Effect of Educational Sessions about Cardiotocography on Nurses Knowledge and Skills at Labor and High Risk Units

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Abstract: This study **aimed** to evaluate the effect of educational sessions about Cardiotocography on nurses knowledge and skills at labor and high risk units.
Design: A quasi experimental Pre&Post design.
Sample type: A purposive sampling was used.
Setting: The study was conducted at labor and high risk unit in Mansoura University Hospital from the beginning of March 2017 up to the end of September 2017.
Tools: Tool I: Structured Interviewing Questionnaire which includes Socio-demographic characteristics of nurses and questions about nurses' knowledge about Cardiotocography. Tool (II) An Observational checklist of Cardiotocography.
Results: The present study results showed that there was statistical significant improvement were found among pretest, immediate Posttest and after 3months Posttest related to knowledge and skills of nurses regarding Cardiotocograph P= (0.001). Also, there were highly significant positive correlations were found between level of knowledge and skills of nurses regarding Cardotocograph in the immediate posttest. Else, a highly positive significant correlation was found between level of knowledge and skills of nurses after 3months postest P= (0.01) while there was no significant relations were found between levels of knowledge regarding Cardotocograph in the immediate posttest and the general characteristics of the studied sample.
Conclusion: The study results concluded that implementing an educational session about Cardiotocograph significantly improved nurses' knowledge and skills at labor and high risk units in Mansoura University Hospitals.
Recommendations: A comparative study can be conducted between nurses in maternity units of different hospitals to assess the effectiveness of Cardiotocography training session.
Keywords: Cardiotocography, Educational Sessions, Knowledge, Skills, labour unit, High Risk Unit.

I. Introduction

Pregnancy is a wonderful natural experience that is part of every woman's life cycle. The health of the mother and her fetus is closely linked, so the midwife plays an important role in maintaining this goal throughout the pregnancy until the moment of birth. The goal of perinatal nurse is to facilitate the maximum physical and emotional well-being of the mother and her fetus (**Sowmya et al., 2013).**

Recurrent fetal heart monitoring during pregnancy and labor gives an impression of fetal well-being, thus promoting the health status of newborns after birth. There are different techniques used to assess fetal well-being, ranging from simple maternal evaluation of fetal movement to more complex diagnostic tests guided by ultrasound. One of the advanced technology is Cardiotocography(**Sowmya et al., 2013).**

Cardiotocography (CTG) is an external fetal monitoring system that records the fetal heart rate (cardio) through a transducer fixed on the mother's abdomen and the uterine contractions (toco) through a transducer placed at the fundus. The main objective of recording fetal heart rate by CTG is to detect any changes might occur that put the fetus at risk of death or fetal distress due to lack oxygen, in addition to prevent intrapartum fetal death and reduce long-term neurological disorders and neonatal seizures *(**American College of Obstetricians and Gynecologists, 2009).**

Furthermore, fetal heart rate monitoring is recommended for women such as 41 to 41 + 6 weeks gestation, gestational hypertension, gestational diabetes, obesity, and maternal age more than or equal to 40 and less than 42 years, maternal pyrexia and pre-dermal anesthesia. Assessment of fetal well-being can be done

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through intermittent auscultation, which is used for women at the onset of labour and having a low risk of developing fetal compromise. Also, continuous monitoring as external CTG which is recommended for women having risk factors or fetal compromise that are identified antenatally & detected at the onset of labour *(Rosy &Princy 2015).*

According to **WHO (2013),** the main cause of perinatal deaths is the lack of monitoring and care by skilled health professionals as 99 percent of perinatal deaths occur in developing countries.

The Maternal Health Service plays a vital role in reducing perinatal mortality. Nurses are those professionals who spend a lot of time with the mother during labor, so nurses need to be expert enough to perform and interpret the proper and timely tracings to promote measures to reduce fetal death *(Sowmya et al., 2013)*.

From previous studies *Pehrson et al.,(2011),* showed that the fetal heart rate training program improves the level of knowledge, interpretive skills and effective management of intrapartum CTG. Although electrocardiogram training programs have been implemented all over the world and especially abroad as a continuing education program, they have not been significantly enhanced in enabling the nurse to be sufficiently adequate in the interpretation of cardiotography.

