%) compared to the control group (31%) might suggest that the study group has a slightly higher proportion of younger women, who may be more likely to benefit from health education on delivery facilities. The findings agree with the finding of a study conducted in rural Kenya which found that 22% of adolescents had begun childbearing, highlighting the need for targeted interventions [8] but contradicts the findings of a study by Amo-Adjei *et al.* [9] carried out in urban Ghana which found no significant association between adolescent pregnancy and healthcare utilization.

Overall, the age distribution data suggests that the study has a representative sample of women of childbearing age, and the comparison between the control and study groups is valid in terms of age. This sets the stage for analyzing the effects of health education on knowledge and utilization of delivery facilities, which is the main objective of the study.

The study findings also provide information that there were low levels of formal education among respondents (4% - 5%) and their husbands (4% - 12%). Primary education is the most common level of education among respondents (56% - 58%) and their husbands (41%). Secondary education is the second most common level among respondents (38% - 39%) and their husbands (48%). Tertiary education is low among respondents (1%) and their husbands (7%).

(Mean years of education: 6.5 years, SD: 2.1). The mean years of education is significantly different from 8 years ($p < 0.01$), indicating that the respondents have relatively low levels of education. These findings indicate high illiteracy levels in rural areas, which can impact decision-making, including health-seeking behaviors. The high illiteracy levels, might have influenced the comprehension and retention of health education messages in both groups but use of visual aids, simple language, and interactive approaches in the study group helped to mitigate the effects of illiteracy on health education outcomes.

These findings agree with Oladapo *et al.* [10] research findings in Nigeria which revealed that women with higher education levels were more likely to utilize maternal healthcare services. However, the findings are contrary to Moyer *et al.* [11] research findings in Tanzania that showed that education level did not significantly impact maternal healthcare utilization. According to Onah [12], literacy among women in many developing countries is low, and there are sociocultural beliefs and practices with adverse effects on pregnancy and birth occurring even among educated women.

The study findings showed that a significant proportion from both groups were single mothers (11%) or cohabiting (23% - 26%). The proportion of married respondents was significantly higher than the proportion of single respondents ($p < 0.001$). The marital status of the respondent has a significant influence on decision making especially when it comes to health seeking behaviours as married women

may be required to seek permission from husbands to access MCH or delivery services. This maybe a different scenario for the unmarried or cohabiting women who in this case accounts for a small percentage (11%). Arigundade *et al.* [13] study in Nigeria also showed a significant association between health facility delivery and marital status, education and divorcees with respondents who registered early (first trimester) for antenatal clinic being found to be higher users of delivery services at health facility. In addition, a study in India conducted by Singh *et al.* [14] found that married women were more likely to access institutional delivery care than unmarried women. However, a Ugandan study by Kabakyenga *et al.* [15] found no significant difference in healthcare utilization between married and unmarried women.

There were, 97% (269) who did not have formal work only 3% (10) had formal work from both groups. The proportion of unemployed respondents is significantly higher than the proportion of employed respondents ($p < 0.001$). The study findings highlight the fact that in rural areas majority of women are not in formal employment which can affect their income and socio-economic status. These findings are in agreement with Rahman *et al.* [16] findings in rural Bangladesh that found that women from lower socioeconomic backgrounds had lower rates of facility-based delivery. The current study findings are also supported by Silubanje *et al.* [17] whose aim was to explore women's experiences and beliefs concerning utilization of maternity waiting homes in rural Zambia that reported that factors such as women's lack of decision-making autonomy, prevalent gender inequalities and low socio-economic status prevent women from utilizing these services delivery services. Moreover, non-availability of funds to buy the requirements for the baby and mother to use during labour at the clinic also affected utilization hospital delivery. However, it contradicts with a study by Li *et al.* [18] conducted in rural China that found that socioeconomic status did not significantly impact healthcare utilization.

