Effects of Educational Blood Pressure Self-Monitoring Guideline among Preeclamptic Women on Pregnancy Outcomes

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Abstract

Preeclampsia, which affects 2-8% of pregnancies globally and up to 10% in developing countries, is still one of the leading causes of maternal morbidity and mortality. **Aim:** assess the effects of educational blood pressure self-monitoring guideline among preeclamptic women on pregnancy outcomes. **Design:** A quasi-experimental research design was used. **Settings:** Maternal and Child Health Centers served as the study's settings. **Sample:** A purposive sample of 136 pregnant women diagnosed with preeclampsia divided into two groups: intervention and control groups. **Instruments**: I) A structured interview questionnaire. II) Knowledge Assessment Sheet III) Structured self-monitoring practices assessment instruments: used for blood pressure self-measure. IV: Structured pregnancy outcomes instruments: to assess the outcomes of pregnant women's maternal, fetal, and neonatal outcomes in addition to the Apgar score. **Results** there was no statistically significant difference between study and control groups in terms of all aspects of knowledge and practice regarding the effects of educational blood pressure self-monitoring guideline at pre-intervention. While a highly statistically significant difference (P-value≤0.001) was observed between them post-intervention, Regarding the difference between the MCH clinic and self-monitoring readings, data from population studies suggests that home measurements are much closer to clinic BP levels. There were statistically significant differences throughout pregnancy for self-monitored and clinic systolic BP readings (P-value≤0.001). Regarding neonatal death, the study group represented no incidence of neonatal mortality compared to the control group the control group (3.4%). Additionally, the study group experienced fewer fetal and neonatal complications (10.3%) than the control group in terms of NICU hospitalization (29.4%). Comparing the study group to the control group, there is no incidence of stillbirth or neonatal mortality (3 cases, or 3.4%), respectively. **Conclusion**: the positive impact of blood pressure self-monitoring Guideline, reported high significant influential improvement in knowledge, increased empowerment, and control of blood pressure self-monitoring practice in addition to the reductive effect on adverse maternal, fetal, and neonatal outcomes. Additionally, the case group's Apgar score was around three-quarters higher than that of the control group, where over half of the participants had aberrant scores. **Recommendations**: Maternity nurses should consider integrating educational blood pressure self-monitoring guideline into the standard care protocol for pregnant women with preeclampsia.

Keywords: Educational blood pressure self-monitoring guideline, preeclamptic women, pregnancy outcome

Introduction

Hypertensive disorders of pregnancy, including preeclampsia, are significant global health concerns affecting around 10% of pregnancies globally, totaling around 18 million pregnancies annually. Preeclampsia characterized by elevated blood pressure and proteinuria after 20 weeks of gestation, poses substantial risks to both maternal and fetal health. It is considered a placental pathology, as most women typically recover normal blood pressure levels after delivery. The condition is linked to an imbalance of proangiogenic and antiangiogenic factors in the uteroplacental area, alongside inadequate invasion of spiral arteries, contributing to its pathogenesis **(Kuehn, 2022).**

Diagnosis of preeclampsia involves identifying high blood pressure (≥140/90 mmHg) and proteinuria after 20 weeks of gestation, though it can also occur in conjunction with chronic hypertension or in the absence of

proteinuria, where signs of organ damage are sought instead **(Agrawal, 2019).** 2%–10% of pregnancies worldwide are complicated by preeclampsia, which dramatically raises the risk of maternal problems such as eclampsia, placental abruption, postpartum hemorrhage, premature delivery, and increased cesarean section rates.

It also elevates the long-term cardiovascular disease risk and venous thromboembolism, contributing to maternal mortality rates. Neonatal complications associated with preeclampsia include intrauterine growth retardation, prematurity, birth asphyxia, and admission to neonatal intensive care units (Ndwiga et al., 2020). Addressing these complexities requires comprehensive prenatal care strategies and targeted interventions to mitigate risks and improve outcomes for both mothers and babies affected by preeclampsia.

The World Health Organization (WHO) recommends self-measured blood pressure monitoring (SMBP) as a means of controlling hypertension. In line with WHO guideline, health professionals should also advocate for SMBP; however, further research is needed to ascertain the efficacy of this treatment for pregnant patients with hypertension, including pre-eclampsia, chronic hypertension, and gestational hypertension. Such data would show whether SMBP lessens the strain on healthcare systems, promotes patient empowerment and autonomy, and helps diagnose pre-eclampsia early. We performed a comprehensive evaluation on the effects of SMBP during pregnancy on maternal and newborn outcomes to strengthen the body of evidence supporting WHO Guideline on self-care interventions **(Teka et al., 2023).**

