# Effect of Simulation-Based Training on Maternity Nurses' Performance and Self-Efficacy Regarding Management of Preeclampsia

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**ABSTRACT**

***Context:*** The use of simulation is one solution to the problem of integrating new care. New nurses must be competent to care for patients in a fast-paced setting where clinical competence and precise and timely decision-making are valued.
***Aim:*** The study aimed to evaluate the effect of simulation-based training on maternity nurses' performance and self-efficacy regarding the management of preeclampsia.
***Methods:*** A quasi-experimental (pre/post-test) design was used. The study was conducted at the obstetric clinical laboratory in the faculty of nursing at port said university and gynecological specialty hospital in Port Said city. A convenient sample of 40 nurses was recruited for the study. Three tools were used for data collection: A structured self-administered questionnaire, nurses' observational checklists, and a self-efficacy assessment scale.
***Results:*** The present study findings revealed a sample mean age of 29.03±7.66 and a highly statistically significant difference between pre-intervention, immediate post-intervention, and eight weeks post-intervention ($p$<0.0001) regarding nurses' knowledge, practice, and self-efficacy concerning the management of preeclampsia.
***Conclusion*:** According to the findings, simulation-based training is an effective strategy for increasing midwives' performance and self-efficacy in managing preeclampsia. So, it is recommended that simulation-based training be used in teaching nurses working in the obstetrics and gynecology emergency department to manage high-risk pregnancies.

***Keywords:*** Simulation, maternity nurses, performance, self-efficacy, preeclampsia

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## 1. Introduction

Simulation is a type of training increasingly used in health education to benefit health practitioners, patients, and services *(Morfoot & Stanley, 2018).* Simulations are crucial, especially in resource-constrained regions where professional healthcare providers and resources are scarce. Medical professionals and nurses have more time constraints than their better-resourced counterparts, so using simulations to improve the teaching of basic skills in obstetrics and gynecology is quite beneficial *(Deering et al., 2019).*

Simulation studies rely primarily on accuracy, reliability, and validation to measure the effectiveness of simulations. Fidelity refers to the degree of realism in a scene, ranging from completely manufactured to completely realistic. Fidelity can be high, medium, or low *(Munshi et al., 2015).* In the cases presented, reliability is defined as consistency and accuracy. In order to achieve simulation dependability, scenarios must be grouped and examined systematically, guaranteeing that each contributor is subjected to the same conditions. Finally, the effectiveness represents what to assume and measure, as defined by a simulated clinical scenario. Effectiveness in a simulated environment is achieved by ensuring that the simulation function closely resembles the real-world condition to put the results into scientific practice *(Munroe et al., 2016).*

Self-efficacy is defined as a person's belief in their ability to complete a task correctly and effectively or as the key construct mediating knowledge and conduct. A high level of self-efficacy allows a person to persevere in their quest for success. This theory states that one's beliefs determine action about efficacy, which determines which conduct is chosen, the degree of persistence, and the quality of performance *(Goulo, 2014).*

Self-efficacy theory has been applied to nursing practice, and a literature review reveals that self-efficacy significantly impacts nursing professional development. Self-efficacy, or the belief that one possesses the necessary skills to achieve, can reflect on one's thinking and behavior. Self-efficacy is regarded to be linked to competence. People who underperform may do so not because they lack the talents but because they lack the self-efficacy to put those skills to good use *(Kimhi et al., 2016).*

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Preeclampsia is one of three causes of maternal death, and it is still one of the obstetrics' unsolved difficulties. It is a systemic condition characterized by Hypertension, proteinuria, and peripheral edema PE occurs after 20 weeks of pregnancy and affects 3 to 8% of all pregnancies. Preeclampsia is predicted to affect 1.8 percent to 16.8 percent of women in underdeveloped nations. According to the World Health Organization, eclampsia occurs in 2.3 percent of preeclampsia cases. Most preeclampsia-related deaths are caused by delayed diagnosis, inadequate management, and poor nursing care *(Tabatabaeian et al., 2018).*

Misinterpreting or failing to recognize the indicators of increasing preeclampsia can cause delays in diagnosis and treatment. Early detection and treatment of preeclampsia have thus been highlighted as a key determinants in lowering maternal morbidity and mortality *(Bernstein et al., 2017).*

Nurses are responsible for diagnosing and managing preeclampsia as health care practitioners. As a result, enhancing clinical nursing abilities in preventing, detecting, and treating pregnancy problems like preeclampsia will lower mother and newborn mortality. Nurses' performance is improved through educating them and strengthening their decision-making abilities *(Tabatabaeian et al., 2018).* Nurses should be able to incorporate best practices and evidence-based approaches to enhancing patient safety and quality into patient care, including knowledge, attitudes, and skills *(Harmon, 2016).*

## 2. Significance of the study

Maternal mortality is the world's largest health discrepancy, with most deaths happening during the perinatal period. Preeclampsia is the most common cause of maternal and neonatal illness and mortality worldwide. Up to 10% of pregnancies worldwide are affected by hypertensive problems. Preeclampsia is a dangerous illness that affects about 3 to 8% of all pregnancies. The maternal death rate in Egypt is 45 per 100,000 live births, according to the *World Health Organization (2019).* In an Egyptian study examining the prevalence of hypertensive diseases in pregnancy, (4.2%) of women had gestational hypertension, and (3.8%) had preeclampsia and eclampsia *(Gabal et al. 2017).*

A crucial aspect in minimizing maternal death and impairment is providing quality care with qualified, competent caregivers through the best training. Simulations are an important teaching tool for health professionals, and they can be utilized as an alternative to traditional methods of learning theory and applying it in practice. They explore new ground in areas like direct patient interaction and the stress experienced by trainees working in intensive care units. As a result, clinical practice simulations can aid in developing nurses' abilities to deal with challenges that may arise in real-world interactions with patients and assist them in performing better and more confidently *(Bias et al., 2016).*

Simulation is an effective teaching approach that engages nurses and requires them to utilize critical thinking and clinical reasoning. It also allows for reflective learning and the integration of nurse knowledge. Simulators have also increased various educational outcomes, including information acquisition, clinical performance, and better self-efficacy *(Gharaibeh., 2017).*

As a result, many studies have indicated using new technologies such as simulation training to increase the nurses' knowledge, practice, and self-efficacy in caring for high-risk pregnant women. Research is now being conducted to expand the knowledge to cover the knowledge gaps among obstetric nurses and to see how simulation-based training affects midwives' performance and self-efficacy in managing preeclampsia. Furthermore, the current research will address the educational needs of maternity nurses who care for a high-risk pregnancy group and the effect of fulfilling the educational needs to improve maternity nurses' performance and self-efficacy in caring for women with preeclampsia.

