

Impact of Educational Intervention on Knowledge Enhancement of CTG (Cardio Toco Graphy) among Nurses working in selected Hospitals at Uttar Pradesh

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KEYWORDS

Educational Intervention Program, CTG (Cardio Toco Graph), Nurse Midwives, Knowledge.

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Abstract

Background:

Each year, approximately 2.4 million Newborns passed away, with nearly one-third of them dying within the first 24 hours of birth as a result of complications related to childbirth, such as birth asphyxia or a lack of breathing. Additionally, there are about 2 million stillborn births reported annually, as per the World Health Organization's report from 2021, These deaths can largely be prevented through the implementation of well-known, evidence-based interventions (World Health Organization report, 2021). Improving Neonatal health, one of the unfinished agendas of the Millennium Development Goals, remains a high priority area in the era of the Sustainable Development Goals (Heidkamp et al, 2021).

Objectives:

This study aimed to Assess the Impact of Educational Intervention on Knowledge Enhancement of CTG (Cardio Toco Graphy) among Nurses working in selected Hospitals at Uttar Pradesh.

Methods:

A Quasi-experimental, Non-Randomized Control Group Research design was used in this study. The total number of samples were 200 staff nurses (100 study & 100 Control group). The samples were selected using non-probability purposive sampling. Data were collected using a structured knowledge questionnaire on CTG. Data were analysed using descriptive and inferential statistics including mean, standard deviation, paired t-test, and unpaired t-test at $p < 0.05$.

Results:

In this study, the study group pre-test showed 55% with poor knowledge, 38% moderate, and 7% adequate. Post-intervention, none had poor knowledge, with 76% moderate and 24% adequate. The mean score improved from 11.89 (SD=4.28) to 16.33 (SD=2.80), with a mean difference of 4.44 (paired $t=8.392$, $p<0.05$). In control group the pre-test showed 59% poor, 33% moderate, and 8% adequate, with no post-test change (mean=11.94, SD=4.31 pre-test; 11.94, SD=4.32 post-test; paired $t=1$, $p>0.05$). The experimental group's post-test mean (16.33) was significantly higher than the control group's (11.94) (unpaired $t=1.839$, $p<0.05$). These findings indicate a statistically significant improvement in knowledge following the Educational Interventional program.

Conclusion:

The study conclusively demonstrates that the Non-Invasive Fetal Monitoring Educational Interventional program significantly improved Nurses' knowledge on CTG, moreover nurses understood the critical & important tools for assessing fetal well-being.

1. INTRODUCTION

Fetal heart monitoring is, as its name implies, an important way to check a baby's heart rate during labour and delivery. It allows healthcare professionals to detect potential complications early and reduce the risk of injury to both the mother and the baby. Cardiotocography (CTG) is widely used as a non-invasive method to assess fetal well-being during pregnancy and labour [4, 9].

Prenatal non-stress test, popularly known as NST, is a method used to test fetal wellbeing before the onset of labour. A prenatal non-stress test functions as part of antepartum surveillance together with ultrasound as a component of the biophysical profile. The presence of fetal movements and fetal

heart rate acceleration is the most critical feature of the non-stress test. It is a non-invasive test used for the surveillance of high-risk pregnancies when the fetus is clinically judged to be at risk for hypoxemia or increased risk of death [14].

Cardiotocography (CTG) is a continuous recording of the fetal heart rate obtained through an ultrasound transducer placed on the mother's abdomen. CTG is widely used in pregnancy as a method of assessing fetal well-being, particularly in pregnancies with increased risk of complications [9].

Nurses and doctors responsible for interpreting CTG tracings during the intrapartum period must possess the necessary knowledge and skills to identify abnormalities that could endanger the fetus. Incorrect interpretation of CTG readings can

result in delayed preventive care measures and may jeopardize fetal wellbeing [5, 11].

Several studies have reported considerable variation in the interpretation of cardiotocography tracings among healthcare professionals. Interobserver and intra observer variability in CTG interpretation has been widely documented, emphasizing the need for structured education and training programs [12, 13, 15].

To improve the consistency and reliability of fetal monitoring interpretation, standardized guidelines for electronic fetal heart rate monitoring have been developed by international organizations and research groups [17].

Furthermore, advancements such as computerized analysis of fetal heart rate tracings have been explored to reduce subjectivity in interpretation and improve diagnostic accuracy [16].

Nurses and doctors are responsible for interpreting CTG tracings during the intrapartum period must possess the necessary knowledge and skills to identify any alterations that could endanger the fetus. Incorrect interpretation of CTG readings can result in delayed preventive care measures and jeopardize the well-being of the unborn child (Hébert, 2022).

Cardiotocography: (CTG) is a continuous recording of the fetal heart rate obtained via an ultrasound transducer placed on the mother's abdomen. CTG is widely used in pregnancy as a method of assessing fetal well-being, predominantly in pregnancies with increased risk of complications.

Aim of the Study:

The primary aim of this study aimed to assess the Impact of Educational Intervention on Knowledge Enhancement of CTG (Cardio Toco Graphy) among Nurses working in selected Hospitals at Uttar Pradesh.

Specific Objectives:

1. To assess the pre-test knowledge on **Educational Intervention on CTG** (Cardio Toco Graph) in both Study and control groups.
2. To Evaluate the Effectiveness of **Educational Intervention on CTG** (Cardio Toco Graph) in both Study and control groups.
3. To compare the post-test knowledge scores between Study and control groups.
4. To find out the Association between the CTG Cardiotocograph with their selected demographic variables (Age in Years, Educational Status, Area of Working, Nature of Organization, Years of Experience, Training Attended (CTG) & Marital Status).

Research Hypotheses: ($p < 0.05$ level of significance)

H₁: There is a statistically significant difference between the pre-test and post-test knowledge scores of CTG (Cardio Toco Graph) in the Study & Control group following the Educational Interventional Programme.

H₂: There will be a statistically significant difference in post-test knowledge scores between the experimental and control groups.

