

Effect of Instructional Sessions on Nursing Perspectives and Attitudes Regarding Use of Artificial Intelligence for Fetal Monitoring in Maternity Units

Amany Shehata Ahmed⁽¹⁾, Safaa Helmy Mohamed⁽²⁾, Mona Ahmed Abd-Elhamed⁽³⁾

(1) Lecturer of Maternity and Newborn Health Nursing, Faculty of Nursing, Damietta University, Egypt.

(2) Assistant Professor of Obstetrics and Gynecological Nursing Department, College of Health Science, Al Rayan National College, Medinah, Al Munaawwarah, Saudi Arabia, Faculty of Nursing, Assuit University, Egypt.

(3) Assistant Professor of Women's Health and Obstetrics Nursing, Faculty of Nursing, Minia University, Egypt.

Abstract

Background: The inclusion of artificial intelligence (AI) based technologies in nursing practice has sparked concerns and public discussions, with some people worried that this technology could replace nurses. **Aim:** The study examined the effect of instructional sessions on nursing perspectives and attitudes regarding use of artificial intelligence for fetal monitoring in maternity units. **Design:** A quasi-experimental design was used, involving a single group pre- and post-intervention. **Setting:** The study was conducted at Minia University Hospital's maternity units in Egypt. **Sample:** A purposive sample of 51 nurses working in maternity units was included. **Tools:** Two tools were used: Self-administered questionnaire about nurses' demographics and perspectives on AI-driven Cardiotocography (CTG) for fetal monitoring, and a questionnaire about nurses' attitudes towards using AI for fetal monitoring. **Results:** Before the training, 76.5% of nurses had low total perspectives scores and 77.4% had a negative attitude. After the training, 62.8% had high total perspectives scores and 76.5% had a positive attitude, with significant differences. Additionally, there were significant differences between demographic characteristics and total perspectives and attitudes levels post-intervention ($P < 0.001$), and a significant positive correlation between nurses' total perspectives and attitudes post-intervention ($r = 0.980$ & $p = 0.001$). **Conclusion:** The study concluded that the training sessions significantly improved maternity nurses' perspectives and attitudes towards using AI-driven CTG for fetal monitoring. **Recommendations:** Providing maternity nurses with in-service training programs on AI applications in obstetrics and ongoing education on AI.

Keywords: Artificial Intelligence, Fetal monitoring, Maternity nurses' perspectives and attitudes.

Introduction:

Artificial intelligence (AI), a new technology, analyzes vast amounts of data to aid in predicting, preventing, and diagnosing diseases, and also in monitoring patients. In obstetrics, AI is utilized in fetal Cardiotocography (CTG), ultrasonography, and magnetic resonance imaging (MRI). AI helps in addressing various diagnostic challenges in obstetrics. It is stressed that AI technology does not replace medical personnel but rather acts as an assistant in medical practice (Kim, et al., 2023).

Artificial intelligence (AI) is the field of study and practice that focuses on developing intelligent machines capable of performing tasks that typically require human intelligence. These machines can adapt to new situations, handle unexpected circumstances, respond to questions, and develop strategies that demonstrate a level of intelligence typically associated with humans (Chai et al., 2021).

The concept of AI involves computers being able to carry out tasks typically associated with intelligent beings (von Gerich et al., 2021). This subject has gained prominence in public discussions in recent times, sparking controversial conversations among politicians, economists, scientists, and the general public. Nevertheless, public understanding of AI often remains limited and its image is not uniformly positive (McCadden, et al., 2020).

OxSys is a computer-based system that utilizes data from a large number of births to provide evidence-based clinical decision support. It aims to reduce unnecessary interventions while identifying and preventing severe perinatal complications. Additionally, it is anticipated that OxSys can enhance healthcare professionals' understanding of patient risks, leading to improved collaborative decision-making (Georgieva, et al., 2017).

The successful implementation of AI-driven decision support systems such as OxSys requires a change in clinical workflow and a willingness among healthcare providers to trust and utilize AI-generated insights. Therefore, it's crucial to consider clinicians' viewpoints during the development and integration of these systems (Dlugatch, et al., 2024).

The primary emphasis in maternal and fetal health currently lies in assessing fetal well-being in order to evaluate fetal health. Approximately 80% of fetal deaths happen during pregnancy, primarily resulting from factors such as chronic oxygen deprivation to the fetus, impaired fetal growth, maternal health issues, diabetes, high blood pressure, infections, and birth defects (Sergi, 2020).

During pregnancy and labor, the primary objective is to ensure the well-being of the fetus. Continuous non-invasive fetal monitoring during pregnancy and labor is crucial to reduce the risk of adverse events for both the mother and the fetus, particularly in cases with increased risk factors (Rivenes, et al., 2019).

Cardiotocography (CTG) is a technique that uses electronic devices to continuously record the fetal heart rate and uterine contractions. This information is displayed on paper and stored in medical records to track fetal health during labor (Jepsen, et al., 2022).

In the present day, CTG monitoring is commonly utilized by the majority of midwives and obstetricians in labor rooms. This method is anticipated to lower neonatal morbidity and mortality rates (Sartwelle, et al., 2019).

Electronic fetal monitoring is used to track the health of both low-risk and high-risk pregnancies, considering the condition of both the mother and the baby (Said & Ali, 2020).

The assessment of FHR is valuable in evaluating fetal well-being in clinical settings, yet midwives may have limited understanding of its analysis. Additionally, midwives may overlook indicators of fetal distress because of insufficient expertise in CTG or misinterpretation of CTG readings, leading to unjustified cesarean sections and negative impacts on both the mother and the fetus (James, et al., 2019).

Significance of the study:

Artificial intelligence (AI) technologies can enhance nursing performance by enabling nurses to deliver more personalized, evidence-based care. By improving their professional and problem-solving abilities, nurses can better meet the needs of their patients (Mohamed Abd El-Monem, 2023).

To successfully integrate AI into clinical practice, it is crucial to understand nurses' attitudes and behaviors toward current and future AI applications. As nurses interact directly with patients and utilize technology, assessing their current AI knowledge is essential for determining future training requirements (O'Connor, 2021). Therefore, the researchers aimed to assess the impact of training sessions on nurses' views and feelings about using AI for fetal monitoring in maternity wards.