## 3. Aim of the study

This study aimed to evaluate the effect of simulation-based training on maternity nurses' performance and self-efficacy regarding the management of preeclampsia. This aim was achieved through:

- Assessing nurses' knowledge regarding the management of preeclampsia.
- Assessing nurses' practice regarding the management of preeclampsia.
- Assessing nurses' self-efficacy regarding the management of preeclampsia.
- Designing and implementing simulation scenarios for nurses regarding the management of preeclampsia.
- Evaluating the effect of simulation-based training on nurses' performance and self-efficacy regarding the management of preeclampsia.

### 3.1 Operational definitions

*Self-efficacy* refers to the self-perception of a nurse's capacity to operate properly and effectively in a specific task or setting.

*Nurses' performance* in this study included the knowledge and practice of a nurse in managing preeclampsia during pregnancy.

### 3.2 Research Hypotheses

- Nurses exposed to the simulation-based training will significantly improve knowledge after training compared to their pre-training level.
- Nurses exposed to the simulation-based training will have an increased practice score after training compared to their pre-training level.
- Nurses exposed to the simulation-based training will have an increased self-efficacy mean score after training compared to their pre-training level.

## 4. Subjects & Methods

### *4.1. Research Design*

A quasi-experimental time-series design was used to implement the aim of this study. Currently, pre/post-test design, one group was employed in this study, in which the dependent variable is measured three times: Once before the intervention (the pretest), after the intervention (the post-test), and again after eight weeks (follow-up). The intervention impact was determined by comparing pre-and post-test data.

### *4.2. Study setting*

This research was carried out in a Port Said gynecological hospital that is part of a comprehensive health insurance plan. It provided low-cost service to a broad civic sector and had a high flow of women with preeclampsia. In addition to the Clinical Laboratory of the University of Port Said's Faculty of Nursing, the Centre of "Fidelity Manikin" has a well-developed obstetrics laboratory with all the essential equipment for conducting research.

### *4.3. Subjects*

A convenient sample of 40 nurses was recruited from the Obstetrics and Gynecology Department of the Gynecological Specialty Hospital in Port Said city at the time of data collection, regardless of their characteristics.

### *4.4. Tools of data collection*

Three main tools were used for data collection:

#### 4.4.1. A Structured Self-Administered Questionnaire

Researchers constructed it to assess nurses' sociodemographic traits, such as age, educational qualification, professional title, years of employment, previous training related to preeclampsia, and sources of information for nurses. This section is only utilized before the implementation phase. It took about 5 minutes for the nurse to fill it in.

#### 4.4.2. Knowledge Assessment Questionnaire

The researcher developed the questionnaire after reviewing relevant literature *(Ishaku et al., 2016)* to measure nurses' knowledge of preeclampsia management in obstetrics and gynecology. It included 20 closed and open-end questions written in simple Arabic that cover two primary points: Antenatal care during normal and high-risk pregnancies, including antenatal schedules, antenatal exams, and antenatal history components, among other things. The second important item is their knowledge of preeclampsia management, including six relevant sub-items. They were risk factors for preeclampsia, signs and symptoms, preventive measures, preeclampsia therapy, and complications. Throughout the investigation, the instrument was measured three times (pre-intervention, post-intervention, and follow-up). The nurses took around 15 minutes to complete it.

*Scoring system*

Each question is graded as three scores for the complete and correct answer, two for incorrect/incomplete answer, and one for the do not know the answer. The total knowledge scores were classified as the following:

- Poor knowledge from the total score of <60% correct answers.
- Average knowledge of 60%-75% correct answers.
- Good knowledge >75% correct answers.

#### 4.4.3. Nurses' Performance Checklists

It consists of 50 questions distributed over 17 items, described as vital signs, electronic fetal/cardiac monitoring, in-depth assessment including tendon reflexes and clonus, and protein detection in the urine. It was adapted from *Christian and Krumwiede (2013)* and modified by researchers to assess nurses' practice regarding the management of preeclampsia. Throughout the investigation, the instrument was measured three times (pre-intervention, post-intervention, and follow-up). It was used by the researchers and roughly took around 30 minutes to be completed.

*Scoring system*

Each item in the checklist scored as follows: Two scores if done and one if not done with a minimum score of 50 and a maximum of 100. The score of total practice was classified as the follows:

- Satisfactory level: ≥ 60%
- Unsatisfactory level: < 60%

#### 4.4.4. Self-efficacy Assessment Scale

It was adapted from *Christian and Krumwiede (2013)*, modified by researchers to assess midwifery nurses' confidence in managing preeclampsia, and translated into Arabic. This test consists of 16 statements, evaluated against a five-point Likert scale that assesses the nurses' self-efficacy. Example of the statements, "I am confident in my ability to assess reflexes (patella, humerus, clonus), collect important physical exams, and administer IV piggyback, among other things." Throughout the investigation, the instrument was measured three times (pre-intervention, post-intervention, and follow-up). Filling out the paramedic form takes roughly 15 minutes.

*Scoring system*

The following is how each statement is graded: Five scores if the response is "very confident," four scores if the answer is "confident," three scores if the answer is "uncertain," two scores if the answer is "not confident," and one score if the answer is "absolutely not." The overall grade is expressed as a percentage. The following is the total score for self-efficacy:

- High self-efficacy: ≥75%
- Moderate self-efficacy: 60 - < 75%
- Low self-efficacy: < 60%

**Supportive materials**

- A comprehensive evaluation of the mother with preeclampsia, clinical procedures including vital signs assessment, maternal abdominal palpation, electronic fetal/cardiac monitoring, insertion of a urinary catheter and start hourly voiding measurements, weigh patient, palpate for edema, assess deep tendon reflexes and clonus, test urine for protein, considering whether women require antihypertensive medication or magnesium sulfate, and keep track of women lab results. Take care of any emergencies that arise.
- Happening Mid-Fidelity Simulation Model: A trained model attached to a monitor with a screen simulates the experience of a woman diagnosed with preeclampsia.
- Clinical scenarios are written scripts created by researchers similar to those in a training video course.