H₃: There will be a statistically significant association between selected demographic variables

(Age in Years, Educational Status, Area of Working, Nature of Organization, Years of Experience, Training Attended (CTG) & Marital Status) in the Study & Control group.

ASSUMPTIONS:

The study will be based on the following assumptions:

1. After Implementation of Educational Interventional Program on Cardiotocography (CTG), Nurses will have adequate knowledge.
2. Nurse Midwives can able to monitor the Fetal wellbeing effectively & can able to provide safe & Respectful maternal care to the mother.
3. Enhancement of first-hand knowledge through the training program may reduce the risk of complications during intra natal period & There will be good fetal wellbeing.
4. It is assumed that no external factors (such as prior exposure, additional training, or environmental distractions) will significantly influence the Nurses' knowledge levels during the study period

Conceptual framework of the study is- "Modified Helping Art in Clinical Nursing Theory" By Ernestine Wiedenbach (1964). The Skill Competency Programme serves as a structured

intervention to advance Nurse Midwives from novice to competent levels of clinical practice in CTG monitoring.

2. METHODOLOGY

Materials and Methods:

A Quasi-experimental, Non-Randomized Control Group Research design is used in this study to evaluate the effectiveness of Educational Intervention on Knowledge Enhancement of CTG (Cardio Toco Graph) among Nurse Midwives. The Researcher used two groups Study and control group. The Study group received the Teaching Intervention on CTG while the control group continued with routine clinical training.

Research Setting:

The study was conducted in three Hospital at Firozabad and Agra, U.P (F.S University cum Hospital, Firozabad Trauma Hospital & Abhay Asha Hospita). The Training program was given to the above-mentioned Hospitals.

Population and Sample:

The target population comprised Nurse Midwives consist of **200 Nurse**, 100 in the Study group and 100 in the control group selected by using **Non-Probability Purposive sampling** based on availability and willingness to participate.

SAMPLING CRITERIA-

Inclusion Criteria:

1. The Nurses Who are willing to Participate & who all are working in Maternal child Health areas in 3 Shifts.
2. The Nurses who are available during Data Collection

Exclusion Criteria:

- The Nurses who all are suffering with any physical illness during data collection period.
- The Nurses who all are on maternity or any other long leave.

Sample Size and Sampling Technique:

The sample size consisted of 200 staff Nurses. The samples were staff Nurses who are working in a OBS & Gynae Units (ANC, Labour Room, OPDs, Post Natal Ward, NICU & OT) in a selected hospitals at Firozabad & Agra.

Population:

The **Target population** for the study comprised all the Nurse Midwives working in the (F.S University cum Hospital, Firozabad

Trauma Hospital & Abhay Asha Hospita). These hospitals are located at Firozabad & Agra, U.P.

Sample Size Determination:

The total sample size was 200 Nurse Midwives were selected to ensure sufficient power for statistical analysis and generalizability of results. The sample size was estimated using the formula for comparing two means in quasi-experimental studies:

$$SS = \frac{z^2 \cdot p \cdot (1-p)}{C^2}$$

Where z = z value
(Example: For
95% confidence
level is 1.96)

- ✓ P= population proportion (assumed 50%= 0.5)
- ✓ M= margin of error (5% =0.05)
- ✓ S= (1.96)2 x 0.5 (1-0.5)/ (0.05)2
- ✓ S= 2.00x 0.25/0.0025

Sample =200

S.NO	TOOL	PURPOSE	DATA COLLECTION TECHNIQUE
1.	Section A- Part- 1 (Demographic characteristics)	To determine the socio-demographic data of the sample	Self-administered questionnaire
2.	Section-B Tool-1 (Self structured Knowledge Questionnaires on CTG)	To assess the level of Knowledge	Self-administered questionnaire

Ethical Considerations:

Prior to data collection, **Ethical clearance** was obtained from the **Institutional Ethics Committee of Swami Vivekanand Subharti University, Meerut**, ensuring compliance with institutional and national research ethics guidelines. Formal **permission** was also secured from the Chief Medical Superintendent/ Medical Officers hospital at Agra & Firozabad. All participants were informed about the purpose, objectives, and procedures of the study, and **written informed consent** was obtained before participation.

Confidentiality and anonymity of responses were strictly maintained throughout the research process. Participation was entirely voluntary, with the right to withdraw at any time without penalty. The study adhered to the ethical principles outlined in the Indian Council of Medical Research (ICMR) 2017 guidelines and the Declaration of Helsinki (2013), ensuring respect for human dignity, privacy, and the right to informed decision-making.

Data Collection Procedure:

The Sample concluded as = 200 study group 100 & control group 100.

The sampling procedure involved the following steps:

- Selecting all the Nurse Midwives from Different Hospitals.
- Screening done based on inclusion and exclusion criteria.
- Assignment of participants into two groups:
 - **Experimental Group (n = 100):** Received Educational Interventional Program on CTG (Cardio Toco Graph)
 - **Control Group (n = 100):** Received Routine clinical trainings.
- Matching of groups based on demographic variables such as (Age in Years, Educational Status, Area of Working, Nature of Organization, Years of Experience, Training Attended (CTG) & Marital Status) to minimize selection bias.

TOOLS AND METHODS OF DATA COLLECTION

- The study aimed to Evaluation of Received Educational Interventional Program on CTG (Cardio Toco Graph) among Midwives Working in Maternity units of Selected Health Centers at U.P.
- The tools used for this study were a (Self Structured Knowledge questionnaire).

Data collection tools and technique:

The data collection was carried out systematically in **five distinct phases** over a period of **5-6 months**, ensuring validity, reliability, and consistency in implementation after obtaining formal permission from the institutional ethical committee and consent from the participants. The investigator first established rapport with the Nurses and explained the purpose of the study. A **pre-test** was conducted for both the experimental and control groups using a validated Demographic Data & **structured knowledge questionnaire** to assess baseline Knowledge on CTG. Following the pre-test, the Educational Interventional Program on **CTG (Cardio Toco Graph)** was implemented exclusively for the experimental group through the Lecture & Discussion & with the Antenatal mother who is on Labour. The control group continued their routine Clinical teaching. After seven days, a **post-test** using the same tools was administered to both groups to evaluate improvement in knowledge. All responses were collected, coded, and subjected to statistical analysis using appropriate inferential and descriptive tests to determine the effectiveness of educational interventional program.