Preeclamptic women are intended to be empowered to actively monitor their blood pressure at home through the educational blood pressure self-monitoring guideline. This guideline improves patient awareness and involvement in managing their disease by offering precise instructions and information on taking blood pressure and interpreting the findings. Self-monitoring can enhance pregnancy results by supporting the early identification of complications and facilitating timely medical interventions, allowing for informed decisions regarding the control of hypertension and fetal well-being **(Yeh et al., 2022).**

Self-monitoring blood pressure (SMBP) is useful in identifying and reducing blood pressure in women who are not pregnant but have hypertension and involves taking blood pressure readings outside clinical settings. But most SMBP during pregnancy has been restricted to tiny, nonrandomized feasibility studies—many of which lacked verified blood pressure monitors. Although these trials' low quality and heterogeneity prevent us from drawing firm conclusions, the preliminary findings point to decreased morbidity and resource consumption, acceptability for patients and physicians, and practicality **(Turker et al., 2022).**

However, the lack of definitive methods to prevent preeclampsia limits nurses' ability to provide anticipatory advice and teach patients evidence-based approaches to lowering preeclampsia risk. Current screening methods focus on identifying preeclampsia risk by collecting demographic data, as well as thorough personal and family histories, which are essential for obtaining accurate blood pressure readings and ensuring proper diagnosis and surveillance of preeclampsia. Despite these challenges, nurses play a crucial role in the care and education of women with, and at risk for, preeclampsia.

Significance of the research: The significance of this study is underscored by the substantial impact of preeclampsia on maternal health in Egypt, where it contributes significantly to maternal mortality rates, accounting for 22% of all maternal deaths and 27% of direct obstetric deaths. With a prevalence ranging from 6% to 8% of pregnancies and even higher in referral centers, preeclampsia poses a critical health challenge for Egyptian women. Against this backdrop, President Abdel Fattah El-Sisi's commitment to improving maternal and fetal health through national initiatives, including the supporting maternal and fetal health initiative launched in 2020, highlights the urgent need for effective healthcare interventions. This study responds directly to these challenges by evaluating the impact of educational blood pressure self-monitoring Guideline among preeclamptic women. By assessing how such interventions can improve pregnancy outcomes, including reducing complications and enhancing maternal and neonatal health, the study aims to contribute crucial evidence to support ongoing efforts to enhance maternal healthcare in Egypt. Based on

this initiative this research was created to assess the effect of educational blood pressure self-monitoring Guideline among preeclamptic women on pregnancy outcomes.

Aim of the study

To assess the effects of educational blood pressure self-monitoring guideline among preeclamptic women on pregnancy outcomes

Study hypothesis

1- Preeclamptic women who receive educational blood pressure self-monitoring guideline will have higher knowledge score regarding preeclampsia than those who do not receive.
2- Preeclamptic women who receive educational blood pressure self-monitoring guideline will improve their blood pressure than those who do not receive.
3- Preeclamptic women who receive educational blood pressure self-monitoring guideline will have better pregnancy outcomes compared to those who do not receive.

Operation definition

Preeclampsia is a pregnancy-related medical condition characterized by the development of high blood pressure (hypertension). It is associated with the development of high blood pressure during pregnancy, with systolic blood pressure consistently equal to or greater than 140 mmHg and/or diastolic blood pressure consistently equal to or greater than 90 mmHg and the presence of protein in the urine (proteinuria) after 20 weeks of gestation and edema. Pregnant women diagnosed with pre-eclampsia (mild or moderate). It will be measured using a structured interview questionnaire.

Education Guideline about blood pressure self-monitoring adopted by the WHO in 2021 refers to a structured set of instructions and recommendations provided to women to educate them on the management of mild preeclampsia, the monitoring process, and the importance of monitoring their blood pressure at home. This includes guidance on proper positioning, cuff placement, and the correct use of the device for the frequency and timing of blood pressure self-monitoring. These Guideline serve as a resource to educate individuals on the proper techniques of self-monitoring, recording, and interpreting blood pressure readings and adopting lifestyle modifications to promote better blood pressure control and overall well-being. It will be measured using a practice report assessment sheet for pregnant women using a knowledge assessment sheet tool and structured self-monitoring practices assessment instruments used for blood pressure self-measure.

Pregnancy outcomes include, first, maternal outcomes. Pregnant women's assessments of the results of their pregnancies will be used to quantify it. such as gestational age at delivery, mode of delivery, and maternal complications during pregnancy, labor, and postpartum. The second outcome is fetal and neonatal outcomes such as birth weight, neonatal complications, neonatal intensive care unit (NICU) admissions, intrauterine growth restriction, a preterm pregnancy, and neonatal death or stillbirth. It will be measured using pregnancy outcomes instruments to assess the outcomes of their pregnancy.