### *4.5. Procedures*

Validity and reliability of the tools: A panel of three specialists assessed the content and face validity of the data collection tool in obstetrics and gynecology. A Cronbach's alpha coefficient test was used to determine the tool's reliability. As indicated by their moderate to high reliability, each of the three tools appears to have rather homogeneous pieces. The knowledge questionnaire had an internal consistency of 0.86, the practice had an internal consistency of 0.87, and self-efficacy had an internal consistency of 0.88.

Ethical considerations: Before starting the study, the Scientific Research Ethics Committee of the University of Port Said, Faculty of Nursing, approved. After the purpose of the study was explained to the participants, they gave their informed consent. The participants used no dangerous techniques, and each participant could withdraw from the study at any time without consequences. Human rights were granted. The information is kept confidential, and a data encoding mechanism is used. Approval to conduct the study: The Dean of the Port Said Faculty of Nursing signed a formal letter specifying the title and purpose of the study. The letter was sent to the director of the Port Said City Specialist Gynecology Hospital.

Before data collection, a pilot study was done with 10% (4 nurses) of the total study participants (40 nurses). It examines the research method's clarity, objectivity, value, and feasibility of the research process. The study included nurses who had taken part in the pilot study.

Fieldwork: The study consumed six-month beginning in October 2021 and terminated in February 2022. The study was carried out in Port Said University's Faculty of Nursing's Obstetrics and Gynecology Clinical Laboratory. The procedures of the study consisted of four phases. They are planning, interview and assessment, implementation, and evaluation phase.

Planning phase: During this phase, the researcher determines the simulation training activity's objectives, creates a scenario and script for the simulation, writes activity instructions, and acquires the necessary equipment.

Interviewing and assessment phase: Firstly, the researchers went to the Obstetrics Department of the Port Said Gynecology Specialist Hospital's learning environment, introduced themselves to the nurses, and explained the learning's aims and self-efficacy. After about 50 minutes, the researchers divided the nurses into four groups. They developed a written plan of weekly visits to the University's School of Nursing's obstetric clinical laboratory, using simulated scenarios for training and instruction.

Implementation phases: All nurses participated in a preeclampsia care clinical simulation. All nurses were separated into eight groups of 4-5 using a simulated mid-fidelity mannequin. A mannequin designed to convey the experience of a pregnant lady diagnosed with preeclampsia is attached to a monitor with a screen. The following courses include simulation-based training:

The first session (educational session). First, nurses received a brief orientation to the simulation experience, which included watching a video of a woman with preeclampsia. Preeclampsia treatment is covered in this video. It includes assessment of vital signs, palpation of the mother's abdomen, electronic fetal/heart monitoring, catheterization and initiation of hourly urine measurements, patient weighing and palpation for edema, assessment of deep tendon reflexes and clonus, and urine testing are among the clinical procedures performed on women diagnosed with preeclampsia. Antihypertensive treatment and magnesium sulfate are required for protein concerns. Besides, keep an eye on the right lab results.

Second session: Nurses were assigned to participate in a clinical scenario for the treatment of preeclampsia and interact with the simulated mid-fidelity model for 15 minutes following the training video session. The clinical scenario included a situation the researchers developed similar to that in the training video session. Nurses collaborate to allocate women's care, plan and implement appropriate care for individual moms, and decide how best to organize it based on the information offered by the circumstance.

Third session: Debriefing for 30 minutes, discussing their simulation lab experience, and determining their performance level.

Evaluation phase: After the simulation training, the researchers assessed nurses' preeclampsia management knowledge, practice, and self-efficacy in an obstetric clinical setting (Port Said Gynecological Hospital) using the same assessment tools, except for sociodemographic data (post-test). Follow-up done after eight weeks, the researchers utilized the same assessment method to examine the impact of the simulation on nurses' knowledge, practice, and self-efficacy in managing preeclampsia in the simulation lab at the University of Port Said's School of Nursing.

### *4.6. Limitations of the study:*

Data collection was difficult because researchers had to assess and score each nurse using different data collection methods.

### *4.7. Data analysis*

Data were analyzed using the Statistical Software for The Social Sciences (SPSS version 20.0). Data was examined, cleaned, arranged, tabulated, and analyzed. The percentages and frequencies of qualitative and quantitative variables' mean and standard deviation are calculated using descriptive statistics. Statistical methods, such as the chi-square test (X2), are used to evaluate statistically significant differences. When comparing two independent populations with normally distributed data, the independence (t) test was applied. Cronbach's alpha coefficient test was used to determine tools' reliability. A significant level is considered at $p \leq 0.05$, a highly significant level is considered at $p \leq 0.01$, and a statistically insignificant difference is $p > 0.05$.

## 5. Results

Table 1 shows that three-quarters of nurses (75%) were between 21 to 31 years old, with a mean age of 29.03±8.66. More than half of them (62.5%) had technical nursing education, and more than two-thirds (70%) had experience of one to five years. More than three-quarters (77.5%) had not attended any preeclampsia care program/workshops, and more than three-quarters of them had their source of information from work experience.

Table 2 shows a highly statistically significant improvement immediately post-simulation compared to pre-simulation training regarding the schedule of antenatal visits during normal pregnancy and high-risk pregnancy, first antenatal tests, Follow up antenatal visits' tests for normal and high-risk pregnancy groups, and Antenatal history components ($p<0.001$). Also, there is a highly statistically significant improvement during follow-up (eight weeks after simulation training) compared to pre-intervention regarding the same items ($p<0.001$). However, there is a significant difference between pre-intervention and follow-up (8 weeks) regarding Antenatal history components ($p<0.05$).

Table 3 shows a highly statistically significant improvement immediately post-simulation training compared to pre-simulation regarding the definition of preeclampsia and eclampsia, risk factors, symptoms and signs, preventive measures, management, and complications of preeclampsia ($p<0.001$). Also, there is a highly statistically significant improvement during follow-up (eight weeks after simulation training) compared to pre-intervention regarding the same items ($p<0.001$).