Aim of the study:

This study aimed to assess the effect of instructional sessions on nursing perspectives and attitudes regarding use of AI for fetal monitoring in maternity units.

Research Hypotheses:

- H1.** The instructional sessions will significantly improve nurses' perspectives and attitudes regarding use of AI for fetal monitoring in maternity units.
- H2.** There will be significant relation between nurses' perspectives and attitudes with their demographic characteristics in the post-test.
- H3.** There will be significant correlation between nurses' perspectives and attitudes regarding use of AI for fetal monitoring in maternity units in the post-test.

Subjects and Methods:

Research Design:

This study used a quasi-experimental design with a single group pre-test and post-test.

A quasi-experiment is an empirical interventional study that does not use randomization to assign but instead evaluates the causal effect of an intervention (education program) on a target population (nurses). In several ways, the quasi-experimental design is similar to a randomized controlled trial or classic experimental model; nevertheless, it excludes assignment to specific treatments or controls.

However, rather than randomly assigning participants to treatments, quasiexperimental designs typically allow for some degree of control (Mohammed, 2024).

Research Setting:

The research was conducted at the maternity units of Minia University's Maternity and Children's Hospital in Egypt. These units provide maternity services to women from Minia and its surrounding areas. The hospital is a major medical facility in North Upper Egypt, offering comprehensive healthcare services to the region. The hospital's first floor houses a pediatric clinic, antenatal care clinic, infertility clinic, and imaging center. Gynecology services are located on the second floor, while the third floor accommodates prenatal, high-risk pregnancy, labor, and postpartum rooms. The fourth floor includes a pediatric department and a critical care unit. The inpatient ward operates 24/7, while outpatient clinics are open from 9 AM to 1 PM Saturday through Thursday.

Sampling:

Type & Size:

A purposive sample of 51 nurses working in maternity units was selected based on specific criteria. This included 15 nurses from the obstetrics unit and 36 nurses from the labor units.

Inclusion Criteria:

- Nurses who were working during data collection and agreed to participate in the study.
- Nurses with at least one year of experience working in maternity wards.

Exclusion Criteria:

- Nurses who were on extended leave at the time of data collection, such as maternity leave, child welfare leave, or unpaid vacation.

Tools of Data Collection:

To gather data, two main tools were utilized. It consisted of:

Tool I: Self-Administered Questionnaire: Researchers developed a self-administered questionnaire to gather data from nurses. The questionnaire was divided into two parts:

Part 1: Demographic Characteristics

This section collected information on nurses' age, qualifications, department of employment,

years of nursing experience, and prior training in AI for fetal monitoring.

Part 2: Nurses' Perspectives on AI-Driven CTG. This tool was developed by the researchers after reviewing literatures related to (Dlugatch, et al., 2024; Abdullah & Fakieh, 2020). This part assessed nurses' views on AI-driven CTG for fetal monitoring, both before and after the intervention. The questionnaire included 15 questions categorized into five subcategories: (1): Advantages of AI-Driven CTG (4 items), (2): Personalization and Individualized Medicine (2 items), (3): Institution Responsible for AI-Driven CTG Development (1 item), (4): Transparency in Development Process (3 items), and (5): Problems Related to AI Application in Healthcare (5 items).

Scoring System

Nurses rated each question on a Likert scale from 1 (strongly disagree) to 5 (strongly agree). The total score for nurses' perspectives ranged from 15 to 75.

Classification	Score
Low perspectives	15-35
Moderate perspectives	36-55
High perspectives	56-75

Tool II: Nurses' Attitudes Toward Use of AI for Fetal Monitoring

A modified version of the tool developed by Sindermann et al. (2021) was used to assess nurses' attitudes toward AI. This tool consisted of 12 questions, such as "I fear AI" and "AI will benefit people."

Scoring System

Nurses rated their responses on a five-point Likert scale ranging from strongly disagree to strongly agree. A score was assigned to each response, and the total score was calculated by adding up the scores for all questions. A score below 60% indicated negative attitudes toward AI, while a score of 60% or higher indicated positive attitudes toward AI.

Content Validity

The tools were originally written in English and then translated into Arabic by the researchers. A panel of five maternity nursing experts reviewed the questionnaire to ensure its content validity. The questionnaire was modified based

on the panel's feedback regarding sentence clarity, relevance, content comprehensiveness, understanding, applicability, and alignment with the study's objectives.

Reliability

Cronbach's alpha coefficient was used to assess the internal consistency of the tools. The reliability of the questions related to nurses' perspectives was 0.972, and the reliability of the questions related to nurses' attitudes was 0.857.

Pilot Study

A pilot study was conducted with 5 nurses (10% of the total sample) to assess the clarity, validity, and time requirements of the study tools. No changes were needed based on the pilot study results, and the participating nurses were included in the main study.

Methods of data collection:

Operational Design

The study's operational design included three phases: planning, execution, and evaluation. The goal was to assess effect of instructional sessions on nurses' perspectives and attitudes toward AI for fetal monitoring in maternity units.

Preparatory Phase

This phase involved a thorough literature review to gain a comprehensive understanding of the existing research on the topic. The review helped define the research scope and guided the development of data collection instruments. A panel of experts evaluated the tools for their content, accuracy, and relevance.

Ethical Considerations

The necessary approvals for conducting the research were obtained from relevant authorities. Nurses were informed about the study's importance and objectives. Participation was voluntary, and nurses could withdraw at any time. Their information was kept confidential and would only be used for research purposes. Nurses who agreed to participate signed a written informed consent form.

Implementation Phase

Following approval from the hospital director and the nursing faculty's ethics committee, the study commenced in July to October 2024. At the

start of each interview, the researchers introduced themselves, greeted the nurses, and obtained informed written consent after explaining the study's objectives, timeline, and procedures. Nurses completed individual questionnaires to assess their baseline perspectives and attitudes toward AI for fetal monitoring. Researchers visited the maternity units twice weekly during both the morning and evening shifts.

The researchers collaborated with hospital administrators to identify a suitable location for the educational intervention. The lecture room, designated for workshops and nurse training, was selected. This room is equipped with data displays for presentations. Before starting the first session, researchers reviewed the session's objectives and collected information about the participants. Instructional sessions followed the pre-test and were separated by brief breaks for questions. A PowerPoint presentation was used to support the educational intervention and various teaching methods as group discussions were employed using clear and accessible language to ensure nurses' understanding. Positive reinforcement and encouragement were provided to motivate nurses and foster participation. Two sessions were conducted per shift each of them lasted about 30 minutes and nurses were divided into small groups of 3-5 members.