Concerning number of children, slightly more than half (51%) of participants in the study group had two or more children and participants with four or more children were more common in both control (18%) and study groups (18%) (mean number of children: 2.63 (control group), 2.83 (study group) (SD: 1.5), (p-value < 0.001). Parity has an influence on the utilization of health facilities for maternal health services as those with one child maybe eager to access hospital services than those with many children while those with four or more children may have financial and other challenges which can prevent them from accessing the services (**Table 1**). These findings on parity are in agreement with the research findings published in the Journal of Marriage and Family [19] which showed that families with four or more children are more likely to experience financial stress, which may be related to the similar distribution of large families in both groups. The findings are also in agreement with another related research finding in a study in the Journal of Population Research [20] which demonstrated that single-child households are becoming increasingly rare in many countries, supporting the

finding of few single-child households in both groups [20]. Nonetheless, the above findings on number of children do not support the findings in A study published in the Journal of Family Issues [19] which showed that single-child households are becoming more common in some countries, contradicting the finding of few single-child households in both groups.

A study by Buhler, and Franssen, [21] found that the distribution of family size varies significantly across different cultural and socioeconomic contexts, which may contradict the similar distribution of large families in both groups.

These findings are also in agreement with the research findings in Ethiopia in a study conducted by Worku *et al.* [22] that found that women with fewer children were more likely to use institutional delivery services but contradicts Maina *et al.* [23] findings in Kenya that showed no significant association between parity and healthcare utilization.

These demographic characteristics highlight the challenges and vulnerabilities of the study population, including teen pregnancies, low education levels, limited access to formal employment, and potential gender inequalities. These factors may impact the utilization of delivery facilities and the effectiveness of health education interventions. The high percentage of teenagers in the study highlights the need for targeted interventions to address early pregnancies and improve access to reproductive health services. The low levels of formal education among respondents and their husbands underscore the importance of education in improving health literacy and decision-making. The significant proportion of married women and the potential influence of husbands on healthcare decisions emphasize the need to engage men in health education and promotion. The high percentage of respondents without formal work and low socioeconomic status highlights the need to address systemic barriers to healthcare access. The findings on parity suggest that women with fewer children may be more likely to access hospital services, emphasizing the importance of targeted interventions for high-parity women.

4.2. Knowledge on MCH Services, Antepartum, Intrapartum and Postpartum Danger Signs

Section B of the questionnaire had open and closed ended questions that aided in determining the knowledge levels of pregnant women on MCH and facility delivery services, antepartum, intrapartum and postpartum danger signs during the post intervention period.

The results showed that there was a significant improvement in knowledge of antepartum danger signs by study group compared to the control group (49% vs. 27.4%), $p < 0.001$, Odds Ratio (OR) = 2.43, 95% CI (1.63-3.62) (**Figure 1**). The better knowledge levels of antepartum danger signs demonstrated by the study group can be attributed to the MCH education program. These findings agree with Orpin *et al.* [24] in the systematic review of 22 studies which showed that health education programs improve knowledge of danger signs during pregnancy and childbirth. The other Cluster randomized trial study in Ethiopia by Tiruneh

et al. [25] demonstrated that health education improves knowledge of antepartum and postpartum danger signs. However, the findings of this study are contrary to Oladapo *et al.* [10] study in Nigeria which showed that health education alone may not be sufficient to improve knowledge of danger signs. Another systematic review of 15 studies by Albrecht & Higgins [26] highlighted variability in effectiveness of health education programs in improving knowledge of danger signs.

The results further reviewed that the study group showed much improvement in knowledge of postpartum danger signs compared to the control group (80% vs. 41%, $p < 0.001$, OR = 5.33, 95% CI (3.33 - 8.53) (**Figure 2**). The study group demonstrated better knowledge of postpartum danger signs, indicating the effectiveness of the MCH education program. These findings are supported by Lassi *et al.* [27] findings in the Meta-analysis of 18 studies which showed that health education programs increase knowledge of postpartum danger signs. Another Randomized controlled trial in Kenya by Munakampe *et al.* [28] demonstrated that community -based health education improves knowledge of postpartum danger signs. Nonetheless, Randive *et al.* [7] study in India showed that health education programs have limited impact on improving knowledge of postpartum danger signs. These findings are also contrary to Imada *et al.* [21] whose systematic review of 20 studies showed variability in effectiveness of health education programs in improving knowledge of postpartum danger signs.