Figure 1 illustrates the percentage distribution of the total scores of nurses' knowledge immediately post-simulation was 80% of the participants had a good level of knowledge, while it illustrates that they were 7.5% before simulation training.

Table 4 shows a highly statistically significant improvement immediately post-simulation (immediate and follow-up) compared to pre-simulation regarding all items ($p<0.001$) except in assessing vital signs every 15 minutes and correctly performing blood pressure, administering antihypertensive treatment, and administering magnesium sulfate.

Figure 2 illustrates the percentage distribution of the total scores of nurses' practice. The figure illustrates that 85% of the participants had a good level of practice immediately post-simulation training, 80% had a good practice in the follow-up, while it was 35% before simulation training.

Table 5 demonstrates a highly statistically significant improvement immediately post-simulation and during follow-up (eight weeks after simulation training) compared to pre-simulation regarding nurses' expression of their level of confidence in the management of preeclampsia, including assessing vital signs, assessing reflexes (patellar, brachial, clonus), completing full obstetrical admission physical assessment, completing the postpartum assessment, inserting IV lines, administering IV push medication, administering IV piggyback, calculating magnesium sulfate loading dose, monitoring fluid levels, administering blood products, understanding preeclampsia lab values, monitoring CNS involvement with preeclampsia, managing the antepartum patient with disease/condition of preeclampsia, and managing active labor for a patient with disease/condition of preeclampsia, ($p<0.001$).

Figure 2 illustrates the percentage distribution of the total scores of nurses' self-efficacy. The figure illustrates that 90% of the participants had a high level of self-efficacy immediately post-simulation training, 80% had a high level of self-efficacy in the follow-up, while it was 2.5% before simulation training.

Table 6 shows a highly statistically significant positive correlation between practice and self-efficacy pre and immediate post and follow-up (eight weeks after simulation training). Also, there is a highly statistically significant positive correlation between knowledge and self-efficacy during follow-up (eight weeks after simulation training) after stimulation.

**Table (1): Frequency and percentage distribution of studied sample sociodemographic data (n= 40).**

| Socio-Demographic Data | Frequency | % |
|---|---|---|
| **Age in years** | | |
| 21-31 | 30 | 75.0 |
| 32-41 | 5 | 12.5 |
| 42-51 | 5 | 12.5 |
| Mean±SD | 29.03±7.66 | |
| **Educational qualification** | | |
| Secondary nursing education | 13 | 32.5 |
| Technical nursing education | 25 | 62.5 |
| Bachelor of nursing | 2 | 5.0 |
| **Professional title** | | |
| Bedside nurse | 13 | 32.5 |
| Technical nurse | 25 | 62.5 |
| Head nurse | 2 | 5.0 |
| **Years of employment** | | |
| 1-5 | 28 | 70.0 |
| 5-10 | 7 | 17.5 |
| 10-20 | 5 | 12.5 |
| **Attending workshops or programs related to preeclampsia** | | |
| No | 31 | 77.5 |
| Yes | 9 | 22.5 |
| **Source of Information (n=32)** | | |
| Studying | 9 | 28.1 |
| Work experience | 23 | 71.9 |

**Table (2): Comparison of the nurses' knowledge mean score regarding antenatal care at different assessment phases (N= 40).**

| Knowledge items | Pre-simulation | Immediate post-simulation | Follow up (8 weeks) | Paired t-test (1)* | P-value | Paired t-test (2)** | P-value |
|---|---|---|---|---|---|---|---|
| | Mean ±SD | Mean ±SD | Mean ±SD | | | | |
| Schedule antenatal visits for normal pregnancy | 1.17±0.67 | 2.77±0.61 | 2.52±0.67 | -11.61 | <0.001 | -9.56 | <0.001 |
| Schedule antenatal visits for high-risk pregnancy | 1.30±0.72 | 2.77±0.57 | 2.47±0.78 | -10.30 | <0.001 | -7.18 | <0.001 |
| First antenatal visit tests | 1.50±0.55 | 2.55±0.59 | 2.30±0.79 | -7.58 | <0.001 | -5.23 | <0.001 |
| Follow-up antenatal visits' tests for normal pregnancy | 1.80±0.79 | 2.75±0.58 | 2.45±0.84 | -6.44 | <0.001 | -3.52 | <0.001 |
| Follow-up antenatal visits' tests for high-risk pregnancy group | 2.02±0.94 | 2.67±0.57 | 2.47±0.59 | -3.82 | <0.001 | -2.74 | <0.001 |
| Antenatal history components | 2.10±0.92 | 2.77±0.53 | 2.47±0.71 | -4.07 | <0.001 | -2.19 | <0.05 |

**Paired (t1) before intervention versus immediately after simulation training. **Paired (t2) before intervention versus after eight weeks of follow-up.*

**Table (3): Comparison of the nurses' knowledge mean score regarding preeclampsia at different assessment phases (N= 40).**

| Knowledge items | Pre-simulation | Immediate post-simulation | Follow up (8 weeks) | Paired t-test (1)* | P-value | Paired t-test (2)** | P-value |
|---|---|---|---|---|---|---|---|
| | Mean ±SD | Mean ±SD | Mean ±SD | | | | |
| Meaning of preeclampsia | 1.70±0.99 | 2.77±0.53 | 2.45±0.71 | -5.73 | <0.001 | -3.90 | <0.001 |
| Meaning of eclampsia | 1.52±0.78 | 2.70±0.56 | 2.35±0.83 | -6.85 | <0.001 | -4.61 | <0.001 |
| Risk factors of preeclampsia | 1.97±1.54 | 4.02±1.22 | 3.67±1.18 | -6.70 | <0.001 | -5.17 | <0.001 |
| Symptoms of preeclampsia | 1.92±1.18 | 4.07±0.94 | 3.72±1.10 | -10.21 | <0.001 | -6.89 | <0.001 |
| Signs of preeclampsia | 1.67±0.94 | 2.77±0.42 | 2.45±0.78 | -7.28 | <0.001 | -4.46 | <0.001 |
| Preventive measures of preeclampsia. | 2.30±1.38 | 3.72±0.98 | 3.45±1.15 | -6.73 | <0.001 | -4.98 | <0.001 |
| Management of preeclampsia | 2.17±1.63 | 3.80±0.96 | 3.47±1.13 | -6.08 | <0.001 | -4.49 | <0.001 |
| Complications of preeclampsia | 1.92±1.42 | 3.65±1.02 | 3.15±1.05 | -7.02 | <0.001 | -4.29 | <0.001 |