First session: The researchers provided nurses with an overview of definition of AI, medical AI, objectives of AI, importance of AI in medicine, key applications of AI in the medical field, how AI systems analyze medical data, technologies used in fetal monitoring, and role of AI in enhancing fetal monitoring technologies.

Second session: It was began with a review of the previous session's content. This was followed by a discussion on the nurse's role in the era of AI, the impact of AI on the nurse-pregnant woman relationship, the importance of maintaining a human connection between nurse and patient, nurses' views on AI in fetal monitoring, technical and ethical challenges of AI implementation, and the top 5 medical AI tools.

Instructional Handout

Researchers developed an instructional handout to guide nurses in improving their

knowledge and attitudes toward AI for fetal monitoring. The handout significantly impacted their understanding and perspectives. It was divided into two sections: section 1: fundamentals of AI and section 2: nurse's role in the age of AI. The Arabic booklet was distributed to nurses upon completion of the instructional sessions to be used as a guide for self-learning.

Evaluation

The researchers conducted two rounds of evaluations, each lasting approximately 20 minutes.

Pre-test: Before implementing the instructional sessions, nurses were evaluated using assessment tool 1, part 2, and tool 2.

Post-test: One week after completing the instructional sessions, a second round of evaluation was conducted using Google Forms to assess nurses' perspectives and attitudes toward AI for fetal monitoring.

Statistical Analysis

The data was organized and analyzed using SPSS version 22. Numerical data was presented as averages and standard deviations, while categorical data was presented as frequencies and percentages. The chi-square test was used to examine relationships between categorical variables. Fisher's exact test was used when expected frequencies were low (less than 5). Paired t-tests were used to compare means between two related groups, such as pre- and post-intervention measurements. The McNemar test was used to compare differences in dichotomous variables between two related groups. Pearson correlation was used to assess relationships between variables. A p-value of 0.05 or less was considered statistically significant, and a p-value of 0.001 or less was considered highly significant.

Results

Table 1: shows the demographic characteristics of the study participants. Approximately 41.2% of the nurses were aged 25 - < 35 year 49% held a bachelor's degree in nursing, and 52.9% worked in labor and

postpartum units. Additionally, 37% of the nurses had 3 - < 5 years of experience, and 76.5% had not received any prior training on AI for fetal monitoring.

Table 2: shows improvement in all items of nursing perspectives towards using AI for fetal monitoring in maternity units with highly statistical significant found after the training intervention ($p < 0.001$).

Table 3: shows that there was a significant improvement in nurses' perspectives on AI-powered fetal monitoring after the training intervention ($p < 0.001$).

Figure 1: Demonstrates that 76.5% of nurses had low perspectives on AI for fetal monitoring before the intervention, while 62.8% had high perspectives after the intervention, indicating a significant improvement.

Table 4: Shows a significant improvement after the intervention in all items of nursing attitudes towards using AI for fetal monitoring in maternity units with ($p < 0.001$).

Table 5: Clears that there was a significant improvement in the maternity nurses' attitudes scores pre and post training on AI with ($p < 0.001$).

Figure 2: Demonstrates that 77.4% of nurses had negative attitudes toward AI for fetal monitoring before the intervention, while 76.5% had positive attitudes after the intervention, indicating a significant improvement.

Table 6: Displays highly statistically significant differences between nurses' perspectives toward use of AI for fetal monitoring in maternity units and their demographic characteristics ($P < 0.001$).

Table 7: Displays highly statistically significant differences between nurses' total attitudes toward use of AI for fetal monitoring in maternity units and their demographic characteristics ($P < 0.001$).

Table 8: Presents a strong positive correlation between nurses' perspectives and attitudes towards AI-powered fetal monitoring.

Table (1): Demographic Characteristics of Study Participants (n=51)

Demographic Characteristics	Study (n=51)	
	No.	%
Age (Years)		
< 25years	14	27.5
25 - < 35 year	21	41.2
35 - < 40 years	16	31.3
Educational Qualification		
Secondary school nursing diploma	15	29.4
Technical nursing institute	11	21.6
Nursing Bachelor	25	49
Department or unit of working		
Labor & postpartum units	27	52.9
ICUs	24	47.1
Years of experience		
1 - < 3 year	13	25.5
3 - < 5 year	19	37.3
5 - < 10 year	17	33.3
≥ 10 year	2	3.9
Do you have any previous training course regarding the use of artificial intelligence for fetal monitoring in maternity units		
Yes	12	23.5
No	39	76.5

Table (2): Nurses' Perspectives on AI-Powered Fetal Monitoring (n=51)