Phase I: Preparatory Phase (Month 1): To prepare all ethical, logistical, and methodological aspects prior to actual data collection.

Phase II: Pre-Test (Baseline Assessment-Month 2): Pre-test data were collected in small batches (5-10 Staff Nurses per session) to ensure adequate supervision for the duration of 2 to 3 days.

Phase III: Intervention (3-4 Month) -Educational Interventional Program on CTG was implemented among Study group only (Total 6 hours & every day 45 mts to 1 hour session was given). The staff Nurses were Educated by Lecture, Group Discussion, Demonstration showed with real mother & Previous CTG Results to enhance knowledge.

Day	Topic	Teaching-Learning Strategy
Day 1	Basics of CTG & different types of Guidelines used in CTG	Lecture-cum-discussion, PPT presentation
Day 2	Normal & Abnormal Results of CTG	Group Discussion
Day 3	Causes of Abnormal CTG (Maternal & Fetal)	Lecture-cum-discussion, PPT presentation
Day 4	Actions & Nursing Management during CTG (protection of Maternal Fetal Well Being	Group Discussion with Demonstration
Day 5	Evaluation and feedback	Post-test, peer discussion

Phase IV: Post-Test (Outcome Evaluation)-Month 4:

To assess the baseline knowledge of Nurses on Cardio Toco Graph after implementation of the Educational Interventional Program, the researcher done the post test. The demographic data sheet & structured knowledge questionnaire were administered to both the **experimental** and **control** groups in a (5-10 staff Nurses per session) after a week of intervention.

The Educational Interventional Program content was validated by 10 experts in nursing including NPM Trainers. The overall reliability coefficient (Cronbach's α) was 0.86 for the knowledge questionnaire. The total duration for data collection was 6 days for the completion of structured competency training among experimental group participants.

Phase V: Data Analysis and Interpretation (Month 6): To analyse collected data statistically and interpret findings.

Data analysis plan and statistical tests:

1. Data Organization and Preparation:

The data obtained from the Nurses were organized, coded, and analysed using the **Statistical Package for the Social Sciences (SPSS)**, version 26.0. Descriptive and inferential statistics were employed to summarize research findings and test hypotheses at a **0.05 level of significance**. All collected data were **coded manually** and entered into SPSS software.

2. Descriptive Statistics:

Descriptive analysis was used to describe **Demographic characteristics & knowledge** of the participants. Frequency and Percentage distribution was used to summarize sample characteristics and to classify knowledge levels among Nurses. Mean, Median, Standard Deviation, Range was used to describe central tendency and variability.

3. Inferential Statistics:

Inferential analysis was performed to test research hypotheses and determine the **effectiveness of the** Educational Interventional Program (EIP) on CTG. Paired t-test was used to assess improvement in knowledge after CTG and to determine effectiveness of Educational Interventional Program within the group. Unpaired t-test was used to assess effectiveness of Educational Interventional Program among the group (Study & Control). Chi-square (χ^2) test was used to determine Association of demographic factors. All statistical tests were two-tailed, and results were interpreted as follows: $p < 0.05$ (Statistically significant).

5. RESULTS

Section 1: Demographic characteristics of Midwives

Table 1: Frequency & Percentage distribution of demographic characteristics of Nurses in Study & Control Group (N=200).

Variables	Category	Experimental Group		Control Group	
		<i>f</i>	(%)	<i>f</i>	(%)
1. Age in Years	21-30	38	(38.0)	34	(34.0)
	31-40	35	(35.0)	32	(32.0)
	41-50	16	(16.0)	18	(18.0)
	> 50	11	(11.0)	16	(16.0)
2. Educational Status	GNM	40	(40.0)	36	(36.0)
	B.Sc. Nursing	29	(29.0)	33	(33.0)

	PB.B.Sc. Nursing	22	(22.0)	17	(17.0)
	M.Sc. Nursing	9	(9.0)	14	(14.0)
3. Area of Working	Labour Room	21	(21.0)	25	(25.0)
	Antenatal Ward	18	(18.0)	18	(18.0)
	ANC (OPD)	21	(21.0)	15	(15.0)
	Post Natal Ward	10	(10.0)	16	(16.0)
	Operating Room	17	(17.0)	17	(17.0)
	Family Planning Clinic	13	(13.0)	9	(9.0)
4 Years of Experience	0-5 years	33	(33.0)	25	(25.0)
	6-10 years	24	(24.0)	27	(27.0)
	11-15 years	15	(15.0)	23	(23.0)
	15-20 years	16	(16%)	13	(13%)
	> 20 years	12	(12%)	12	(12%)
5 Training Attended (ANC Assessment)	Yes	55	(55%)	66	(66%)
	No	45	(45%)	34	(34%)
6 Marital Status	Single	29	(29%)	26	(26%)
	Married	61	(61%)	65	(65%)
	Widow	6	(6%)	7	(7%)
	Divorced	4	(4%)	2	(2%)

Table 1: Explains describes that Most participants in both groups are between 21-30 years (38% experimental, 34% control) & the next major age group is 31-40 years, followed by 41-50 years, while participants aged above 50 years form the smallest proportion. This indicates both groups are fairly comparable in age distribution, with a slightly higher proportion of older participants in the control group.

Educational Status: In both groups, the highest proportion belongs to GNM qualification (40% experimental, 36% control). B.Sc. Nursing and PB.B.Sc. Nursing categories follow.

The M.Sc. Nursing category has the lowest representation but is higher in the control group (14%) than in the experimental group (9%). Education level distribution is similar across both groups.

Area of Working: Participants are distributed across various working units. In the experimental group, the highest proportion is from the Labour Room (21%) and ANC(OPD) (21%). In the control group, the Labour Room (25%) has the highest representation, followed by the Postnatal Ward (16%). Both groups have participants from all work areas, showing wide departmental representation.