II. Significance of the Study
Most fetal deaths (80%) exist in the prenatal period as a result of different reasons as chronic fetal hypoxia, intrauterine growth retardation, congenital malformation of the fetus and complications of the mother as diabetes, arterial hypertension and infection**.** Also, when CTG is performed without sufficient knowledge and proper training, it can lead to increase the rate of caesarean section and intrapartum asphyxia **(Sajida et al., 2015).**
Most clinical agencies require nursing services to attend continuing education courses or provide evidence of proficiency in the use of CTG *(Rosy &Princy 2015).* Also from previous studies as **Parhizkar (2012**) recommended the need for an effective training program to improve the interpretive skill of midwifery nurses which would ultimately benefit mothers and babies. Else, **Sowmya et al., (2013)** recommended to conduct a similar study as a follow-up after 3 months. In addition, most of researches concentrates on improving knowledge and ignore skills. Also, researcher, clinical setting, there were lack of teaching programs and trainings given to maternity nurses regarding Cardiotocography and almost all maternity nurses were poor at interpreting Cardiotocography tracings. They usually seek the help of the doctors to interpret the findings in emergency.

So the researchers decide to conduct this study to improve knowledge and skills also make follow up immediately and 3 months later.
Aim of the study:
The current study aimed to evaluate the effect of educational sessions about Cardiotocography on nurses knowledge and skills at labor and high risk units.

Research hypothesis:
It was expected that maternity nurses who received educational sessions about Cardiotocography exhibit an improvement in knowledge and skills in the post test than on the pretest.
Operational definitions:

Cardiotocography: Refers to recording(graphy) the fetal heartbeat(cardio) and the uterine contraction (toco) during the third trimester of pregnancy and during labour.

Knowledge: An information regarding Cardiotocography that nurses can get by experience or acquire through education session.

Skills: A type of behavior that involves a lot of attention to detail or to small issues that aren't important regarding electronic fetal monitoring .

Sujects& Method
Study Design: A quasi-experimental pre post test design was utilized to achieve the aim of this study

Study Setting: The study was carried out at labor and high risk unit in Mansoura University Hospital.

Study Subjects: Forty maternity nurses regardless their age, the level of education were chosen by a purposive sampling according to the following criteria:
- Nurses responsible for providing nursing care to women, at high risk and labour unit.
- Six months of experience and more.:
- The nurses who havent't had an administrative role only as the head nurses.
- The nurses who haven't had any training regard Cardiotocography.

Tools of Data collection
Tool I: A Structured Interviewing Questionnaire Schedule: It consisted of two parts:

Part 1: This part covers the data related to Socio-demographic characteristics of nurses as age, experience year, level of education, work department.

Part II: It includes questions on nurses' knowledge about CTG. It included 24 major questions divided into 74 sub questions regarding definition, indications, advantages, disadvantages, types, nursing responsibilities, interpretations of CTG results & nursing roles in case of late fetal heart rate deceleration.This part was delivered to the participating nurses three times; before intervention, immediate after the intervention, three months after the intervention.

Scoring system:
Each question had given three options (Yes, No, I don't know), scores range from 0-2. Score two was given for the correct answer, score 1 was given for the wrong answer while the zero score was given for I don't know. The total knowledge scores = 140, it was classified as the following, Scores (117- 124) = Poor, Scores (125-131) = Average Scores (132- 148) = Good

Tool II: An Observational Checklist of Cardiotocography:
It was obtained from maternity and gynecologic nursing clinical checklist; it adopted from Egypt health workforce project, 2006. It was used to assess nurse's performance regarding Cardiotocography procedure. It consisted of three domains and 18 items. (it was used to observe the participating nurses three times; before the intervention, immediate after the intervention, three months after the intervention).
Scoring system:
Each item was scored (1) if performed and scored (0) if not performed. The total score was remanded from 0 to 18; higher score indicates higher performance.
The content validity of the Tool:
These tools were reviewed by five panels of experts in maternal nursing field to test the content validity. According to expert suggestions and comments modification was considered.
Reliability:
The reliability analysis was used to verify the relevance of the questionnaire elements to each other. Cronbach's alpha was used,it has been shown that Cronbach's alpha is 0.75 for the first tool and 0.86 for the second tool.