	Pre				Post					McNemar test (P value)
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Advantages of AI-driven CTG (Cardiotocography).										
1. AI-driven CTG is an accurate and efficient risk assessment tool										
	24 (47.1)	17(33.3)	10 (19.6)	0 (0)	8 (15.7)	9 (17.6)	17 (33.3)	15 (29.4)	2 (3.9)	5.92(0.001**)
2. AI-driven CTG can prevent adverse labor outcomes and having confidence making decision										
	28 (54.9)	15(29.4)	8 (15.7)	0 (0)	8 (15.7)	8 (15.7)	8 (15.7)	20 (39.2)	7 (13.7)	5.96(0.001**)
3. AI has no space-time limitation										
	25 (49)	18(35.3)	8 (15.7)	0 (0)	10 (19.6)	8 (15.7)	7 (13.7)	19 (37.3)	7 (13.7)	5.93(0.001**)
4. AI has no emotive exhaustion or physical constraint										
	22 (43.1)	21(41.2)	8 (15.7)	0 (0)	9 (17.6)	8 (15.7)	6 (11.8)	21 (41.2)	7 (13.7)	5.98(0.001**)
Personalization and individualized medicine: recognizing differences										
1. AI-powered CTG will allow healthcare providers to give patients more personalized risk assessments.										
	21 (41.2)	17(33.3)	12 (23.5)	1 (2)	11 (21.6)	8 (15.7)	11 (21.6)	19 (37.3)	2 (3.9)	5.78(0.001**)
2. AI offer clinically relevant and high-quality data										
	19 (37.3)	21(41.2)	11 (21.6)	0 (0)	9 (17.6)	10 (19.6)	15 (29.4)	15 (29.4)	2 (3.9)	6.05(0.001**)
The type of organization that is developing AI-powered CTG.										
1. AI-powered CTG developed by public institutions or universities may be more trusted by patients than those developed by private companies due to public distrust of for-profit corporations.										
	18 (35.3)	21(41.2)	12 (23.5)	0 (0)	11 (21.6)	7 (13.7)	18 (35.3)	15 (29.4)	0 (0)	6.12(0.001**)
Transparency in development: ethical guidelines and rigorous research methods.										
1. Transparency in research, development, and validation is essential for healthcare professionals to trust the reliability of AI.										
	15 (29.4)	24(47.1)	12 (23.5)	0 (0)	7 (13.7)	5 (9.8)	18 (35.3)	18 (35.3)	3 (5.9)	6.01(0.001**)
2. Transparency will enable health care professionals to well understand the tool's abilities and limits.										
	21 (41.2)	16(31.4)	14 (27.5)	0 (0)	8 (15.7)	6 (11.8)	18 (35.3)	14 (27.5)	5 (9.8)	5.91(0.001**)
3. It's crucial to ensure that the research is thorough and adheres to ethical guidelines.										
	22 (43.1)	16(31.4)	13 (25.5)	0 (0)	9 (17.6)	7 (13.7)	13 (25.5)	17 (33.3)	5 (9.8)	5.82 (0.001**)
Problems related to applications of AI in health care										
1. AI cannot be used to offer ideas in unexpected conditions										
	28 (54.9)	21(41.2)	2 (3.9)	0 (0)	7 (13.7)	6 (11.8)	14 (27.5)	18 (35.3)	6 (11.8)	6.09(0.001**)
2. AI is not flexible to be useful for every patient										
	19 (37.3)	18(35.3)	13 (25.5)	1 (2)	6 (11.8)	7 (13.7)	12 (23.5)	21 (41.2)	5 (9.8)	6.02(0.001**)
3. AI is difficult to apply to arguable subjects										
	20 (39.2)	19(37.3)	12 (23.5)	0 (0)	8 (15.7)	9 (17.6)	13 (25.5)	19 (37.3)	2 (3.9)	5.96(0.001**)
4. AI has low capability to empathize and reflect the emotional well-being of the patient										
	21 (41.2)	15 (29.4)	12 (23.5)	3 (5.9)	9 (17.6)	7 (13.7)	17 (33.3)	15 (29.4)	3 (5.9)	6.05(0.001**)
5. AI was established by a specialist with slight clinical experience in medical practice										
	31 (60.8)	19(37.3)	1 (2)	0 (0)	9 (17.6)	5 (9.8)	15 (29.4)	19 (37.3)	3 (5.9)	6.01(0.001**)

* Statistical significant difference (P ≤ 0.05)

** highly Statistical significant difference (P ≤ 0.001)

Table (3): Number and Percentage Distribution of Nurses' Total Perspective Score on AI-Powered Fetal Monitoring (n=51)

Total Knowledge Score	Pre		Post		Mcenmar test (P value)
	No	%	No	%	
Low perspective (15-35)	39	76.5	9	17.6	5.82 (0.001**)
Moderate perspective (36-55)	12	23.5	10	19.6	
High perspective (56 - 75)	0	0	32	62.8	
Mean ± SD	26.5 ± 10.8		45.2 ± 17.7		t= 14.7 (0.001**)

** highly Statistical significant difference (P ≤ 0.01)

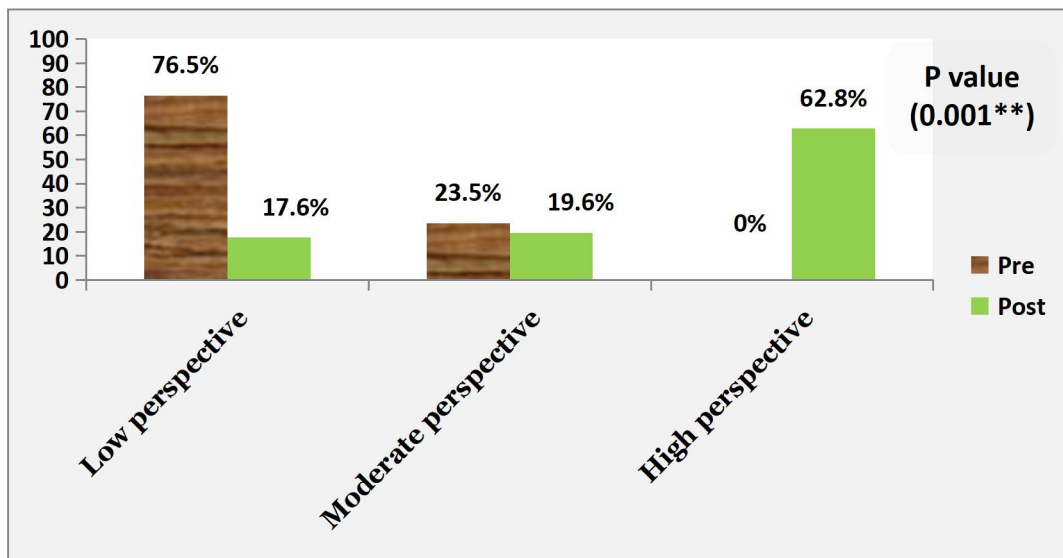


Figure (1): Distribution of Nurses' Total Perspective Score on AI-Powered Fetal Monitoring (n=51)

Table (4): Nurses' Attitudes Towards AI-Powered Fetal Monitoring (n=51)