**Paired (t1) Before intervention versus immediately after training. **Paired (t2) before intervention versus after eight weeks of follow up*

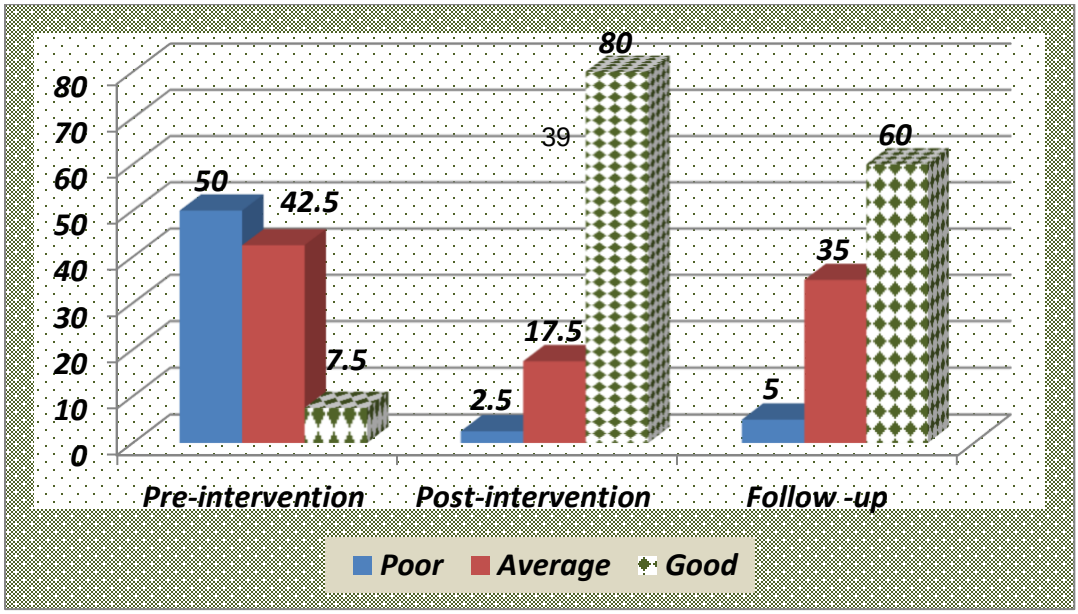


**Figure (1): Percentage distribution of studied sample total knowledge score regarding the management of preeclampsia at different assessment times (n= 40).**

**Table (4): Comparison of the nurses' practice regarding the management of preeclampsia pre and immediate post-simulation training (N= 40).**

| Item | Pre-simulation | | | | Immediate post-simulation | | | | Follow up | | | | Chi-square (1) | P-value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Not done | | Done | | Not done | | Done | | Not done | | Done | | | |
| | No | % | No | % | No | % | No | % | No | % | No | % | | |
| Follow correct measures of infection control during each procedure. | 24 | 60.0 | 16 | 40.0 | 9 | 22.5 | 31 | 77.5 | 12 | 30 | 28 | 70 | 11.60 | <0.001 |
| Assess vital signs every 15 minutes and correctly perform blood pressure. | 29 | 72.5 | 11 | 27.5 | 16 | 40.0 | 24 | 60.0 | 15 | 37.5 | 25 | 62.5 | 8.58 | <0.05 |
| Palpate the mother's abdomen. | 36 | 90.0 | 4 | 10.0 | 7 | 17.5 | 33 | 82.5 | 6 | 15 | 34 | 85 | 42.28 | <0.001 |
| Electronic fetal / Heart monitoring. | 30 | 75.0 | 10 | 25.0 | 4 | 10.0 | 36 | 90.0 | 5 | 12.5 | 35 | 87.5 | 34.57 | <0.001 |
| Insert bladder catheter and start hourly urine measurements. | 30 | 75.0 | 10 | 25.0 | 0 | 0.0 | 40 | 100 | 1 | 2.5 | 39 | 97.5 | 11.42 | <0.001 |
| Use chart for hourly observation of vital signs, oxygen saturation, urine output, fluid input (IV and oral) | 21 | 52.5 | 19 | 47.5 | 0 | 0.0 | 40 | 100 | 1 | 2.5 | 39 | 97.5 | 28.47 | <0.001 |
| Weight the patient and palpate for edema. | 28 | 70.0 | 12 | 30.0 | 0 | 0.0 | 40 | 100 | 2 | 5 | 38 | 95 | 43.30 | <0.001 |
| Assess deep tendon reflexes and clonus | 22 | 55.0 | 18 | 45.0 | 0 | 0.0 | 40 | 100 | 1 | 2.5 | 39 | 97.5 | 30.34 | <0.001 |
| Test urine for protein | 27 | 67.5 | 13 | 32.5 | 10 | 25.0 | 30 | 75.0 | 12 | 30 | 28 | 70 | 14.53 | <0.001 |
| No visitors and Reduce stimulation from noise and light. | 18 | 45.0 | 22 | 55.0 | 0 | 0.0 | 40 | 100 | 1 | 2.5 | 39 | 97.5 | 23.22 | <0.001 |
| Assess CNS as Headache and Visual changes. | 31 | 77.5 | 9 | 22.5 | 0 | 0.0 | 40 | 100 | 0 | 0.0 | 40 | 100 | 50.61 | <0.001 |
| Assess GI system as Nausea/vomiting, Epigastric pain | 34 | 85.0 | 6 | 15.0 | 1 | 2.5 | 39 | 97.5 | 3 | 7.5 | 37 | 93.5 | 55.31 | <0.001 |
| Inform obstetric consultants and obstetric anesthetists | 18 | 45.0 | 22 | 55.0 | 0 | 0.0 | 40 | 100 | 2 | 5 | 38 | 95 | 23.22 | <0.001 |
| Inform neonatal unit if <37 weeks' gestation | 32 | 80.0 | 8 | 20.0 | 17 | 42.5 | 23 | 57.5 | 10 | 25 | 30 | 75 | 11.85 | <0.001 |
| Consider the need for antihypertensive treatment | 19 | 47.5 | 21 | 52.5 | 6 | 15.0 | 34 | 85.0 | 5 | 12.5 | 35 | 87.5 | 9.83 | <0.05 |
| Consider the need for magnesium sulfate | 6 | 15.0 | 34 | 85.0 | 0 | 0.0 | 40 | 100 | 1 | 2.5 | 39 | 97.5 | 6.48 | <0.05 |
| Monitored appropriate lab values | 33 | 82.5 | 7 | 17.5 | 6 | 15.0 | 34 | 85.0 | 4 | 10 | 36 | 90 | 36.47 | <0.001 |