Outcome measures:

Antepartum Outcomes: antenatal Outcomes:

Decrease in Elevated Blood Pressure Episodes: The study group experienced fewer episodes of elevated blood pressure, indicating better overall blood pressure management.

Lower Incidence of Severe Preeclampsia: The rate of severe preeclampsia was lower in the study group, suggesting better management or prevention strategies.

Fewer Serious Antenatal Complications: The study group had a reduced number of serious complications during the antenatal period, contributing to better overall maternal health.

Labor and Postpartum Outcomes:

- **Maternal Outcomes:** The study group showed significant improvements in antenatal outcomes compared to the control group. This included a decrease in elevated blood pressure episodes, a lower incidence of severe preeclampsia, and fewer serious antenatal complications. Maternal outcomes during labor and postpartum also favored the study group, with a higher rate of full-term deliveries and normal vaginal births compared to the control group. Cesarean sections in the study group were primarily due

to non-hypertensive reasons, indicating better overall maternal health in this cohort.

Higher Rate of Full-Term Deliveries: More women in the study group carried their pregnancies to full term, which is associated with better outcomes for both mother and baby.

Higher Rate of Normal Vaginal Births: The study group had a higher percentage of normal vaginal deliveries, indicating fewer complications necessitating cesarean sections.

Cesarean Sections Primarily Due to Non-Hypertensive Reasons: When cesarean sections were performed in the study group, they were mostly for reasons unrelated to hypertensive disorders.

Fetal Outcomes: The study group exhibited fewer fetal complications, such as signs of fetal distress and NICU admissions, compared to the control group. Although some infants in the study group had lower birth weights (<2500 gm), they generally had better Apgar scores compared to a significant portion of the control group. This suggests improved fetal outcomes despite the lower birth weights, and NICU admissions which is typical for pregnancies affected.

These results suggest that the study group, with better management of hypertensive disorders and overall maternal health, experienced more favorable outcomes during the antenatal period, labor, and postpartum compared to the control group.

Study Design

This study employs a quasi-experimental research design with study and control groups to assess the effects of educational blood pressure self-monitoring guideline among preeclamptic women on pregnancy outcomes.

Study Settings

The study is set in two health centers participating in the supporting maternal and fetal health initiative: Quibli MCH and Bahari MCH in Shebin El-Kom, Menoufia Governorate. These centers serve approximately 222 and 197 pregnant women annually, respectively, from surrounding cities and villages.

Study Sample

Sample Type: A purposive sample of 140 pregnant women diagnosed with moderate preeclampsia was recruited from the specified health centers over nine months. Four cases were withdrawn (two from the study group and two from the control group), resulting in a final sample of 136 participants.

The retained total cases became 136 participants.

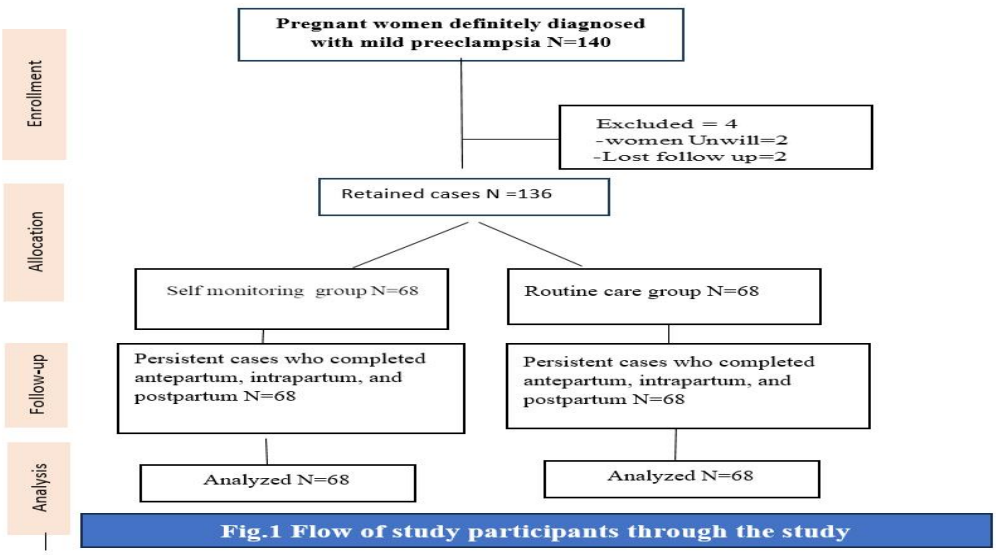

Fig.1 Flow of study participants through the study

Inclusion Criteria:

- Pregnant women with a confirmed diagnosis of mild and moderate preeclampsia.
- Gestational age between 20 to 36 weeks.