Years of Experience: The largest experience group in both categories is 0-5 years (33% experimental, 25% control). Participants with 6-10 years and 11-15 years follow.

A moderate proportion falls under 15-20 years, while the smallest group is more than 20 years in both groups. Overall, both groups include participants with a wide range of experience.

Figure 1: Bar Diagram showing frequency distribution of Educational Status among Midwives.

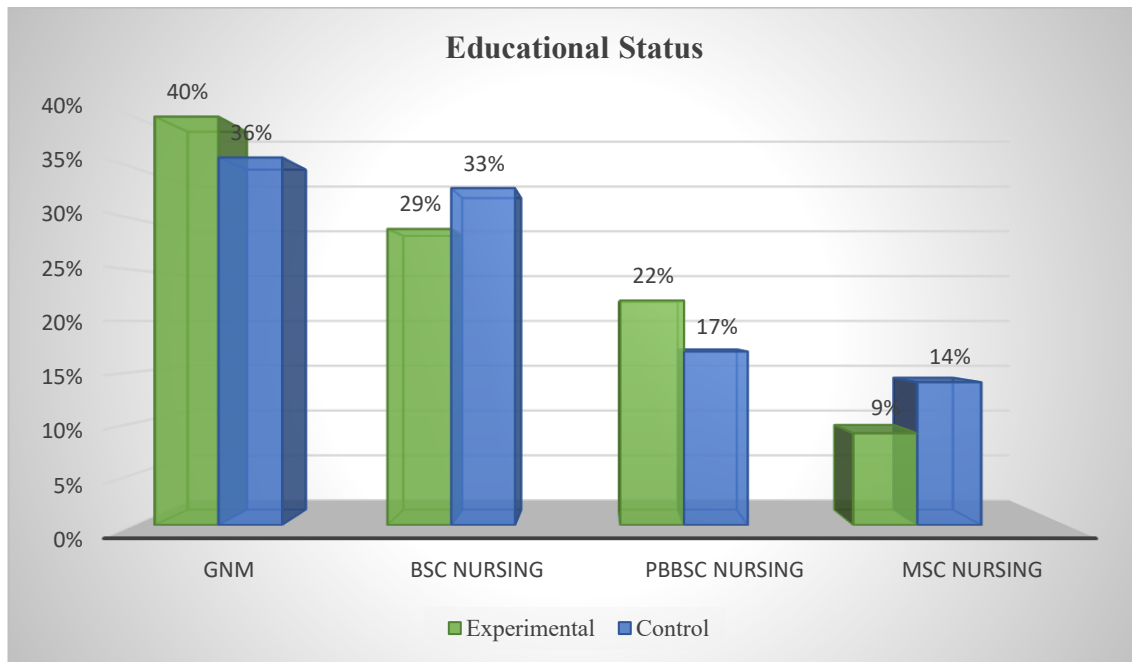


Figure 2: Bar Diagram Shows the Frequency Distribution of area of working among Midwives.

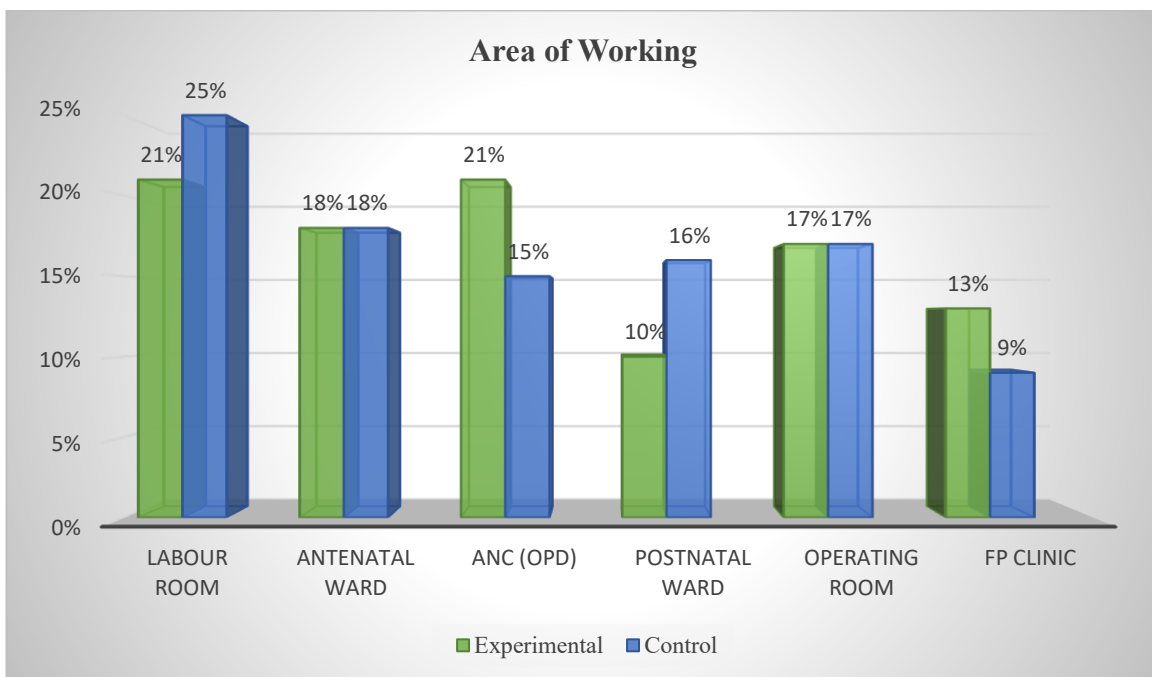


Figure 3: Bar Diagram showing frequency distribution of Training attended among Midwives