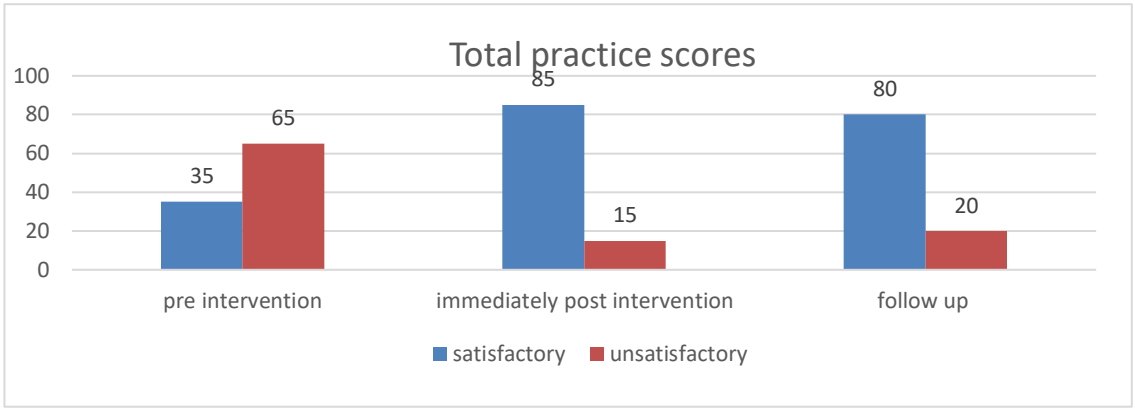


**Figure (2): Percentage distribution of studied sample regarding their total practice score regarding preeclampsia management at different assessment times (n= 40).**

**Table (5): Comparison of the nurses' self-efficacy mean score regarding the management of preeclampsia at different assessment phases (N= 40).**

| I am confident that in the clinical setting, I can: | Pre-simulation | Immediate post-simulation | Follow up (8 weeks) | Paired t-test (1)* | P-value | Paired t-test (2)** | P-value |
|---|---|---|---|---|---|---|---|
| | Mean ±SD | Mean ±SD | Mean ±SD | | | | |
| Assess vital signs (BP, P, R, T) | 2.62±0.92 | 4.67±0.47 | 4.27±0.84 | -12.50 | <0.001 | -9.49 | <0.001 |
| Assess reflexes (patellar, brachial, clonus) | 2.55±0.74 | 3.55±0.81 | 3.05±1.03 | -7.21 | <0.001 | -3.38 | <0.001 |
| Complete full obstetrical admission physical assessment | 2.92±1.07 | 4.07±0.69 | 3.40±1.17 | -7.26 | <0.001 | -2.07 | <0.001 |
| Complete postpartum assessment. | 2.55±1.06 | 4.10±0.67 | 3.45±1.01 | -7.02 | <0.001 | -4.26 | <0.001 |
| Insert IV line. | 2.67±0.99 | 4.77±0.42 | 3.85±1.07 | -11.54 | <0.001 | -5.07 | <0.001 |
| Administer IV push medication. | 2.60±0.77 | 4.72±0.45 | 3.97±0.86 | -15.75 | <0.001 | -8.06 | <0.001 |
| Administer IV piggyback. | 2.17±0.71 | 4.05±6.36 | 2.87±1.28 | 10.43 | <0.001 | -3.50 | <0.001 |
| Calculate magnesium sulfate loading dose | 2.45±0.78 | 4.22±0.94 | 3.05±1.06 | -8.56 | <0.001 | -3.07 | <0.001 |
| Monitor fluid levels. | 2.35±0.73 | 3.52±0.93 | 3.55±0.87 | -6.85 | <0.001 | -7.27 | <0.001 |
| Administer blood products. | 2.52±0.75 | 4.60±0.59 | 4.55±0.59 | -12.83 | <0.001 | 12.49 | <0.001 |
| Understand preeclampsia lab values. | 2.50±0.64 | 3.65±0.83 | 3.65±0.80 | -8.14 | <0.001 | -8.42 | <0.001 |
| Monitor CNS involvement with preeclampsia. | 2.85±0.57 | 3.55±0.95 | 3.45±0.93 | -4.24 | <0.001 | -3.58 | <0.001 |
| Manage the antepartum patient with the disease /condition of preeclampsia. | 2.17±0.90 | 4.17±0.74 | 4.07±0.76 | -11.17 | <0.001 | 10.65 | <0.001 |
| Manage active labor patient with disease /condition of preeclampsia. | 2.25±0.43 | 4.25±0.63 | 4.07±0.72 | -14.42 | <0.001 | 12.40 | <0.001 |

**Paired (t1) Before simulation versus immediately after training. ** Paired (t2) Before simulation versus after eight weeks of follow-up.*