Pre				Post					Mcenmar test (P value)
Strongly Disagree	Disagree	Neutral	Agree	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree	
Are you worried about artificial intelligence (AI)?									3.04
9 (17.6)	10 (19.6)	14(27.5)	18(35.3)	5 (9.8)	4 (7.8)	14(27.5)	12(23.5)	16 (31.4)	(0.001**)
Do you believe artificial intelligence can be reliable?									6.23
17 (33.3)	18(35.3)	16(31.4)	0 (0)	3 (5.9)	9 (17.6)	12 (23.5)	16 (31.4)	11 (21.6)	(0.001**)
Is there a chance AI could become a threat to humanity?									3.89
18(35.3)	17 (33.3)	13(25.5)	3 (5.9)	10 (19.6)	13 (25.5)	12 (23.5)	10(19.6)	6 (11.8)	(0.001**)
Do you think advancements in AI could improve people's lives?									6.39
17 (33.3)	18(35.3)	12(23.5)	4 (7.8)	1 (2)	6 (11.8)	12 (23.5)	20 (39.2)	12 (23.5)	(0.001**)
Could AI lead to widespread unemployment?									2.14
5 (9.8)	9 (17.6)	12(23.5)	25 (49)	5 (9.8)	6 (11.8)	7 (13.7)	20 (39.2)	13 (25.5)	(0.001*)
Do you see value in the capabilities of AI?									6.43
16(31.4)	19(37.3)	14(27.5)	2 (3.9)	3 (5.9)	3 (5.9)	10(19.6)	18 (35.3)	17 (33.3)	(0.001**)
Does AI hinder or inspire human creativity in your opinion?									2.47
8 (15.7)	11 (21.6)	13(25.5)	19(37.3)	9 (17.6)	8 (15.7)	8 (15.7)	11 (21.6)	15 (29.4)	(0.001*)
Can AI technology contribute to improving nurses' well-being?									6.31
24 (47.1)	21 (41.2)	6 (11.8)	0 (0)	3 (5.9)	7 (13.7)	11 (21.6)	20 (39.2)	10(19.6)	(0.001**)
Could AI create new economic opportunities for hospitals?									6.12
21 (41.2)	18(35.3)	12(23.5)	0 (0)	4 (7.8)	6 (11.8)	12 (23.5)	16 (31.4)	13 (25.5)	(0.001**)
Can AI outperform humans in certain tasks?									6.10
21 (41.2)	19(37.3)	11(21.6)	0 (0)	4 (7.8)	7 (13.7)	11 (21.6)	16 (31.4)	13 (25.5)	(0.001**)
Would you be interested in using AI in your work?									6.28
22 (43.1)	17(33.3)	12(23.5)	0 (0)	5 (9.8)	7 (13.7)	8 (15.7)	20 (39.2)	11 (21.6)	(0.001**)
Do you find the potential of AI exciting?									6.15
24 (47.1)	18(35.3)	9 (17.6)	0 (0)	4 (7.8)	8 (15.7)	10(19.6)	11 (21.6)	18 (35.3)	(0.001**)

** highly Statistical significant difference (P ≤ 0.01).

Table (5): Number and Percentage Distribution of Nurses' Total Attitude Score on AI-Powered Fetal Monitoring (n=51)

Total Compliance Score	Pre		Post		Mcnemar test (P value)
	No	%	No	%	
Negative attitude (< 60%)	40	77.4	12	23.5	5.29 (0.001**)
Positive attitude (≥ 60%)	11	22.6	39	76.5	
Mean ± SD	25.6 ± 10.1		41.9 ± 10.9		t= 19.9 (0.001**)

** highly Statistical significant difference (P ≤ 0.01)

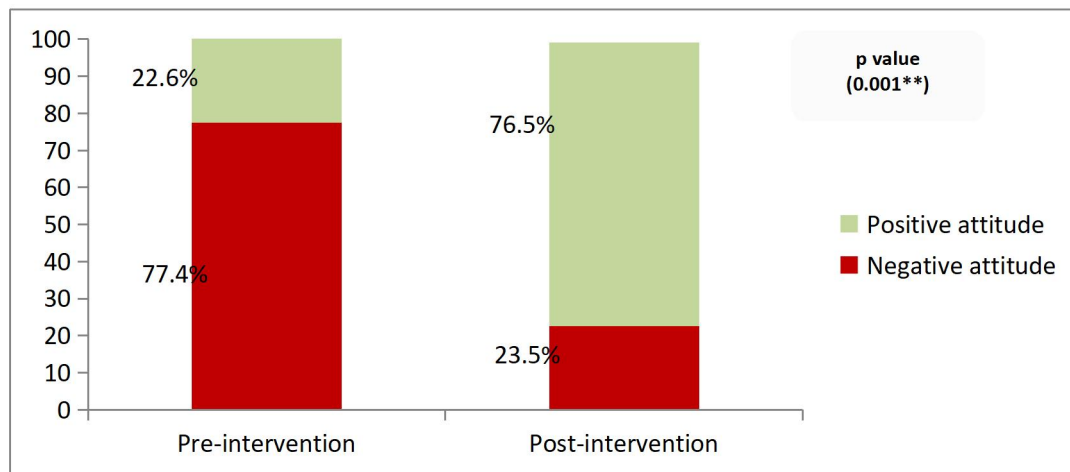


Figure (2): Distribution of Nurses' Total Attitude Score on AI-Powered Fetal Monitoring (n=51)

Table (6): Relationship between Nurses' Demographics and Perspectives on AI-Powered Fetal Monitoring (n=51)

Demographic Characteristics	Study (n=51)		
	Low (n=9) No. (%)	Moderate (n=10) No. (%)	High (n=32) No. (%)
Age (Years)			
< 25years	9 (100)	5 (50)	0 (0)
25 - < 35 year	0 (0)	5 (50)	16 (50)
35 - < 40 years	0 (0)	0 (0)	16 (50)
X² (P value)	42.1 (0.001**)		
Educational Qualification			
Secondary school nursing diploma	9 (100)	6 (60)	0 (0)
Technical nursing institute	0 (0)	4 (40)	7 (21.9)
Nursing Bachelor	0 (0)	0 (0)	25 (78.1)
Fisher exact (P value)	48.7 (0.001**)		
Department or unit of working			
Labor & postpartum units	9 (100)	10 (100)	8 (25)
ICUs	0 (0)	0 (0)	24 (75)
X² (P value)	28.8 (0.001**)		
Years of experience			
1 - < 3 year	9 (100)	4 (40)	0 (0)
3 - < 5 year	0 (0)	6 (60)	13 (40.7)
5 - < 10 year	0 (0)	0 (0)	17 (53.1)
≥ 10 year	0 (0)	0 (0)	2 (6.2)
Fisher exact (P value)	42.5 (0.001**)		
Do you have any previous training course regarding the use of artificial intelligence for fetal monitoring in maternity units			
Yes	9 (100)	3 (30)	0 (0)
No	0 (0)	7 (70)	32 (100)
Fisher exact (P value)	37.7 (0.001**)		