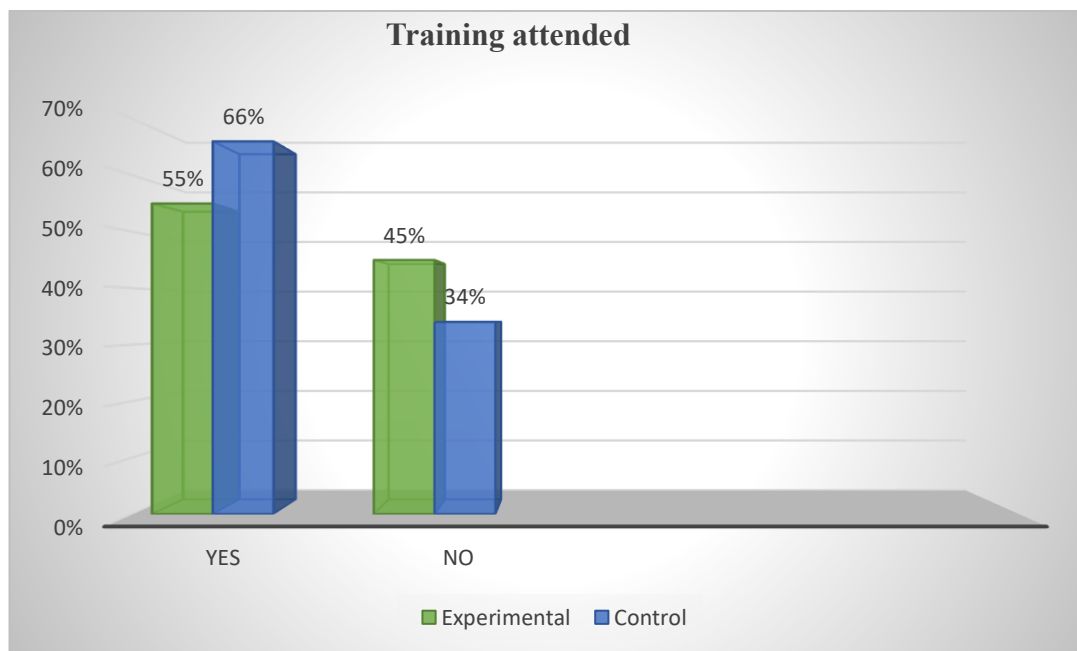


Table 2: Pre-test and Post-test Frequency & Percentage Distribution of knowledge score among Midwives in Study & Control Group (N=200)

Level of Knowledge	Experimental group				Control Group			
	Pre-Test		Post-Test		Pre-Test		Post-Test	
	f	%	f	%	f	%	f	%
Poor Knowledge	55	55.0	0	0.0	59	59.0	59	59.0
Moderate Knowledge	38	38.0	76	76.0	33	33.0	33	33.0
Adequate Knowledge	7	7.0	24	24.0	8	8.0	8	8.0

In the pre-test, In **Experimental group** a majority of midwives (55; 55.0%) were found to have poor knowledge regarding CTG. About 38 (38.0%) of them had moderate knowledge, while only 7 (7.0%) had an adequate knowledge. In Post test Majority of the Midwives 76 (76%) had a Moderate Knowledge & 24 were had (24%) adequate Knowledge This indicates that before the intervention, most

participants lacked sufficient knowledge, and only a small proportion showed an adequate Knowledge after intervention majority of them had Moderate Knowledge.

In the pre-test, In **Control Group** the majority of midwives, 59 (59.0%), demonstrated poor knowledge. Only 33 (33.0%), had

moderate knowledge & 8 (8.0%) had adequate knowledge. In posttest there was no changes in the knowledge score of control group.

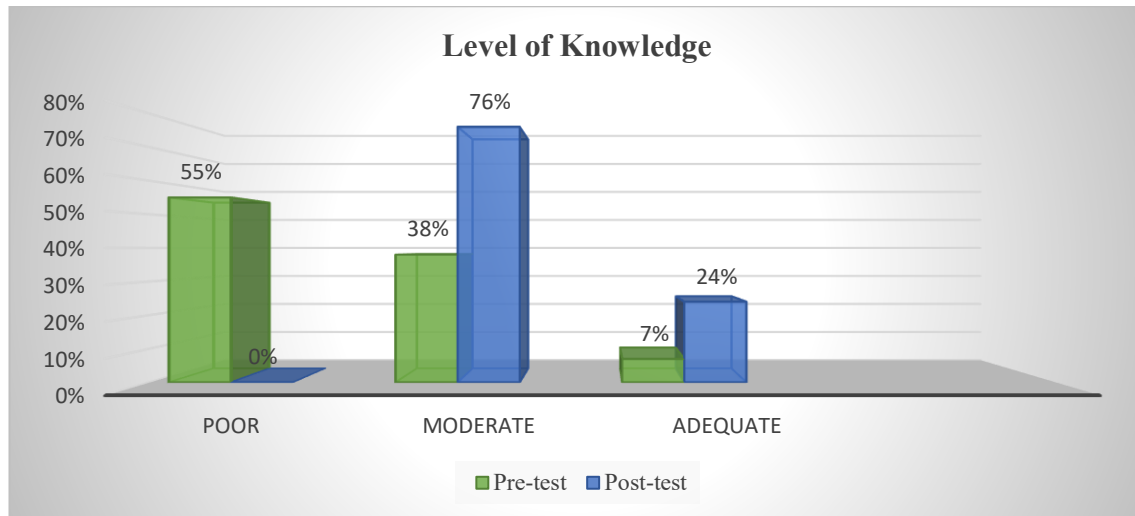


Figure 4: Shows the Pre-test and Post-test Frequency & Percentage Distribution of knowledge score among Midwives in Study & Control Group (N=200)

Table 3: Comparison of Pre-test Knowledge score of Educational Interventional program in Study & Control group (N=200)

Knowledge Score	Study Group				Control Group			
	Mean	S. D	Mean Difference	Paired T test	Mean	S. D	Mean Difference	Paired T test
Pre-test	11.89	4.28	4.44	8.392*	11.94	4.31	0.0	1**
Post-test	16.33	2.80			11.94	4.32		

at 0.05 level of significance ($P < 0.05$), *-significant, **-Not-significant

The findings show a clear difference between the two groups. In the study group, the average pre-test mean score was 11.89, Standard Deviation is 4.28 Mean Difference is which increased to 16.33, Mean score is 2.80 & it's Mean Difference is 4.44 after the skill competency program. This improvement, supported by a significant paired t-value of 8.392, indicates that the training had a strong positive effect on knowledge.