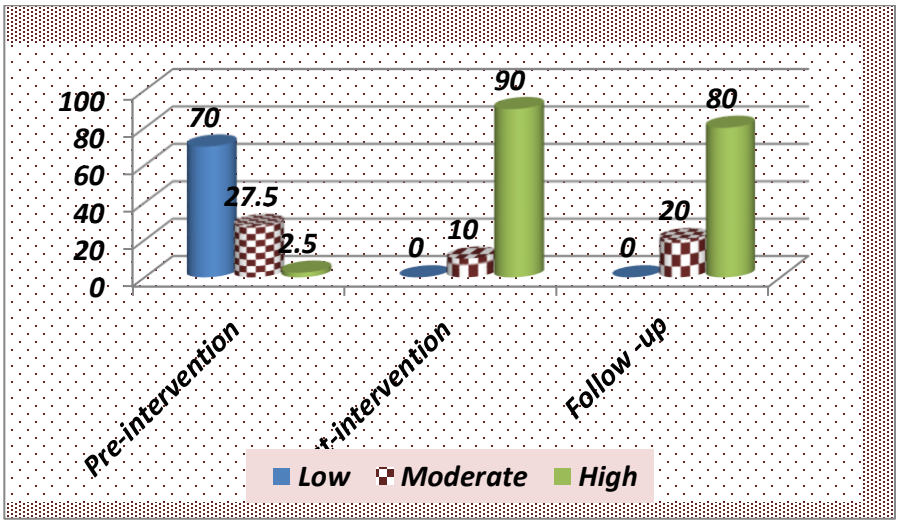


**Figure (3): Percentage distribution of nurses' total self-efficacy score regarding preeclampsia management at different assessment times (N= 40).**

**Table (6): Correlation between studied sample total knowledge, practice, and self-efficacy at different assessment phases (n= 40).**

| Variables | | Pre-simulation | | | Immediate post-simulation | | | Follow-up (8 weeks) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Practice | Knowledge | Self-efficacy | Practice | Knowledge | Self-efficacy | Practice | Knowledge | Self-efficacy |
| **Total practice** | **Pearson Correlation (r)** | 1 | 0.277 | 0.336 | 1 | 0.353 | 0.414 | 1 | 0.343 | 0.674 |
| | **P-value** | | 0.084 | 0.034 | | 0.025 | 0.000 | | 0.030 | 0.000 |
| **Total knowledge** | **Pearson Correlation(r)** | 0.277 | 1 | 0.116 | 0.353 | 1 | -0.010 | 0.343 | 1 | 0.427 |
| | **P value** | 0.084 | | 0.475 | 0.025 | | 0.953 | 0.030 | | 0.006 |
| **Total self–efficacy** | **Pearson Correlation(r)** | 0.336 | 0.116 | 1 | 0.414 | -0.010 | 1 | 0.674 | 0.427 | 1 |
| | **P value** | 0.034 | 0.475 | | 0.000 | 0.953 | | 0.000 | 0.006 | |

## 6. Discussion

Preeclampsia is still a serious risk throughout pregnancy. At 20 weeks of pregnancy, it is classified as a multisystem illness characterized by hypertension and proteinuria with or without edema *(Serban et al., 2018).* Nursing education should try to increase clinical abilities, according to most experts. Clinical practice simulations can assist nurses in improving their capacity to manage factors that may affect their performance with patients or in real-world settings and give them the support they need to perform well. Based on this broad premise. This study aimed to evaluate the effect of simulation-based training on maternity nurses' performance and self-efficacy regarding the management of preeclampsia.

Personal characteristics reveal that three-quarters of registered nurses were between the ages of 21 and 31, with a mean age of 29.03±7.66 years, more than half of registered nurses were technical nurses, and about one-third completed secondary nursing education due to the lack of a nursing school at the time. It matches *Emam and Sabre (2018),* who discovered that more than half of nurses were skilled nurses in a study to analyze the impact of nursing programs on enhancing nurses' knowledge and abilities in caring for women with eclampsia. This match could be owing to the two undergraduates' nursing degrees and job rules being comparable. We believe that nurses' lack of knowledge and practical experience in managing preeclampsia and eclampsia is due to their young age and few years of experience, as evidenced in this study that nearly three-quarters of them had between one and five years. This finding disagreed with *Emam and Sabre (2018),* who discovered that over half of registered nurses have more than ten years of experience. *Verma et al. (2016)* discovered that most nurses had less than two years of overall job experience.

This finding highlights registered nurses' lack of knowledge and expertise in preeclampsia care and their need to enhance their knowledge and practice in this area. Because about a quarter of the study participants attended a scientific workshop after an antenatal care workshop, and the majority did not attend a preeclampsia management course.

These findings are similar to those of *Sheikh et al. (2016),* who discovered some knowledge gaps among healthcare providers in Sindh regarding the genesis, diagnosis, and management of preeclampsia. These findings suggest that a lack of knowledge about preeclampsia management is due to a lack of refresher training and written guidelines for managing patients with preeclampsia in primary and secondary healthcare settings and that preeclampsia management should be included in primary and secondary health care settings. Regularly train healthcare providers in courses and provide management protocols in all healthcare facilities.

*Ishaku et al. (2016)* reported poor knowledge and application of preeclampsia preventive techniques among frontline healthcare workers in Bangladesh in their study "Knowledge and practice of preeclampsia prevention among frontline healthcare providers in Bangladesh." Furthermore, *Adoyi et al. (2016)* discovered that healthcare workers' awareness of preeclampsia is significantly low, obstructing the need to focus on first-line prenatal care in monitoring PE-related health outcomes. Provider competency is crucial for the prevention of preeclampsia, according to on-the-job training for health care personnel.

Moreover, according to the current study, three-quarters of the examined sample had a general awareness of preeclampsia based on their work experience from the researchers' point of view. This data is insufficient to ensure efficiency, necessitating additional training and experience. Introducing simulation-based knowledge and practice lays the groundwork for contemporary research.

Concerning nurses' knowledge mean score regarding antenatal care, the current study shows a highly statistically significant improvement of nurses' knowledge immediately post-simulation compared to pre-simulation training in respect to the schedule of antenatal visits during normal pregnancy and high-risk pregnancy, first antenatal tests, follow up antenatal visits' tests for normal and high-risk pregnancy groups, and antenatal history components. Also, there is a highly statistically significant improvement during follow-up (eight weeks after simulation training) compared to pre-intervention regarding the same items. However, there is a significant difference between pre-intervention and follow-up (8 weeks) regarding antenatal history components.