- An educated pregnant woman
- No additional medical or obstetric risk factors.
- Sufficient income to purchase a blood pressure monitor (provided to participants to remove economic barriers).
- Willingness to participate in the study.

Exclusion Criteria:

- Presence of other medical or obstetric complications.
- Inability to comply with the study protocol.

Sample Size Calculation:

Using Daniel's (1999) formula: n=Z2×P(1−P) d2n = \frac{Z^2 \times P(1-P)}{d^2}n=d2Z2×P(1−P) where:

- P is the prevalence of preeclampsia (estimated at 8% based on a previous study in Egypt).
- d is the margin of error (5%).
- Z is the Z-value for a 95% confidence level (1.96).

The calculation is as follows: n=(1.96)2×0.08(1−0.08)(0.05)2n = \frac{(1.96)^2 \times 0.08(1-0.08)}{(0.05)^2}n=(0.05)2(1.96)2×0.08(1−0.08) Considering an attrition rate of 20%, the total sample size required is 140, with 70 participants per group.

Data Collection Instruments:

Will be classified into four instruments. The instrument that measures sociodemographic data, instrument measures knowledge, instrument measures practice, and instrument measures pregnancy outcomes.

Instrument I: A structured interview questionnaire: The researchers adopted from (Ben-Ari, et al., 2020) adapted and developed after reviewing the pertinent literature. It was divided into two parts.

Part (1): It includes socio-demographic data, as age in years, educational level, employment status, type of work, and income quality.

Part (2): It included pregnancy-related data such as gestational age in weeks, regularity of follow-up, and place of follow-up.

Instrument II: Structured Knowledge Assessment

Designed by Goddard, Wee, & Vinayakarao (2020) and Munyungula & Shakwane (2021), this instrument assesses participants' knowledge about preeclampsia through nine questions covering the following areas:

- Definition of preeclampsia.
- High-risk factors for preeclampsia.
- Signs and symptoms.
- Methods of diagnosis.
- Preventive measures.
- Complications for mother and fetus.
- Steps to reduce risk of complications.
- Schedule of visits for high-risk pregnant women.

Scoring System:

The scoring of knowledge: For each item, a score of (3) was assigned for a perfectly accurate answer, a score of (2) for an incompletely correct answer, and a score of (1) for an entirely incorrect or unknown answer. The total score for the knowledge of women was classified as the following: - inadequate when the total score is ≤60%. Adequate when the total score is≥ 60.

Instrument III: Structured Self-Monitoring Practices Assessment

Instrument (III): structured self-monitoring practices assessment: - It was adopted by WHO, in 2021: It includes 24 items have four subscales; Women's self-monitoring practices steps regarding measuring blood pressure self-monitoring in the research group **(WHO 2021).**

Scoring system: To obtain the outcome of practice subscales, each statement scored as the following: score (1) for never, score (2) for sometimes, and score (3) for always. The total score is expressed as a percentage, the total practices score was converted into a percentage

and classified into - The total score of women's practices was classified as the following Satisfactory practices ≥ 60%and unsatisfactory practices≤ 60%.

Instrument IV: Structured Pregnancy Outcomes Instruments

Part 1: Maternal outcomes: It was designed by **Prabhu, Malha, & Riley, (2021)**. The instruments include time and type of delivery in the control group and self-monitoring in the research group, complications such as severe hypertension, and serious maternal complications.

Part 2: Neonatal and fetal outcome: designed by Katherine et al. (2021). The instruments include Essential data such as gestational age at delivery, stillbirth, neonatal death within 7 days, small for gestational age and admission to neonatal intensive care unit adapted from. In addition to **Apgar scoring:** Virginia Apgar, MD (1909-1974) introduced the Apgar score in 1952**. (Tan, S. Y., & Davis, C. A. (2018).**

Validity:

Four experts in obstetrics and gynecology medicine, obstetrics and gynecology nursing, and community health nursing evaluated the tools' face, content, criterion validity it is already adapted. Regarding the adopted instruments they were also requested to provide feedback on the tool's content, accuracy, relevancy, and relevance to the research goal. Finally, no modifications were made to reflect the judge's decision as tools were adopted and applicable.

Reliability

The self-reported practices checklist had a reliability score of 0.784, the structured interview questionnaire had a reliability score of 0.821, and the remaining instruments had a reliability score of 0.981, as reported by all sources. The reliability study was conducted using the Cronbach Alpha coefficient.