Ethical Considerations:
        Approval from the head of woman health and midwifery department, then approval from an ethics research committee of the faculty of the nursing Mansoura university, else, a letter of approval from the director of Mansoura University Hospital (MUH) was taken to implement this study. Informed consent was obtained from each nurse before intervention. They have been informed of their rights to refuse to participate or withdraw at any time. Study maneuver cannot cause harm to participants. All tools of data collection after statistical analysis had burned to maintain confidility of the study, also tools of data collection did not touch moral, religious or cultural issues also did not harm the nurses's dignity and their rights.

Pilot Study:
 A pilot study was conducted with 4 nurses in order to examine the applicability, practability and to test the clarity of the questionnaire as well as to estimate the time needed to answer them. According to statistical analysis of pilot study modification was considered,this modification included change open ended question to MCQ and decreased interviewing questionnaire from 80 into 74 questions.These nurses were excluded from the study sample.
Data collection procedure:

- The data was collected two days a week based on the time available for nurses and the schedule of hours of attendance.

- The fieldwork was carried out from the beginning of March 2017 to the end of September 2017.The study was carried out through.

- Assessment phase: Official permission was obtained for the study. The nurses were selected according to the criteria above. Before starting the data collection, the purpose of the study was explained to them. Nurses were told that the interview was voluntary and unknown. Each nurse is interviewed individually and completes the CTG questionnaire and performance. It took 45-60 minutes..

-**Planning phase:** The educational sessions, were designed by researchers and modified based on the results obtained from the assessment phase.

-**Implementation phase:** All nurses participated in the educational session's activities such as lectures and demonstration of CTG. It was three sessions with nurses in small groups. Eight groups were established, and five nurses were in each group.
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First session: It covered knowledge related, definition, indications, advantages, disadvantages and type of CTG.

Second session: It covered knowledge of nurses regarding responsibilities, interpretations of results regarding CTG and nursing role in case of late deceleration of fetal heart rate

Third session: It aims to improve the skills of nurses in the CTG. The steps of the CTG procedure were covered, then demonstration and re-demonstrations occurred 2-3 times.

Each session took about 45-60 minutes using a simple language to track the level of nurses' understanding. At the end of each session, feedback was solicited, and nurses' questions were discussed to explain any misunderstanding. Different teaching methods were utilized as lectures, demonstrations and group discussions.

Evaluation and Follow up phase: During this phase, the effect of intervention was evaluated by using the same tools.The immediate post test was conducted then subsequent follow up phases was done after three months later.

Statistical Analysis:
Statistical analysis were done using Statistical Packages for Social Science (SPSS) version 16.0. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables, means and standard deviations for quantitative variables. Quantitatives variable were compared using ANOVA Test for Repeated Measures. Statistical significance was considered at p-value <0.05 *(Krzywinski& Altman, 2013).*

III. Results
Table (1): Frequency distribution among the studied sample according to their general characteristics

Variables	No (40)	%
Age pre (year)		
- 19-31	22	55
- 32-44	11	27.5
- 45-58	7	17.5
Mean ± SD	33.65 ± 10.22	
Level of education		
- Diploma	27	67.5
- Institute of Nursing	11	27.5
- Bachelor	2	5
Marital Status		
- Single	1	2.5
- Married	37	92.5
- Divorced	2	5
Years of experience		
- Less than 5 years	12	30
- 5-10 years	2	5
- More than 10 years	26	65

Table one : Shows that more than half of nurses (55%) have age of 19-31 year with a mean of (33.65 ± 10.22). 67.5% of the nurses had a diploma. Most of them (92.5 %) were married and two third of nurses (65%) have more than 10 years of experience**.**

Table (2): Significance of Differences among Pretest, Immediate Posttest & after 3months Posttest for Knowledge of Nurses regarding Cardiotocograph (n=40).

Measures	Means	Differences among Means			F	P-value
		Pretest	Immediate Posttest	After3months		
Pretest	86.67		36.950	9.50		
Immediate Posttest	1.24	----		27.100	1.302	0.001*
After 3months	96.53	----	----			

Table two : Reveals that statistical significant difference (improvement) were found among pretest, immediate Posttest and after 3months Posttest related to knowledge of nurses regarding Cardiotocograph p= (0.001).

Table (3): Significance of Differences among Pretest, Immediate Posttest & after 3months Posttest for skills of Cardotocograph Using ANOVA Test for Repeated Measures (n=40).