** highly Statistical significant difference (P ≤ 0.01)

Table (7): Relationship between Nurses' Demographics and Attitudes towards AI-Powered Fetal Monitoring (n=51)

Demographic Characteristics	Study (n=51)	
	Negative (n=12)	Positive (n=39)
	No. (%)	No. (%)
Age (Years)		
< 25years	12 (100)	2 (5.1)
25 - < 35 year	0 (0)	21 (53.8)
35 - < 40 years	0 (0)	16 (41.1)
Fisher exact (P value)	42.1 (0.001**)	
Educational Qualification		
Secondary school nursing diploma	12 (100)	3 (7.7)
Technical nursing institute	0 (0)	11 (28.2)
Nursing Bachelor	0 (0)	25 (64.1)
Fisher exact (P value)	34.7 (0.001**)	
Department or unit of working		
Labor & postpartum units	12 (100)	15 (38.5)
ICUs	0 (0)	24 (61.5)
X² (P value)	13.9 (0.001**)	
Years of experience		
1 - < 3 year	12 (100)	1 (2.6)
3 - < 5 year	0 (0)	19 (48.7)
5 - < 10 year	0 (0)	17 (43.6)
≥ 10 year	0 (0)	2 (5.1)
Fisher exact (P value)	40.9 (0.001**)	
Do you have any previous training course regarding the use of artificial intelligence for fetal monitoring in maternity units		
Yes	12 (100)	0 (0)
No	0 (0)	39 (100)
X² (P value)	51.1 (0.001**)	

** highly Statistical significant difference ($P \leq 0.01$)

Table (8): Correlation Between Nurses' Perspectives and Attitudes Towards AI-Powered Fetal Monitoring (n=51)

	Post	
	Perspectives	Attitude
	<i>r (p)</i>	<i>r (p)</i>
Perspectives	----	0.980 (0.001**)
Attitude	0.980 (0.001**)	----

** highly Statistical significant difference ($P \leq 0.001$)

Discussion

Artificial intelligence (AI) has the potential to improve healthcare by enhancing information synthesis, task fulfillment, problem-solving, decision-making, and patient outcomes (Ronquillo, 2021). However, the lack of research on healthcare workers' attitudes and views towards AI highlights the importance of understanding these factors. Negative perceptions can hinder the successful adoption of AI technologies in healthcare. Hence, this study

aimed to examine effect of training sessions on nursing perspectives and attitudes regarding the use of AI for fetal monitoring in maternity units.

According to the study, approximately half of the nurses were between the ages of 25 and 35, and about half held a bachelor's degree in nursing. Additionally, over half of the nurses worked in labor and postpartum units, and more than one third had between three to five years of experience. Also, more than three quarters of them didn't have any previous training course regarding the use of AI for fetal monitoring.

The outcomes of the current research were consistent with a previous Egyptian study conducted by **Mohamed Abd El-Monem et al., (2023)** which examined the connection between AI technology and nurses' professional identity and problem-solving abilities. The 2023 study found that over two-fifths of staff nurses were younger than 30, and approximately 25% of staff nurses had 5 to 10 years of experience.

The current study aligned with the findings of investigation by **Kamal Abd Elkhalek et al., (2024)** This study examined the influence of educational guidelines on maternity nurses' understanding and perspectives towards AI applications. It concluded that a significant portion of the maternity nurses involved in the study had no prior teaching or experience with AI.

The study found significant improvements in nursing perspectives towards using AI for fetal monitoring in maternity units after participating in instructional sessions. These findings suggest that the instructional guidelines were effective in meeting the nurses' desire to increase their knowledge of AI for fetal monitoring.

This finding aligns with a study by **Kamal Abd Elkhalek et al., (2024)** found significant improvements in all AI-related knowledge items between the pre-and post-test, which was evaluated one month after the implementation of the instructional recommendations. These results supported the first research hypothesis of the current study.

This study's findings were in line with **Abuzaid et al., (2022)** which investigated the lack of knowledge and understanding of AI principles and their technical potential in the nursing field. The researchers concluded that healthcare organizations and higher education institutions need to cultivate and apply appropriate AI education and training programs for nursing staff to improve their ability to safely integrate and utilize AI in nursing practice. Additionally, most nursing staff members agreed that nursing education and training programs should include basic AI knowledge.

Additionally, **Zhou 's (2022)** study on the use of AI in clinical nursing by Chinese nursing staff found positive results and contributed to the application of AI technology in this field. The

study recommended developing effective application measures that align with actual work content.

The majority of maternity nurses in the current study had low perspectives on the use of AI for fetal monitoring before participating in instructional guidelines. However, after the implementation of these guidelines, most nurses had high perspectives. These findings were consistent with a previous study by **Abdullah Mohamed et al., (2023)** on the effects of an AI training program on head nurses' leadership skills and well-being, which showed that few head nurses had sufficient AI expertise before program implementation.

This finding of the current study was constant with a previous study conducted by **Kamal Abd Elkhalek et al., (2024)** revealed that a minority of nurses had insufficient knowledge about AI before participating in the educational intervention. However, after the intervention, significant improvements were observed in all domains of nurses' AI knowledge scores, suggesting that the nurses' overall level of knowledge increased immediately following the implementation of the educational program. These findings supported the first research hypothesis of the current study, which claimed that nurses' perspectives and attitudes regarding the use of AI for fetal monitoring in maternity units were influenced by applied AI instructional guidelines.

The increase in nurses' perspectives on AI may be attributed to their increased awareness of the profits and uses of AI in nursing, resulting from the AI instructional sessions. AI can observe its surroundings, identify objects, assist in decision-making, resolve conflicts, organize tasks, learn new things, and solve complex problems. Additionally, the program's effectiveness in advancing knowledge and perspectives across all AI domains may have contributed to these positive outcomes.

Swan (2021) study examined the understanding and attitudes of nursing personnel regarding AI in US healthcare settings. The study found that most nurses were either unaware or misunderstood the concept of AI in clinical practice. This finding contradicts the results of a study conducted by **Khaled and Elborai (2024)** explored nursing students' knowledge and

attitudes towards AI. This study indicated that the majority of the participating nursing students exhibited a moderate level of knowledge and held positive attitudes towards AI.