Administrative and ethical considerations:

By letter, the Dean of the Nursing Faculty at Menoufia University granted the directors of the MCH center's administrative permission to carry out this investigation on July 20, 2021. Permission was requested in this letter to collect study data. The goal of the study was described, along with the anticipated results of carrying it out. The goal of the study was explained to the expectant mothers. The participants were advised by the researchers that their participation in the study was completely optional and that they might choose not to participate. The opportunity to leave the study at any time and without giving a reason was provided to pregnant women. They received guarantees that the information they provided would be kept private and used only for study.

Pilot study:

Ten percent of the expectant mothers took part in a pilot study that involved roughly sixteen cases. The final version of the instruments was established by testing the study methodology's variability and clarity, which required modifications based on the pilot study's findings. In a preliminary trial, the pregnant participants were not included in the analysis.

Study Procedure

From September 2021 to May 2022, the study was carried out in four separate phases, covering duration of nine months Three days a week, from 9:00 am to 12:00 pm; researchers visited the study locations, Quibli and Bahari MCH in Shebin El-Kom in the Menoufia Governorate.

Preparatory Phase:

- **Literature Review**: Extensive review of local and international literature on preeclampsia and blood pressure monitoring to inform study design and intervention development.
- **Permissions**: Obtained necessary permissions from the director and head of the study settings to conduct research.
- **Educational Material Development**: Developed an Arabic booklet based on literature review and expert validation. The booklet includes:
    - **Part 1**: Information on preeclampsia definition, importance of blood pressure

monitoring, and monitoring methods.

- **Part 2**: Instructions for using an automated blood pressure monitor, accompanied by illustrated step-by-step guides.

Fig. 2 A digital blood pressure monitor being used to measure someone's blood pressure. The monitor displays systolic and diastolic pressure readings, along with pulse rate. The image highlights the arm cuff connected to the monitor, which is wrapped around the person's upper arm. Kario & Tomitani (2021) advanced blood pressure monitoring devices. Retrieved from https://doi.org/10.1038/s41440-021-00671-3

Interviewing and Assessment Phase:

- **Recruitment**: Participants were recruited during routine MCH clinic visits. Researchers explained the study's objectives, obtained informed consent, and assured participants of confidentiality.
- **Data Collection**: Structured questionnaires were administered to collect sociodemographic data, reproductive history, blood pressure history, and baseline knowledge about preeclampsia.

Implementation Phase

- Researchers developed a comprehensive learning resource on of preeclampsia. This resource covered theoretical knowledge, interpretation skills, and Education Guideline about blood pressure self-monitoring adopted by WHO, in 2021 referred to a structured set of instructions and recommendations provided to women to educate them on the management of mild preeclampsia, monitoring process and importance of monitoring their blood pressure at home. This includes guidance on proper positioning, cuff placement, and the correct use of the device for the frequency and timing of blood pressure self-monitoring. These Guideline serve as a resource to educate individuals on the proper techniques of self-monitoring, recording, and interpreting blood pressure readings and adopting lifestyle modifications to promote better blood pressure control and overall well-being.
- The training included two sessions, each lasting approximately 30-45 minutes and including discussion periods based on participants' progress and feedback.
  - Small group educational sessions were conducted according to participants' availability and readiness. Each participant attended three sessions, each lasting with discussions tailored to their progress, achievements, and feedback.
  - Various teaching methods were employed, including lectures, group discussions, demonstrations, critical thinking exercises, and video presentations to enhance engagement and understanding.
  - Supportive tools such as educational booklets, stickers, and flyers were provided to reinforce session content and stimulate positive behavioral changes.
  - Each woman was informed about the time of the next sessions. The sessions were conducted in the following order.
  - The researcher started to give health education sessions immediately after the interviewing phase according to subjects needs derived from the pre-test and used a guide educational booklet and pamphlets to facilitate explanation.

Educational Sessions:

- **Session 1**: Participants in the study group received the educational booklet and attended a session covering general knowledge about preeclampsia, including its definition, causes, symptoms, and management. Sessions lasted approximately 45 minutes each.
- **Session 2**: Interactive sessions using audiovisual aids such as group discussions, role-playing, and multimedia presentations

focused on healthy practices related to nutrition, antenatal visits, and self-monitoring blood pressure. Sessions lasted approximately 45 minutes each.

- **Self-Monitoring**: Study group participants practiced self-monitoring of blood pressure using validated automated monitors (e.g., Microlife Watch BP home). They were instructed to monitor BP three times a week and submit readings through WhatsApp or directly to healthcare providers.

Follow-Up Phase

- **Monitoring Visits**: Participants attended regular MCH clinic visits for antenatal care. During visits, researchers assessed blood pressure, weight, proteinuria, and edema for both study and control groups.
- **Data Management**: Self-monitored blood pressure readings were compared with clinic records to evaluate consistency and identify any discrepancies. Data were managed securely, with records stored electronically and accessible to healthcare providers for real-time monitoring and analysis.