Measures	Means	Differences among Means			F	P-value
		Pretest	Immediate Posttest	After 3months		
Pretest	9		6.650*	6.800*		
Immediate Posttest	15.65	----		0.150	814.27	0.001*
After 3months	15.80	----	----			

Table three: Presents that the minimum mean was for pretest, while the maximum mean was for the after 3 months. Significant differences (improvement) were found among pretest, immediate and after 3 months of performance of Cardotocograph p= (0.001).

Table (4): Correlation between Knowledge and skills of Nurses Regarding Cardotocograph in the Immediate Posttest and after three month test *(n=40).*

Variables	Skills Immediate Posttest	Skills after3months Posttest
Knowledge Immediate Posttest	0.42**	
Knowledge after 3months Posttest		0.55**

**Pearson Correlation is significant at the less than 0.01 levels (2 tailed)
Table four: Illustrate correlation between knowledge and skills in the immediate and after three months Posttest. A significant positive correlation was found between the level of knowledge and the nurses' skills regarding CTG in the immediate Posttest. Else, a positive significant correlation was found between level of knowledge and skills of nurses after 3months (p= 0.01)

Table (5): Relationship between Levels of knowledge about Cardiotocograph in the Immediate Posttest and Age of the Studied Group *(n=40).*

Item	Levels of knowledge						X^2	P- value
	Poor		Average		Good			
	no	%	no	%	no	%		
Age per (year)								
- 19-31	10	45.5	11	50	1	4.5		
- 32-44	7	63.6	4	36.4	0	0	6.908	0.14
- 45-58	6	85.7	0	0	1	14.3		

Table five: Demonstrats that there was no significant relations found between levels of knowledge regarding Cardotocograph in the immediate Posttest and age of the studied sample (p > 0.05).
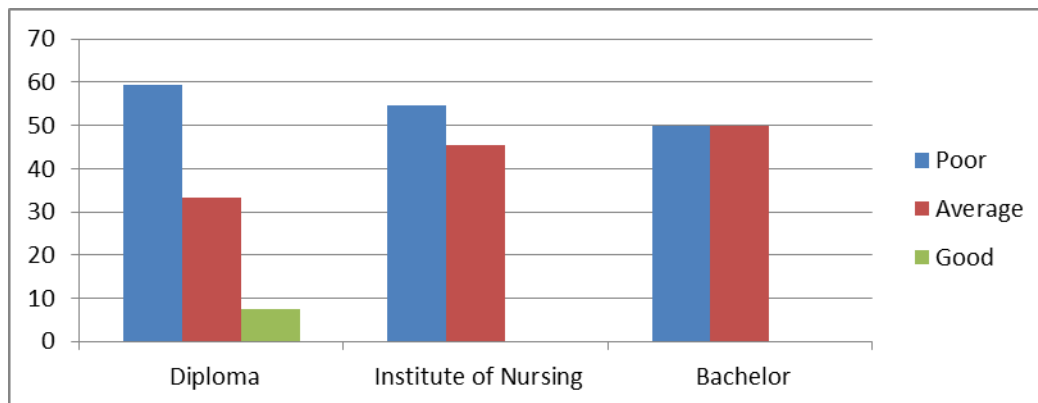
Figure (1): Levels of knowledge about Cardiotocograph in the Immediate Posttest According to Level of Education.

Figure (1): Reveals levels of knowledge about cardiotocograph in the immediate posttest according to level of education. As regarding to diploma and institute of nursing, poor level of knowledge was high. While bachelor education, poor and average level of knowledge were the same.
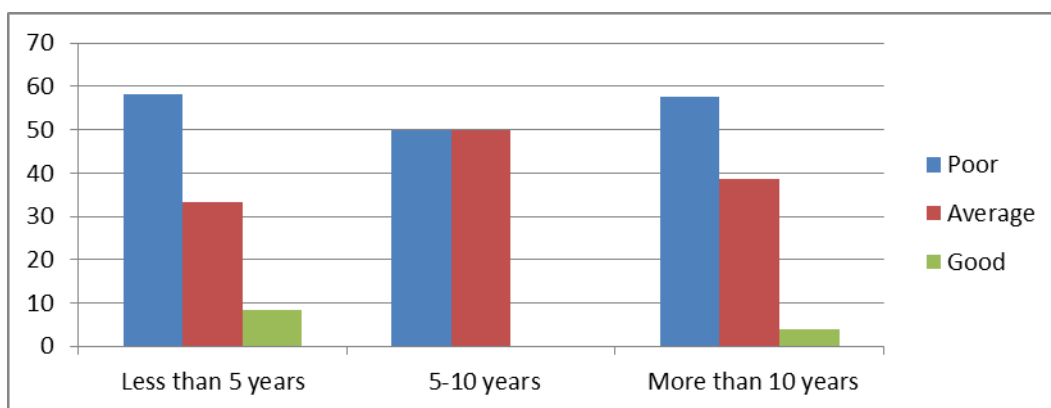