In contrast, the control group showed no change at all. Their mean pre-test and post-test scores remained at 11.94, Standard Deviation was 4.31, Mean Difference was 0.0 with a non-significant paired t-value. This lack of improvement suggests that the increase seen in the experimental group was due to the intervention. Overall, the results confirm that the Educational Interventional program was effective in improving the participants' knowledge. Hence accepted alternate hypothesis H_2 and rejected null hypothesis H_{02} .

Table 4: Comparison of Post Test Knowledge score of Educational Intervention program in experimental and Control group (N=200)

knowledge	Mean	S. D	Mean Difference	Unpaired T test
Experimental	16.33	2.80	13.53	1.839 *
Control	11.94	4.32	7.62	

at 0.05 level of significance ($P < 0.05$), *-significant, **-Not-significant

The mean post-test knowledge score of midwives in the experimental group was 16.33 with a standard deviation of 2.80, Mean Difference is 13.53. Whereas in the control group it was 11.94

with a standard deviation of 4.32 & the Mean Difference is 7.62. and a p-value is 1.839 at 0.05 level of significance ($P < 0.05$) indicate that this difference is highly significant. Therefore, Consequently, the null hypothesis is again rejected, indicating that the educational intervention significantly improved the participants' skill performance compared to the control group.

Table 5: Association of knowledge scores with selected demographic variables in Study group (n=100)

Variables	Category	Level of Knowledge			x ² Value	df	P-value
		Adequate	Moderate	Poor			
1. Age in Years	21-30	2	9	23	7.543	6	.274**
	31-40	4	14	14			
	41-50	0	7	11			
	> 50	2	3	11			
2. Age in Years	GNM	1	14	21	5.488	6	.483**
	B.Sc. Nursing	4	7	22			
	Post Basic B.Sc. Nursing	1	7	9			
	M.Sc. Nursing	2	5	7			
3. Area of Working	Labour Room	1	8	16	7.991	10	.630**
	Antenatal Ward	1	8	9			
	ANC (OPD)	1	5	9			
	Post Natal Ward	2	5	9			
	Operating Room	3	6	8			
	Family Planning Clinic	0	1	8			
4. Years of Experience	0-5 years	1	9	15	7.174	8	.518**
	6-10 years	2	10	15			
	11-15 years	2	6	15			
	15-20 years	0	5	8			
	> 20 years	3	3	6			
5. Training Attended (Antenatal Examination)	Yes	4	21	41	1.315	2	.518**
	No	4	12	18			
6. Marital Status	Single	1	10	15	6.6563	6	.363**
	Married	7	19	39			
	Widow	0	2	5			
	Divorced	0	2	0			

at 0.05 level of significance (P<0.05), *-significant, **-Not-significant

The association between demographic variables and the level of knowledge was examined using the chi square test.

There is no Significant association with the Educational Interventional Program on CTG with their selected demographic Variables like (Age in Years, Area of Working, Years of Experience, Training Attended on CTG & Marital Status) all showed p-values greater than 0.05 at (P<0.05) level of significance.

This indicates that, within the Study group, The demographic characteristics such as age, education, work area, work experience, training status, and marital status did not influence the level of knowledge. Therefore, no significant association was observed between demographic variables and knowledge scores in the study group. **Hence the Researcher rejected the Alternate Hypothesis & accepted the Null Hypothesis.**

Table 6: Association of knowledge scores with selected demographic variables in Control group (n=100)

Variables	Category	Level of Knowledge			x ² Value	df	p-value
		Adequate	Moderate	Poor			
1. Age in Years	21-30	23	9	2	7.543	6	.274**
	31-40	14	14	4			
	41-50	11	7	0			
	> 50	11	3	2			
2 Educational Status	GNM	21	14	1	5.488	6	.483**
	B.Sc. Nursing	22	7	4			
	Post Basic B.Sc. Nursing	9	7	1			
	M.Sc. Nursing	7	5	2			
3 Area of Working	Labour Room	16	8	1	7.991	10	.630**
	Antenatal Ward	9	8	1			
	ANC (OPD)	9	5	1			
	Post Natal Ward	9	5	2			
	Operating Room	8	6	3			
	Family Planning Clinic	8	1	0			
4 Years of Experience	0-5 years	15	9	1	7.174	8	.518**
	6-10 years	15	10	2			
	11-15 years	15	6	2			
	15-20 years	8	5	0			
	> 20 years	6	3	3			
5 Training Attended Antenatal Examination	Yes	41	21	4	1.315	2	.518**
	No	18	12	4			
6 Marital Status	Single	15	10	1	6.563	6	.363**
	Married	39	19	7			
	Widow	5	2	0			
	Divorced	0	2	0			

at 0.05 level of significance ($P < 0.05$), *-significant, **-Not-significant

The association between knowledge scores and selected demographic variables in the control group was analyzed using the Chi-square test.

The results showed that none of the demographic variables had a statistically significant association with the level of knowledge (Age in Years, Area of Working, Years of Experience, Training Attended on CTG & Marital Status) all showed p-values greater than 0.05 at ($P < 0.05$) level of significance. This indicates that, within the control group, demographic characteristics such as age, education, work area, work experience, training status, and marital status did not influence the level of knowledge. Therefore, no significant association was observed between demographic variables and knowledge scores in the control

group. Hence the Researcher rejected the Alternate Hypothesis & accepted the Null Hypothesis.

Summary:

The present study was conducted to assess the effectiveness of Educational Interventional Program on CTG & there is increased Knowledge of participants in the Study group compared to those in the control group. A **quasi-experimental** Non-Randomized Control Group Research design was adopted for this study.