Control Group:

Participants assigned to the control group underwent an initial interview and assessment to gauge their understanding of healthy practices related to preeclampsia during pregnancy (pre-test). Throughout the study period, they did not receive any specific intervention from the researchers. Instead, control group participants received standard antenatal care tailored for managing preeclampsia, including regular visits to maternal and child health (MCH) clinics, and adherence to established protocols for blood pressure measurements. Following delivery, researchers assessed both maternal and neonatal outcomes to compare with those of the intervention group.

Evaluation Phase: The evaluation phase consisted of two assessments: one conducted one month after the intervention (post-test) and another after delivery. Both the study and control groups participated in these assessments to evaluate the impact of the intervention on maternal and neonatal outcomes.

1. **Post-Test Evaluation**: After one month from the intervention, participants from both the study and control groups completed a post-test to assess their knowledge and practice related to self-monitoring practices related to preeclampsia during pregnancy. This evaluation aimed to measure any improvements in knowledge and practice among those who received the intervention compared to those who did not.
2. **Maternal and Neonatal Outcomes**: After delivery, researchers assessed maternal and neonatal outcomes in both groups. This evaluation included factors such as maternal blood pressure trends, incidence of severe preeclampsia, mode of delivery, and neonatal health indicators like birth weight, Apgar scores, and complications. By comparing these outcomes between the study and control groups, researchers aimed to determine the overall effectiveness of the intervention in improving health outcomes.

Statistical analysis:

1. Data have been coded and analyzed using the Statistical Package for Social Sciences version 21.0 (SPSS Inc, Chicago, IL). Descriptive analyses using numerical summaries including measures of central tendency and dispersion were performed on the research data to describe the sample characteristics. For determining normality, Kolmogorov-Smirnov was used. Inferential statistics, including repeated measures analysis of variance, Chi-square, and independent t-tests were used to test the research hypotheses. The significance level was set at 5%. Comparison Analysis: A comparative analysis was conducted between the study and control groups for both the pre- and post-test knowledge assessments regarding self-monitoring of blood pressure. This analysis helped identify any significant and comprehensive effects of the intervention on enhancing knowledge and practice related to self-monitoring of blood pressure during pregnancy.

Results

Table 1: Showed the preeclamptic pregnant women's demographic characteristics. Regarding

age, most participants in both the control and study groups were between the ages of 28 and 38. According to education, the current study reported that more than half in both groups (57.4%) and (54.4%) respectively have a university education. Additionally, it showed that over 50% of the study group (53%) were working (including governmental work and Private work) compared to 56.8% in the control group. Meanwhile, more than half of the pregnant women in two groups reported sufficient family income (67.6% & 60.3% respectively) might be related to most of them being employees.

Table 2: displays the blood pressure and obstetrical histories of the subjects. In terms of current pregnancy weeks, it was observed that the study group had a gestational age of 29.5±2.66, while the control group had a gestation age of 28.90±2.14. Furthermore, as most of them have regular follow-ups, there was no statistically significant difference between the two groups regarding the regularity of pregnancy follow-up P (0.396).

Table 3: shows that post-intervention study participants women had significantly better overall knowledge mean scores regarding pre-eclampsia than did their pre-intervention study participants' women during the three phases of the study - pre-intervention, immediately post-intervention, and follow-up (p. 0.001).

Table 4 shows that women who participated in the intervention group showed a substantial improvement in their overall practice mean score in blood pressure self-monitoring throughout the three phases, as compared to women who participated in the pre-intervention study (p. 0.001).

Figure 3 shows MCH and self-monitored systolic BP readings from 28 weeks through pregnancy among the study group. By using RM-ANOVA, there are statistically significant differences throughout 28 to 36 week for self-monitored and clinic systolic BP readings at (P-value≤0.001) with a wide effect size of the intervention on systolic BP (0.98:0.99). In the same direction RM-ANOVA results for self-monitored and MCH diastolic BP readings, there are statistically significant differences throughout 28 to 36 weeks at (P-value≤0.001) with maximum effect size (0.99). Data from population studies suggests that self-monitoring readings measurement is much closer to MCH clinic BP measures.

Configuring MCH readings and home self-monitoring of diastolic BP measurements from week 28 to week 36 of pregnancy among the study group are shown in Fig. 4. Most diastolic point estimates for self-monitoring and MCH readings were within 5 mmHg and 95% confidence intervals overlapped for both systolic and diastolic BP. However, the point estimates for systolic clinic BP tended to be most near to self-monitoring readings.