Figure (2): Levels of knowledge about Cardiotocograph in the Immediate Posttest According to Years of Experience.

Figure (2): Reveals levels of knowledge about cardiotocograph in the immediate posttest according to years of experience. As regarding to nurses that had less than five years of experience, poor level of knowledge was high, the same for nurses had more than ten years of experience.While for five to ten years of experience, poor equal average level of knowledge.

IV. Discussion

The current study aimed to evaluate the effect of educational sessions about Cardiotocography on nurses' knowledge and skills at labor and high risk units.The findings of the study indicated that statistically significant differences (improvement) were found among pretest, immediate and after 3 months of knowledge and skills of Cardiotocograph among nurses. Thus, these findings support the proposed research hypothesis.

Regarding to the age of studied sample. The present study findings showed that around half of nurses' age was from 19-31years. The results were supported by **Abdul Razek (2016),** who study the effect of educational programs about methods of assess fetal well-being during pregnancy among nurses and reported that more than one third of sample were 20 – 30 years. Also the present study results were in agreement with a study conducted by **Beydag (2011)** who assessed knowledge and application of nurse in educational hospital on early diagnosis and showed that more than 50% of nurses included in the study have been in the (20-30) years of age group. Else, the study results agreed with **Collins et al**. **(2010)** who assessed the level of satisfaction of nurses working in the midwifery group practice and reported that nurses had age ranged from 25 to 29 years. Moreover, **Chuny et al.,(2011)** who assessed experience by providing continuity of care to laboring women in China showed that all participants were aged between 24-32 years. This can be interpreted as young nurses were more able to acquire knowledge and practice more than older nurses.

Concern to education level. The present study results showed that more than two third of nurses had a diploma.The current study findings were in agreement with **Thamer (2014)** who assess medication errors among nurse in maternity hospitals and reported that most nurses have a secondary nursing school. Also, **Kudhaer (2009)** who study nurse knowledge toward children with the Guillian- barre syndrome in Baghdad showed that the majority nurses have secondary education. Else, **Rizk and Hafez (2013)** who study the effect of an interactive computer-based simulators on a nurses'performance about electronic fetal heart rate monitoring and reported that more than half of nurses had a diploma in nursing. This reveals diploma nurses were communicated with pregnant women more than other nursing groups, and they must be aware of all updates related to electronic fetal monitoring.

Regarding the level of knowledge of nurses related to electronic fetal monitoring, significant differences (improvement) were found among pretest, immediate Posttest and after 3months Posttest. This reveals positive effect of the educational sessions on the nurses' knowledge.The lack of knowledge of nurses before the education can be attributed to the fact that training courses for nurses before joining their profession do did not contain issues about this topic, while nurses acquire little information later in the clinical field.

The current study results were in agreement with **Sajidah & Ibbas (2015)** who study the effectiveness of an education program concerning Cardiotocography on nurse's knowledge in Maternity Hospitals of Baghdad and reported that there were low Means in pre-test concerning knowledge CTG. While there were high mean scores with statistical significance improvement of knowledge post test**.** Also **Rosy & Princy (2015)** who study the effect of the planned teaching program on CTG among Midwives in Alappuzha showed that Midwives had no adequate knowledge on the CTG while after intervention there was improvement in the level of knowledge regarding CTG.

Moreover, The current study findings were consistent with **Sowmya et al., (2013)** who study the effect of CTG program on nurses knowledge and skill in maternity units and reported that the mean of the knowledge regarding CTG in pretest was 6.07 and post-test was 9.57which showed a significant change. Else, **Sajidah & Abbas (2015)** who reported that more than half of participants don't have knowledge about CTG.