The findings of this study were consistent with a recent study by **Abdullah Mohamed et al., (2023)** which reported significant differences in head nurses' mean scores before and after an intervention, as well as between pre-intervention and follow-up. Similar findings were obtained by **Zhou et al., (2022)** concluded that the study produced excellent results and promoted the use of AI in clinical nursing, and recommended developing effective application measures aligned with the actual work content.

The findings of the current research demonstrated a significant difference between pre and post-test scores of studied nurses regarding all items of nursing attitudes towards using AI for fetal monitoring in maternity units. Similar findings were obtained by **Kamal Abd Elkhalek et al., (2024)** who discovered that after implementing instructional guidelines for one month, there was an improvement in the overall scores of maternity nurses' attitudes. In the pre-test phase, the majority of the study group had a negative overall attitude towards AI. However, following the implementation of educational guidelines, less than 10% of the group had this view.

The findings of the current study may be related to the recent trend of Egyptian hospitals implementing AI in various settings, in alignment with Egypt's 2030 vision. In line with this vision, Egypt has begun integrating technology and AI into all aspects of society.

Kwak et al., (2022) found that initial positive attitudes towards AI predicted its use and implementation, supporting the findings of this study. Their study examined the impact of AI ethics awareness, attitude, anxiety, and self-efficacy on nursing students' intentions to use AI. Additionally, a study by **Sabra et al. (2023)** found that over two-thirds of nurses had a positive attitude towards AI. Their study examined nurses' perspectives and attitudes regarding the use of AI in healthcare.

The findings of the current research were also consistent with those of **Liu et al., (2022)** who predicted that nurses and AI robots could

collaborate in clinical settings in the near future. Liu's study assessed the use of AI in processing medical information and managing emergency nursing care. The development of AI care robots is crucial for creating effective nurse-assistance technologies in response to the increasing workload and shortage of nurses.

Oh et al., (2019) who investigated confidence in AI: A Mobile Survey, reported in the United States that only five percent of the survey respondents claimed to be knowledgeable about AI. However, most participants had a positive attitude towards AI in healthcare. They identified one benefit of AI as its ability to analyze large amounts of high-quality clinical data.

The study found a significant correlation between nurses' overall perspectives and attitudes towards AI-powered fetal monitoring and their demographic characteristics. This may be due to the increasing use of AI in various healthcare settings. These findings align with study by **Elsayed & Sleem (2021)** in Egypt, found a strong positive relationship between nurses' demographic factors (job, education, experience, and position) and their views on AI in healthcare. This supports the second research hypothesis.

Similar to this study, **Sabra et al., (2023)** found significant differences in nurses' attitudes towards AI based on their age, qualifications, years of experience. Furthermore, these results were consistent with those of a **IJsebaert study (2019)** that examined attitudes towards robots and AI in the workplace in 22 European nations. Additionally **Khaled and Elborai (2024)** found a significant positive correlation between nursing students' age, education level, and their overall knowledge and attitudes towards AI.

The findings of the current study were also consistent with those of **Kamal Abd Elkhalek et al., (2024)** who demonstrated a strong positive relationship between nurse managers' perceptions of using AI and their occupation, level of education, and workplace. This finding may be attributed to the three main environmental factors that influence an individual's thoughts and perceptions, which in turn shape their perspectives. These factors are employment, education, and the workplace.

The study found a very strong correlation between nurses' perspectives and attitudes

towards using AI for fetal monitoring after the training sessions. The researchers suggest that this may be due to nurses being exposed to new information and influences that shaped their perceptions of AI. This supports the third research hypothesis.

These findings align with a study by **Kamal Abd Elkhalek et al., (2024)** which found also a strong positive correlation between attitudes towards AI and overall knowledge. Additionally, a study by **Khaled and Elborai (2024)** found a very strong positive correlation between nursing students' overall knowledge of AI and their attitudes towards AI.

Conclusion:

The study findings demonstrated that the instructional guidelines implemented in maternity units significantly improved maternity nurses' perspectives and attitudes toward AI-driven CTG for fetal monitoring.

Recommendations:

The researchers recommend the following:

1. Maternity nurses should receive training on AI applications in obstetrics and fetal monitoring to improve patient outcomes.
2. Policymakers should create strategies to increase institutional AI readiness.
3. Integrating AI into nursing education can motivate students to learn about AI, its applications, and ethical considerations.
4. Nursing students should have access to AI-related training courses, webinars, and seminars.
5. Further research with a larger sample of nurses in various settings is needed to generalize the findings.

References

Abdullah Mohamed, H., Gamal Awad, S., Elgharib Mohamed Mostafa Eldiasty, N., & ELsaid ELsababy, H. (2023). Effect of the artificial intelligence enhancement program on head nurses' managerial competencies and flourishing at work. *Egyptian Journal of Health Care*, 14(1), 624-645.

Abdullah, R., & Fakieh, B. (2020). Health Care Employees' Perceptions of the Use of AI Applications: Survey Study. (*J Med Internet Res*) doi: 10.2196/17620

Abuzaid, M. M., Elshami, W., & Fadden, S. M. (2022). Integration of artificial intelligence into nursing practice. *Health and Technology*, 12(6), 1109-1115.

Chai, C. S., Lin, P., Jong, M. S., Dai, Y., Chiu, T K. F., & Qin, J. (2021). Perceptions of and Behavioral Intentions toward Learning Artificial Intelligence in Primary School Students. *Forum of Educational technology & Society*. 24, (3). pp. 89-101.

Dlugatch, R., Georgieva, A. & Kerasidou, A. (2024). AI-driven decision support systems and epistemic reliance: a qualitative study on obstetricians' and midwives' perspectives on integrating AI-driven CTG into clinical decision making. *BMC Med Ethics* 25, 6 <https://doi.org/10.1186/s12910-023-00990-1>

Elsayed, W. A., & Sleem, W. F. (2021). Nurse Managers' Perception and Attitudes toward Using Artificial Intelligence Technology in Health Settings. *Assiut Scientific Nursing Journal*; 9(24.0), 182-192.

Georgieva, A., Redman, C. W., & Papageorghiou, A. T. (2017). Computerized data driven interpretation of the intrapartum cardiotocogram: a cohort study. *Acta obstetrica et gynecologica Scandinavica*, 96(7), 883-891.