The antepartum maternal outcome is shown in **Table 5**. The study group had episodes of increased blood pressure (19.1%) compared to the control group's 42.6%. These cases were highly predictive of the study group because they were referred right away and were confirmed by clinic readings. Additionally, the study group observed a clear decrease in the progression to severe preeclampsia, with only one (1.5%) and one (1.5%) of serious prenatal problems recorded in both groups due to a previous case of severe preeclampsia, compared to 13.2% and 16.1% in the control group, respectively. In terms of the maternal outcomes both during and after childbirth, 89.7% of the study group's pregnant women gave birth at full term, but only 66.2% of the control group's women did so. In terms of delivery mode, 86.7% of women give birth vaginally, compared to 52.3% of women in the control group. In relation to postpartum complications there were no postpartum complications in the study group compared to 2.9% developed postpartum precalampsia, 11.7% postpartum hemorrhage and 1.5 complained other complications.

The study and control groups' pregnancy fetal and neonatal outcomes following deliveries are shown in **Table 6**. Regarding neonatal death the study group represented, there no incidence of neonatal mortality compared to (3.4%) in control group. In terms of NICU admission (10.3%) in study group compared to over one-third in the control group, the study group experienced fewer issues than the control. Additionally, the case group's Apgar score was around three-quarters higher than that of the control group.

Table (1): Participants' Scio demographic characteristics.

Items	Total number of pregnant women =136				P- value Significance test
	Study group N=(68)		Control group N= (68)		
	No.	%	No.	%	
Age					
18-<28	21	30.9	29	42.6	0.107
28-<38	46	67.6	35	51.5	
-38 and more	1	1.5	4	5.9	
(SD)	32.19(4.26)		30.88(5.09)		
Educational level					
Basic education	6	8.8	2	3	0.259
Secondary education	23	33.8	29	42.6	
University	39	57.4	37	54.4	
Occupation					
Governmental work	28	41.2	26	38.2	0.625
Private work	8	11.8	12	17.6	
Housewife	32	47.0	30	44.2	
Marital status					
Married	63	92.6	62	91.2	0.263
Divorce	3	4.4	6	8.8	
Widow	2	3	0	0	
Residence					
Rural	24	35.3	27	39.7	0.595
Urban	44	64.7	41	60.3	
income quality					
Not enough	32	47.1	27	39.7	0.387
Enough	46	67.6	41	60.3	

P-value for Chi-square test and/or independent t-test, P Significance * Significant (p≤ 0.05).

Table (2): Participants' obstetrical and blood pressure measuring history.

Items	Total number of pregnant women =136				P- value Significance test
	Study group N=(68)		Control group N= (68)		
	No.	%	No.	%	
Gravidity					
Primigravida	17	25	22	32.4	0.343
Multigravida	51	75	46	67.6	
Gestational week					
(SD)	29.5(2.66)		28.90(2.14)		0.192
Regularity of antenatal follow-up					
Irregular	12	17.6	16	23.5	0.396
Regular	56	82.4	52	76.5	
Did you measure blood pressure at home?					
No	57	83.8	52	76.5	0.282
Yes	11	16.2	16	23.5	
Barriers to measuring blood pressure at home					
No reasons	11	16.2	16	23.5	0.509
Have no device	32	47.0	32	47	
Don't know how to perform it	20	29.4	18	26.5	
Never heard about it before	5	7.4	2	3	

The P-value for Chi-square test and/or independent t-test, P Significance * Significant (p≤ 0.05).

Table (3): Participants' Total Knowledge Scores toward Pre-Eclampsia throughout the three Study Phases

Items	Pregnant women No=136											
	Study group N=(68)						Control group N= (68)					
	Pre		Immediate Post		Follow-up		Pre		Immediate Post		Follow-up	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Total knowledge score=(49)												
Inadequate	53	77.9	00	00	2	2.9	56	82.4	55	80.9	53	77.9
Adequate	15	22.1	68	100	66	97.1	12	17.6	13	19.1	15	22.1
(SD)	24.63(6.15)		51.01(2.67)		43.32(3.33)		23.88(6.46)		24.76(5.67)		24.04(5.52)	
Significance test	F= 617.83		P-value≤0.001		η^2=0.90		F= 2.79		P-value=0.065		η^2= 0.04	

F for repeated measure ANOVA, η^2 = partial eta squared, P Significance * Significant ($p \leq 0.05$).