Data were collected over a **six-month period**, during which both groups were assessed using validated instrument- a **knowledge questionnaire**. The experimental group received the Educational Interventional program, while the control group was exposed only to routine Clinical learning.

Descriptive and inferential statistics, including **mean, standard deviation, Paired & unpaired t-tests**, were used to analyse the data. The significance of results was determined at $p < 0.05$.

Major Findings:

- Most participants in both groups are between 21-30 years (38%) experimental, 34% control). Educational Status: In both groups, the highest proportion belongs to GNM qualification (40% experimental, 36% control). Area of Working In the experimental group, the highest proportion is from the Labour Room (21%) In the control group, the Labour Room (25%) has the highest representation.
- Years of Experience: The largest experience group in both categories is 0-5 years (33% experimental, 25% control). Training Attended (CTG) in both Groups Majority of the had a basic training during Their Educational Period, in both group majority of them are Married.
- In the pre-test, **In Experimental group** a majority of midwives (55; 55.0%) were found to have poor knowledge regarding CTG. About 38 (38.0%) In Post test Majority of the Midwives 76 (76%) had a Moderate Knowledge.
- In the pre-test, **In Control Group** the majority of midwives, 59 (59.0%), showed the poor knowledge. In posttest there was no changes in the knowledge score of control group.
- The experimental group's **knowledge mean score** increased substantially after the intervention, with a **mean difference 16.33 (SD=2.80)** between groups.
- The obtained **t-value 1.839** at $p < 0.001$ indicates a **highly significant improvement** in the knowledge level due to the educational Interventional program.
- There was no any change s in the control group on Knowledge score.

Discussion of Findings:

The present study evaluated the effectiveness of an Educational Interventional Program on cardiotocography knowledge among nurse midwives working in maternity units of selected hospitals in Uttar Pradesh.

Previous studies have reported significant variation in CTG interpretation among midwives and obstetricians, highlighting the importance of structured training to improve clinical decision-making and patient safety [5, 12, 18].

Research has also demonstrated that interobserver and interobserver variation may influence the assessment of fetal heart rate tracings during labour [15]. These findings support the need for continuous professional training programs in CTG interpretation.

Technological advancements, including computerized assessment of CTG tracings, have been introduced to minimize subjective interpretation and enhance accuracy in fetal monitoring [16].

The results of the present study demonstrated a significant improvement in knowledge scores among the experimental group following the educational intervention. These findings are consistent with previous research which emphasized the importance of competency-based training in improving CTG interpretation skills among midwives and nurses [9, 14].

Therefore, implementing structured educational programs for nurses working in maternity units can significantly enhance their knowledge and competency in fetal monitoring, thereby contributing to improved maternal and neonatal outcomes.

This chapter presents an integrated discussion of the study's findings in relation to the research objectives, theoretical

framework, and existing literature. The study aimed to evaluate the effectiveness of Educational Interventional program Cardiotocography (CTG) among Nurses working in maternity units of selected health centers in Uttar Pradesh. A quasi-experimental non-randomized control group design was adopted, including 200 midwives (100 experimental and 100 control) from Hospitals in Firozabad and Agra.

The program was developed, validated, and implemented to strengthen Nurses' knowledge on CTG. These competencies are essential for assessing fetal well-being during pregnancy and labor, especially in high-risk conditions where accurate interpretation can prevent fetal hypoxia, birth asphyxia, and perinatal mortality. As presented in Chapter I, the WHO (2021) reports around 2.4 million neonatal deaths annually, with India contributing roughly 28 percent of global newborn deaths. Improving fetal monitoring skills among midwives, who spend the most time with labouring women, is therefore critical to improving perinatal outcomes.

6. DISCUSSION

The study conclusively shows that the Educational interventional program on CTG has significantly improved midwives' knowledge, critical tools for assessing fetal well-being. The experimental group's marked improvements (knowledge: mean difference=4.44, $p < 0.05$; practice: mean difference=4.46, $p < 0.05$) compared to the control group's unchanged scores confirm the program's efficacy. The strong correlation between knowledge and practice ($r=0.927$, $p < 0.00001$) underscores the program's integrated approach, ensuring theoretical understanding translates into clinical competence.

There is no any association between the CTG Cardiotocograph with their selected demographic variables (Age in Years, Educational Status, Area of Working, Years of Experience, Training Attended (CTG) & Marital Status). These findings align with prior studies (e.g., Walla H. Ibrahim & Amal F. Arief, 2019; Mumtaj Begum, 2019), reinforcing the value of structured training in reducing perinatal risks. The program supports global health priorities, such as the Sustainable Development Goals (SDGs), by addressing neonatal mortality in resource-limited settings like Uttar Pradesh.

Implications

The study's findings have significant implications across nursing practice, education, administration, and research, particularly in the context of maternal and neonatal health:

- ❖ **Nursing Practice:** The program equips midwives with enhanced skills to accurately interpret CTG, reducing errors that could lead to adverse outcomes like fetal hypoxia or perinatal death (Kelly et al., 2021). It promotes safe, respectful maternal care, aligning with WHO (2021) recommendations for evidence-based interventions to improve neonatal outcomes.
- ❖ **Nursing Education:** The validated program and tools can be integrated into nursing curricula and in-service training, ensuring midwives are competent in non-invasive fetal monitoring. This is critical in India, where training programs are less prevalent compared to global standards.
- ❖ **Nursing Administration:** Health facilities, particularly in rural areas, should adopt regular CTG training to enhance staff competency, reduce litigation risks (Maternity Guidelines Group, 2015), and improve maternal-fetal outcomes. Administrators can use the program's framework to standardize training protocols across PHCs, CHCs, and hospitals.

- ❖ **Nursing Research:** The study provides a model for evaluating skill-based interventions, encouraging further research into scalable training programs for other obstetric skills (e.g., Doppler ultrasound, fetal kick counts). It also highlights the need to explore long-term impacts on perinatal mortality rates.