In terms of the impact of simulation training on nurses' knowledge regarding preeclampsia, the current study finds significant improvements in nurses' knowledge in forms of preeclampsia and eclampsia definitions, risk factors, symptoms and signs, prevention, management, and complications of preeclampsia ($p$<0.001) immediately after the simulation compared to pre-simulation. Furthermore, the current study reveals significant improvements in the follow-up (eight weeks after simulation training) compared

to pre-intervention ($p<0.001$). This result can be explained by a lack of preeclampsia experience and training previous to the intervention and evidence that the simulation training was effective. These findings support the first research hypothesis.

*Kim and Shin (2016)* investigated the impact of nursing process-based simulation of maternal emergency care on clinical nurses' knowledge, attitudes, and abilities. They found that nurses who were taught through simulation outperformed compared to the controls. *Ekaterina et al. (2017)* found that physicians and nurses in all studied disciplines gained considerable knowledge ($p<0.001$, 0.009), and their teamwork scores improved and remained steady for three months after implementing simulation training.

Similarly, *Tabatabaeian et al. (2018)* conducted a study comparing the effects of simulation-based training, blended, and lecture on the simulated performance of midwives in preeclampsia and eclampsia. A three-group clinical trial study was performed on 90 midwives of selected hospitals in Mashhad. They found that mean cognitive ability scores and performance of the management of preeclampsia and eclampsia in the simulation educational group were higher than that of the blended and lecture groups after the intervention, so we can use the simulation education, which is a self-centered method.

According to the current study, nurses' practice in managing preeclampsia has improved significantly immediately after simulation training and after eight weeks, with around two-thirds of nurses performing unsatisfactorily during pre-simulation assessment and the remaining third having satisfactory practice. This improvement might be due to the simulation training being designed as a real-life scenario, preceded by an educational video that motivates nurses to provide their best practice. These findings support the second research hypothesis.

This finding is in line with *Emam and Sabre's (2018)* findings, which revealed that most nurses had poor and average practice before the intervention and that most nurses had good practice after that. Furthermore, *Adoyi et al. (2016)* support this conclusion as they examined the ongoing challenges in providing quality midwifery care for women with preeclampsia and eclampsia in Nigeria. The finding revealed that preeclampsia and eclampsia providers lacked basic instruments such as blood pressure monitors and stethoscopes, urine test strips, and drugs such as magnesium sulfate (MgSO4) and antihypertensive drugs. Improvement after simulation training demonstrates the value of simulation in enhancing nursing practice in an emergency.

The concept of self-efficacy refers to the belief that everyone must evaluate their ability to complete a task successfully. This idea significantly impacts task approach, goal persistence, and effort level *(Goulo., 2014).* After the intervention and eight weeks of follow-up, the current study finds a statistically significant improvement in nurses' self-efficacy to do all care required for the preeclamptic mothers ($p<0.001$). The improvement of self-efficacy might be related to the improved knowledge and clinical skills taught during the simulation training. This rationale was evident in the current study as there is a highly statistically significant positive correlation between practice and self-efficacy pre and immediate post and follow-up (eight weeks after simulation training) and between the self-efficacy and knowledge in follow-up. These findings support the third research hypothesis.

The current findings align with those of *Christian and Krumwiede (2013),* who discovered a statistically significant difference in self-efficacy scores before and after training and eight weeks after training. This finding is also in line with *Kimhi et al. (2016).* They examined the effects of simulation and clinical experience on student nurses' self-efficacy. They found that simulation enhanced confidence and self-efficacy in the same way, whether done before or after the clinical experience.

*Larsen et al. (2017)* observed that individuals who got simulation teaching had more pleasant experiences and greater self-efficacy ratings than those who received a traditional education, which is consistent with the current findings. Similarly, *Hsu et al. (2015)* investigated the effects of scenario-based simulation course training on nurses' communication, competence, and self-efficacy. They found that traditional classroom lectures and simulation-based communication training can improve nurses' communication skills and self-efficacy.

This finding also aligns with *Kimhi et al. (2016),* who found that simulations increased confidence and self-efficacy in both before and post-clinical experiences. Furthermore, *Roh et al. (2016)* investigated the impact of simulation-based resuscitation training combined with clinical practice on nursing student mastery and self-efficacy learning, concluding that comprehensive simulation-based resuscitation training combined with clinical practice may improve nursing students' learning ability and self-efficacy through learner engagement and feedback.

The current study finds a significant increase in overall self-efficacy after the intervention and after eight weeks, even though almost all of the nurses in the study had low-to-moderate self-efficacy in the care of preeclampsia before the intervention. This finding is owing to advancements in nursing practice and knowledge gained during simulation training, as indicated by the positive association between practice and self-efficacy (before, immediate, after eight weeks) and knowledge and self-efficacy during the follow-up.

This finding matches that of *Roh et al. (2016),* who conducted a study investigating the effects of an integrated simulation-based resuscitation skills training with clinical practicum on mastery of learning and self-efficacy in nursing students. Integrated simulation-based resuscitation skills training combined with a clinical practicum might be beneficial for enhancing mastery learning and self-efficacy in nursing students through learner engagement and feedback. Because psychomotor skills and nursing knowledge are linked to self-efficacy, these findings support the notion that knowledge and abilities alone are insufficient

to produce desired outcomes and that self-efficacy as a mediator between knowledge and action.

The current study shows that innovative nursing education strategies, such as simulation-based training, can improve nurses' knowledge and practical abilities and their self-efficacy and confidence in their care delivery. It should be based on new enhancing techniques and advances in nursing practice, which should be reflected in nursing research and based on closing existing gaps in nursing performance related to high-risk populations.

## 7. Conclusion

Based on the findings, the researchers concluded that simulation-based training to manage preeclampsia could improve nurse-midwifery performance (knowledge and practice) and self-efficacy. Furthermore, after the intervention and during follow-up, there was a highly statistically significant positive association between knowledge, practice, and self-efficacy. The preceding findings mostly support the research hypothesis.

## 8. Recommendations

- All nurses in obstetrics and gynecology units should get simulation-based training, particularly in emergency rooms.
- This study should be repeated with additional participants and at more hospitals to acquire meaningful simulation results and gain more statistical power across diverse nurse populations.
- Nursing education programs should use simulation in undergraduate education and promote simulation as a critical component of curriculum development.
- More study is needed on the usefulness of simulation versus traditional methods for midwifery self-efficacy.

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