He, J., Baxter, S. L., Xu, J., Xu, J., Zhou, X., & Zhang, K. (2019). The practical implementation of artificial intelligence technologies in medicine. *Nature medicine*, 25(1), 30-36.

<https://migrationletters.com/index.php/ml/article/view/4410>

IJsebaert, K. (2019). Attitudes towards robots and Artificial Intelligence at work in 22 European countries, Published Master thesis, Tilburg University.

James, S., Maduna, N. E., & Morton, D. G. (2019): Knowledge levels of midwives regarding the interpretation of cardiotocographs at labour units in KwaZulu-Natal public hospitals. *Curatonia*, 42(1), 1-7.

- Jepsen, I., Blix, E., Cooke, H., Adrian, S. W., & Maude, R. (2022).** The overuse of intrapartum Cardiotocography (CTG) for low-risk women: An actor-network theory analysis of data from focus groups. *Women and Birth*, 35(6), 593-601.
- Kamal Abd Elkhalek, N., Hamdy Nasr Abdelhalim, E., Atef Osman, H., Mohamed Ahmed Ayed, M., & Fawzy Hasab Allah Youssef, M. (2024).** Effect of Educational Guidelines on Maternity Nurses' Knowledge and Attitude regarding Artificial Intelligence Application. *Egyptian Journal of Health Care*, 15(3), 663-680.
- Khaled, E. M., & Elborai, S. A. (2024).** Knowledge and Attitude of Nursing Students Regarding Artificial Intelligence. *Egyptian Journal of Health Care*, 15(3), 510-523.
- Kim, A. Y., & Sim, I. O. (2020).** Communication skills, problem-solving ability, understanding of patients' conditions, and nurse's perception of professionalism among clinical nurses: A structural equation model analysis. *International journal of environmental research and public health*, 17(13), 4896.
- Kim, H. Y., Cho, G. J., & Kwon, H. S. (2023).** Applications of artificial intelligence in obstetrics. *Ultrasonography*, 42(1), 2-9.
- Kwak, Y., Ahn, J. W., & Seo, Y. H. (2022).** Influence of AI ethics awareness, attitude, anxiety, and self-efficacy on nursing students' behavioral intentions. *BMC nursing*, 21(1), 267.
- Liu, Q., Yang, L., & Peng, Q. (2022).** Artificial Intelligence Technology-Based Medical Information Processing and Emergency First Aid Nursing Management. *Computational and mathematical methods in medicine*, 2022(1), 8677118.
- McCraden, M. D., Sarker, T., & Paprica, P. A. (2020).** Conditionally positive: a qualitative study of public perceptions about using health data for artificial intelligence research. *BMJ open*, 10(10), e039798.
- Mohamed Abd El-Monem, A., Elsayed Rashed, S., & Ghoneimy Hasanin, A. (2023).** Artificial Intelligence Technology and its Relation to Staff Nurses' Professional Identity and Problem Solving Abilities. *International Egyptian Journal of Nursing Sciences and Research*, 3(2), 144-164.
- Mohamed, N., A. (2024).** Effectiveness of an Educational Program on Nurses' Knowledge regarding Active Management of Third Stage of Labor to Control of Postpartum Hemorrhage.
- O'Connor, S. (2021).** Artificial intelligence and predictive analytics in nursing education. *Nurse education in practice*, 56, 103224-103224.
- Oh, S., Kim, J. H., Choi, S. W., Lee, H. J., Hong, J., & Kwon, S. H. (2019).** Physician confidence in artificial intelligence: an online mobile survey. *Journal of medical Internet research*, 21(3), e12422.
- Rivenes Lafontan, S., Kidanto, H. L., Ersdal, H. L., Mbekenga, C. K., & Sundby, J. (2019):** Perceptions and experiences of skilled birth attendants on using a newly developed strap-on electronic fetal heart rate monitor in Tanzania. *BMC Pregnancy and Childbirth*, 19, 1-10.
- Ronquillo, C. E., Peltonen, L. M., Pruinelli, L., Chu, C. H., Bakken, S., Beduschi, A., ... & Topaz, M. (2021).** Artificial intelligence in nursing: Priorities and opportunities from an international invitational think-tank of the Nursing and Artificial Intelligence Leadership Collaborative. *Journal of advanced nursing*, 77(9), 3707-3717.
- Sabra, H. E., Abd Elaal, H. K., Sobhy, K. M., & Bakr, M. M. (2023).** Utilization of artificial intelligence in health care: Nurses' perspectives and attitudes. *Menoufia Nursing Journal*, 8(1), 253-268.
- Said, A. R., & Ali, H. A. (2020).** Effect of supportive nursing instructions for maternity nurses regarding electronic fetal monitoring. *International Journal of Nursing Science*, 10(1), 1-11.
- Sartwelle, T. P., Johnston, J. C., Arda, B., & Zebenigus, M. (2019):** Cerebral palsy, cesarean sections, and electronic fetal monitoring: all the light we cannot see. *Clinical Ethics*, 14(3), 107-114.

Sergi, C. M., & Sergi, C. M. (2020). Placenta, Abnormal Conception, and Prematurity. *Pathology of Childhood and Adolescence: An Illustrated Guide*, 1409-1569.

Sindermann, C., Schmitt, H., Sariyska, R., Stavrou, M., Becker, B., and Montag, C. (2021). Assessing the Attitude Towards Artificial Intelligence: Introduction of a Short Measure in German, Chinese, and English Language. *KI - Künstliche Intelligenz* 35:109–118

Swan, B. A. (2021). Assessing the Knowledge and Attitudes of Registered Nurses about Artificial Intelligence in Nursing and Health Care. *Nursing Economic\$,* 39(3).

von Gerich, H., Moen, H., Block, L. J., Chu, C. H., DeForest, H., Hobensack, M., & Peltonen, L. M. (2022). Artificial Intelligence-based technologies in nursing: A scoping literature review of the evidence. *International journal of nursing studies*, 127, 104153.

Zhou, J., Zhang, F., Wang, H., Yin, Y., Wang, Q., Yang, L., & Luo, W. (2022). Quality and efficiency of a standardized e-handover system for pediatric nursing: A prospective interventional study. *Journal of nursing management*, 30(8), 3714-3725.