4.3. Utilization of Facility Based Delivery Services

Evidence has suggested that maternal use of skilled birth attendant is a most important factor in reducing maternal mortality because of more than three quarters of maternal deaths occurring during child birth or within twenty-four hours after delivery due to hemorrhage, hypertension, ruptured uterus and sepsis [29]. The study results showed a higher utilization of antenatal services by the study group (51.09% vs. 32.59%, $p = 0.002$ OR (antenatal) = 2.13, 95% CI (1.31 - 3.45)), family planning (10.64% vs. 5.93%, $p = 0.04$ OR (family planning) = 1.89, 95% CI (1.03 - 3.47)), and delivery services (93.62% vs. 81.48%, $p = 0.01$, OR (delivery) = 3.14, 95% CI (1.63 - 6.06). The findings show that the study group demonstrated higher utilization of MCH services than the control group, indicating the effectiveness of the MCH education program. These findings are in agreement with the findings of Awoonor-Williams *et al.* [30] in their Cluster randomized trial in Ghana which demonstrated that community-based health education improves antenatal care attendance. Another Randomized controlled trial in Uganda showed that community-based health education improves antenatal care attendance (Kakaire *et al.* [31]). However, these findings contradict with a study by Moyer *et al.* [11] in Tanzania which highlighted socioeconomic factors as barriers to antenatal care attendance. These findings are also different from Shrestha *et al.* study in Nepal findings which demonstrated that health education programs have limited impact on improving antenatal care attendance.

Concerning number of antenatal visits made by the respondent, the study re-

sults showed the Study group attended more antenatal visits than the control group (4 or more: 85% vs. 64%, $p < 0.001$; OR = 3.55, 95% CI, 2.03 - 6.23) an indication of the effectiveness of the health education program. These findings agree with Lassi *et al.* [32]. Meta-analysis of 18 studies which demonstrated that health education programs increase number of antenatal visits. Munakampe *et al.* [28] randomized controlled trial in Kenya also showed that community-based health education improves number of antenatal visits. On the contrary Rahman *et al.* [16] study in India showed that health education programs have limited impact on improving number of antenatal visits. Another Systematic review of 20 studies highlighted a variability in effectiveness of health education programs in improving number of antenatal visits Kumar R., Mandava S [2].

Concerning where the respondent delivered from, the study findings showed that all study group participants delivered from government hospital/clinics compared to the control group who had 4% delivering from home (100% vs. 84%, $p = 0.02$; OR = 2.13, 95% CI, 1.23 - 3.69). The study group was more likely to deliver in a government hospital or clinic, indicating improved access to facility-based delivery care after targeted health education program. These findings are in agreement with a systematic review of 15 studies' results which showed that health education programs encourage facility delivery (Li *et al.* [18]). Another study by Zanbaba *et al.* [33] showed that most of the respondents who had good knowledge of maternal health services were found to have a statistically significant association with facility-based delivery utilization. Another Ethiopian study by Demissie, Worku, and Berhane [34] showed that having knowledge of obstetric complications, attending > 4 antenatal care visits showed significant association with health facility delivery.

The study findings also showed a corresponding higher skilled birth attendance. The Study group more was more likely to have a midwife conduct last delivery (88% vs. 79%, $p = 0.04$; OR = 1.93, 95% CI, 1.03 - 3.63). The study group was more likely to have a midwife conduct their last delivery, indicating improved access to skilled birth attendants. These findings are in agreement with Awoonor-Williams *et al.* [30] whose findings in a cluster randomized trial in Ghana demonstrated that community-based health education improves access to skilled birth attendants.

4.4. Health Education

The study findings showed that 41% (60) of the respondents from the study group received more than 5 - 6 health education sessions compared to 21% (30) of the control group and 45% (64) of the study participants received more than 6 sessions compared to 8% (11) of the controls. Most (57%) of the respondents from the control group received 3 - 4 sessions of health education (**Figure 9**). The findings of this study showed that the study group received more comprehensive health education, with a higher proportion receiving 5 - 6 or more sessions. On the other hand, the control group received fewer sessions, with most receiving

only 3 - 4 sessions. The findings also show that only 39% (53) of the controls received information on the four topics (birth plan, complication readiness, importance of hospital delivery and danger signs) compared to 91% (128) of the study participants (**Figure 10**). This means that the study group had better coverage of key topics, with 91% receiving information on all 4 topics, compared to 39% of the control group.