Recommendations

1. **Nursing Practice:** Implement regular, mandatory CTG training programs in maternity units, particularly in high-risk settings, to maintain competency and reduce perinatal complications. Continuous clinical supervision should accompany training to reinforce skills.
2. **Nursing Education:** Incorporate non-invasive fetal monitoring modules into pre-service and in-service nursing curricula, emphasizing hands-on practice and simulation-based learning to bridge theory-practice gaps.
3. **Nursing Administration:** Allocate resources for ongoing training programs and establish quality assurance mechanisms to monitor CTG competency among midwives. Policymakers should prioritize funding for such interventions in rural healthcare settings.
4. **Nursing Research:** Conduct longitudinal studies to assess the long-term impact of the training program on midwives' skills and perinatal outcomes. Future research should explore additional non-invasive techniques (e.g., Doppler ultrasound) and include randomized controlled trials to enhance generalizability.
5. **Scaling Up:** Expand the program to other regions in India and similar low-resource settings, adapting it to local needs and evaluating its impact on national perinatal mortality rates.
6. **Interdisciplinary Collaboration:** Engage obstetricians, neonatologists, and midwives in designing and delivering training to ensure comprehensive coverage and alignment with clinical standards.
7. **Technology Integration:** Explore mobile CTG devices and remote analysis (Renata Pilarczyk et al., 2022) to enhance accessibility in rural areas, integrating these into future training programs.

Limitations

The study has several limitations that should be considered when interpreting the findings:

- **Study Duration:** The six-month study period may not capture long-term retention of knowledge and skills, as sustained competency requires ongoing practice and reinforcement.
- **Scope of Monitoring Techniques:** The program focused exclusively on CTG, excluding other non-invasive methods like fetal kick counts or Doppler ultrasound, which could provide a more comprehensive assessment of fetal well-being.
- **Non-Randomized Design:** The use of a non-randomized control group may introduce selection bias, although baseline demographic homogeneity mitigates this concern to some extent.
- **Exclusion Criteria:** Nurses on maternity leave or with physical illnesses were excluded, potentially omitting perspectives from a subset of the workforce that could influence program outcomes.
- **Short-Term Evaluation:** The post-test was conducted seven days after the intervention, limiting insights into the durability of knowledge and practice improvements over time.

Declarations:

Conflict of Interest:

The authors declare that there is **no conflict of interest** regarding the conduct, analysis, authorship, or publication of this research study. No financial, professional, or personal relationships influenced the outcomes or interpretations presented herein. This study was carried out purely for **academic and research purposes**, following the ethical standards of the institution.

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Ethical Approval:

Ethical clearance for conducting this study was obtained from the Institutional Ethics Committee (IEC) of Swami Vivekanand Subharti University, Meerut, UP. All participants were informed about the objectives of the study, and informed consent was obtained prior to data collection. Confidentiality and anonymity were maintained throughout the research process, in accordance with the Declaration of Helsinki (2013) ethical principles for research involving human subjects.

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Author Contribution:

Infant Rani Augustin: Conceptualization, methodology design, data collection, statistical analysis, and manuscript preparation.

Geeta Parwanda & Prof. Dr. Smriti Gupta: provided academic supervision, critical feedback, and editorial revisions throughout the research process.

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9. REFERENCES

- World Health Organization. Newborns: improving survival and well-being. Geneva: WHO; 2021.
- Heidkamp RA, Piwoz E, Gillespie S, Keats EC, D'Alimonte MR, Menon P, et al. Health and nutrition interventions for women, children, and adolescents in conflict settings. *Lancet*. 2021;397(10273):531-42.
- Rigby E. An essay on uterine haemorrhage. London: J Johnson; 1775.
- National Institute for Health and Care Excellence (NICE). Intrapartum care for healthy women and babies. NICE Guideline CG190. London: NICE; 2017.
- Hébert N. Cardiotocography interpretation and clinical implications in intrapartum fetal monitoring. *J Obstet Care*. 2022;18(3):122-8.
- Kelly A, Smith J, Brown R, et al. Improving fetal surveillance competency among maternity nurses through structured CTG education. *Midwifery*. 2021; 98:102995.
- Indian Council of Medical Research. National ethical guidelines for biomedical and health research involving human participants. New Delhi: ICMR; 2017.

- World Medical Association. Declaration of Helsinki: ethical principles for medical research involving human subjects. *JAMA*. 2013;310(20):2191-4.
- Amer-Wählin I, Yli B, Arulkumaran S. Foetal ECG and STAN technology: a review. *European Clinical Obstetrics Gynaecology*. 2005; 1:61-73.
- Premila S, Arulkumaran S. Intrapartum fetal surveillance. *Obstet Gynaecology Reproduction Med*. 2007; 18:12-7.
- Begum M. Effectiveness of CTG training programme among nurse midwives in maternity units. *Int J Nurs Educ*. 2019;11(2):45-50.
- Ibrahim WH, Arief AF. Impact of educational guidelines on nurses' competency regarding fetal monitoring. *J Nurs Health Sci*. 2019;8(4):66-72.
- Maternity Guidelines Group. Guidelines for electronic fetal monitoring and litigation prevention. London: MGG; 2015.
- Pilarczyk R, Kowalska J, et al. Remote cardiotocography monitoring and digital maternal care technologies in rural settings. *BMC Pregnancy Childbirth*. 2022;22:814.
- Ayres-de-Campos D, Spong CY, Chandrachan E, et al. FIGO consensus guidelines on intrapartum fetal monitoring: Cardiotocography. *Int J Gynecology Obstet*. 2015;131(1):13-24.
- International Federation of Gynecology and Obstetrics. FIGO guidelines for fetal heart rate monitoring. London: FIGO; 2015.
- American College of Obstetricians and Gynecologists. Practice bulletin: intrapartum fetal heart rate monitoring. Washington DC: ACOG; 2020.
- Royal College of Obstetricians and Gynaecologists. The use of electronic fetal monitoring. London: RCOG; 2019.

Web Reference:

1. <https://studylib.net/>
2. <https://www.ncbi.nlm.nih.gov/>
3. <https://www.ncbi.nlm.nih.gov/>
4. www.pubmedcentral.nih.gov