Furthermore, the present study results were in the same line with **Abd El-Razek (2016)** who reported that nurses had increased in knowledge on post intervention than on pre intervention. Also, **Rizk & Hafez (2013)** reported that there is a statistically significant difference was noticed between intervention and control group in favor of the study group about their knowledge after one and three months after the intervention. Else,**Cimil Babu (2013)** who evaluate the effect of care guide on CTG among midwives, showed that the mean Posttest knowledge score was higher than the mean Pretest score.

Regarding the skills of nurses related to CTG. The present studying findings showed significant improvement were found among pretest, immediate posttest and after 3months posttest. This improvement may be related to effective training sessions and also due to improved nurses' knowledge regarding CTG lead to improve the performance of the nurses.This finding may be due to the fact that nurses believe that electronic fetal monitoring is an invasive procedure only performed by the physician. However, after the implementation of the program, they realized their role in this procedure

The current study results were in the same line with **Sowmya et al., (2013**) who found that the majority of the nurses had inadequate skill in pretest while in Posttest, most of the nurses had adequate skill in interpreting the CTG tracings. Also, **Rizk & Hafez (2013)** reported that there is a high statistical significant improvement noticed among the intervention group regarding their performance after 1 and 3 after intervention.

Moreover, the present study findings were in agreement with **Daniels et al. (2010)** who evaluate the effect of simulation versus didactic teaching for obstetrical emergencies they stated that the program about EFHM was improve the performance of staff. Also **Bambini et al. (2009)** who study outcomes of clinical simulation for novice nursing students reported that simulation was an essential tool for improving technical proficiency and teamwork.

Concerning correlation between knowledge and skills in the immediate Posttest and after three months. The current study results showed highly significant positive correlations were found between level of knowledge and skills of nurses regarding CTG in the immediate Posttest and after 3 months Posttest test. This may be explained by providing CTG training increase the frequency of performing CTG for practices which improves the quality of CTG for women in labour and high risk units.

The current study results were in the same line with **Sowmyaet., al., (2013**) who found that there was a positive correlation between the level of knowledge and skill in Posttest. **Also, Abd El-Aziz (2014)** who study the effect of educational program on nurse's knowledge and skills about oral care for traumatized patients reported significant positive correlation between knowledge and practice.

Regarding CTG and demographic characteristics of the nurses. The present study results showed that there was no statistical significant association was found between level of knowledge and demographic characteristics.These findings were supported by **Rosy & Princy (2015)** who reported that there was no association between nurses' knowledge and demographic variables. Also, The present study results were supported by **Sowmya et al., (2013**) who reported that there was no association between level of knowledge and skill with demographic data. Else, study findings were in agreement with **Pushpaveni (2012)**who evaluate the effect of the self instructional module on fetal wellbeing measures among nurses and reported that no significant association between level of knowledge regarding CTG and any of the demographic data of the nurses.

While the present study results were in disagreement with **Oleiwi, & Abbas (2015)** who reported that there was significant relationship between knowledge and practices regarding CTG and demographic characteristics of nurses as age, years of experiences. Also the current study results were contrasted with **Sangeetha (2012)** who assess the knowledge, attitude and practice regarding CTG among staff nurses and reported a significant correlation between nurses' knowledge and their Sociodemographic data concerning CTG. The researchers interpreted that improvement occur in nurses knowledge and skills regarding fetal monitoring wasn't affected by their demographic characteristics, and it related to the positive effect of our educational sessions.

V. Conclusion

Based on the results of the present study, we can be concluded that implementing an educational session about Cardiotocograph significantly improved nurses' knowledge and skills at labor and high risk units in Mansoura University Hospitals.

VI. Recommendations

In view of the findings arising from the present study, we recommend that:
- Implementing educational session about Cardiotocography in maternity units of different hospitals.
- A comparative study can be conducted among nurses in maternity units of different hospitals to assess the effectiveness of Cardiotocography training session.
  Brochure clarifying information about CTG and CD contains a video about procedure steps of Cardiotocography should be distributed to the maternity nurses.
- The similar study could be conducted by control group.

Further Research
- Investigate factors that interfere with accurate interpretation of CTG flinging.

Study Limitation
- Few studies and inadequate references, were regarded nurses' knowledge and skills about Cardiotocography.

Conflicts of Interest Disclosure
The authors declare that there is no conflict of interest.

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