This data suggests a dose-response relationship between the number of health education sessions and the coverage of key topics in that the study group, which received more sessions, had better coverage of key topics (91% vs 39%). On the other hand, the control group received fewer sessions and had poorer coverage of key topics, indicating inequity in health education. These positive findings concerning the study group may be related to the effectiveness of the health education program as the study group's better outcomes suggest that the health education program was effective in providing comprehensive information. In addition to that, the study group's better coverage of key topics may lead to improved health outcomes, such as increased hospital deliveries, better complication readiness, and reduced maternal and neonatal mortality.

The above findings relate well with a study published by Albrech and Higgins [26] which found that women who received more antenatal care sessions had better knowledge and attitudes towards maternal health. Another research by Downe and Finlayson [35] revealed that comprehensive health education improved birth outcomes and reduced maternal and neonatal mortality. A study by Hsieh and Nichols [36] also found that standardized health education materials improved knowledge and empowerment among pregnant women. However, the findings of this study are contrary to Kruk and Leslie [37] study findings published in the Journal of Health Services Research (2020) which revealed that the number of antenatal care sessions did not significantly impact birth outcomes. Another study by Lassi and Bhutta [27] found that health education had limited impact on maternal and neonatal mortality in low-resource settings. Another study which contradicts the findings of this study is a study by Downe, S., & Finlayson, K [38] which found that health education programs may not be effective in reducing health disparities due to systemic barriers.

Nonetheless, basing on the above findings, it can be concluded that the comprehensive health education received by the study group may empower women to make informed decisions about their health and that of their newborns. The findings therefore highlight the need to address inequities in health education, particularly in resource-poor settings, to reduce health disparities. These findings also point to the fact that effective health education program can be scaled up and sustained to reach more women, potentially leading to improved health outcomes at the population level.

5. Conclusion

The findings of this study demonstrate the positive impact of comprehensive

health education on knowledge and utilization of maternal health services among antenatal mothers in Mpika District. The findings show significant improvements in knowledge of danger signs, birth planning, and complication readiness as well as increased utilization of antenatal and delivery services. Upon reviewing the study's results in comparison to other studies, it was noticed that our intervention showed significant improvements in knowledge and utilization of facility-based delivery services, whereas some other studies reported mixed or limited effects.

One possible reason for these differences could be the tailored approach to health education in our study, which took into account the specific needs and cultural context of the participants. For instance, our study used visual aids and simple language to facilitate understanding, which might have contributed to better outcomes. In contrast, studies with different outcomes might have used more generic or complex health education materials that didn't resonate as well with their participants. We acknowledge that the effectiveness of health education interventions can vary depending on factors like the target population, intervention design, and implementation.

Based on our study's results, we recommend that antenatal education programs prioritize culturally sensitive and tailored approaches to health education, using visual aids and simple language to facilitate understanding. Additionally, we suggest that healthcare providers assess participants' literacy levels and adapt their teaching methods accordingly. This could involve using more visual or interactive approaches to health education, such as videos, pictures, or group discussions.

The study underscores the importance of health education in enhancing maternal health outcomes and reducing maternal and neonatal mortality. The results inform policymakers, healthcare providers, and stakeholders to prioritize comprehensive health education as an integral component of antenatal care. The study has also shown that routine health education may not have much impact on knowledge and utilization of MCH and delivery services.

Key Recommendations

1) There is need to integrate comprehensive health education into antenatal care by Ministry of Health.

2) Health care providers should ensure provision of a minimum 4 scheduled health education sessions per participant.

3) There is need to prioritize danger sign recognition and birth planning education to all pregnant women.

4) Ministry of Health should strengthen healthcare provider training and support in MCH related issues.

5) While our study demonstrates the positive impact of comprehensive health education on knowledge and utilization of maternal health services among antenatal mothers, it is essential to acknowledge that the sustainability of these knowledge gains and behavior changes was not explored. Therefore, we recommend follow-up studies to assess the long-term impact of antenatal education on maternal

health outcomes.

6) Future research should investigate the duration of knowledge retention and behavior change maintenance after the intervention, as well as identify factors that influence sustainability. This will provide valuable insights into the effectiveness of antenatal education in promoting lasting improvements in maternal health outcomes and inform strategies for long-term implementation and evaluation.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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