Table (4): Participants' total self-monitoring practice scores toward blood pressure self-monitoring throughout the three study phases

Items	Pregnant women No=136											
	Study group N=(68)						Control group N= (68)					
	Pre		Immediate Post		Follow-up		Pre		Immediate Post		Follow-up	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Total blood pressure monitoring practice score (16)												
Unsatisfactory	68	100	2	2.9	8	11.8	68	100	63	92.6	65	95.6
Satisfactory	00	00	66	97.1	60	88.2	00	00	5	7.4	3	4.4
(SD)	7.08(1.00)		12.66(1.32)		11.51(1.86)		7.66(0.74)		7.85(0.98)		7.67(0.85)	
Significance test	F=374.79		P-value≤0.001		η^2=0.84		F=2.68		P-value =0.07		η^2=0.038	

F for repeated measure ANOVA, η^2 = partial eta squared, P Significance * Significant ($p \leq 0.05$).

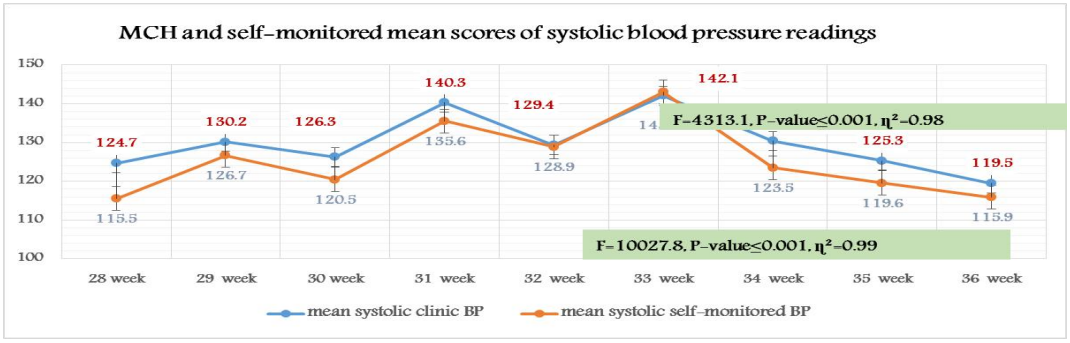

Fig. 3: MCH and self-monitoring systolic blood pressure readings in the study group.

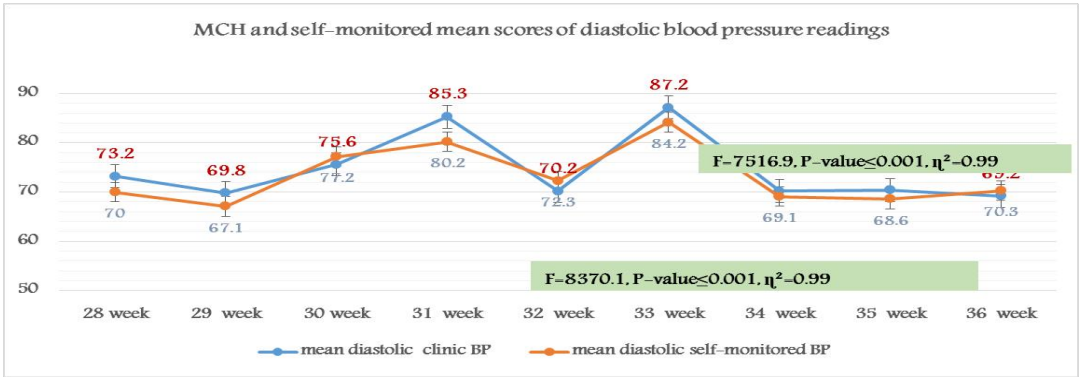

Fig. 4: MCH and self-monitoring of diastolic blood pressure readings in the study group.

Table (5): Distribution of the participants according to maternal outcomes among the study and control group.

Items	Study group N=(68)		Control group N= (68)		Chi-square test and/or Exact tests
	No.	%	No.	%	
Antepartum Maternal outcomes					
1- Elevated blood pressure	13	19.1	29	42.6	X^2 =15,81 ≤0.001
2-Sever preeclampsia	1	1.5	9	13.2	
3-other antenatal complications	1	1.5	11	16.1	
Intrapartum Maternal outcomes					
a-Time of delivery					
Preterm delivery	7	10.3	23	33.8	X^2 =10.94 ≤0.001
Term delivery	61	89.7	45	66.2	
b- Type of delivery					
Normal vaginal delivery	59	86.7	45	52.3	X^2 =12.93 ≤0.001
caesarean section	9	10.3	41	47.7	
Other intrapartum complications	0	0	6	8.8	
Postpartum(N=68)					
Post-partum preeclampsia	0	0	2	2.9	X^2 =16.77 ≤0.001
Postpartum hemorrhage	0	0	8	11.7	
Other post-partum complications	0	0	1	1.5	

X^2: Chi-square test, P Significance * Significant (p≤ 0.05).

Table (6): Distribution of the participants according to fetal and neonatal outcomes among study and control group.

Items	Study group N=(68)		Control group N= (68)		Chi-square test and/or Exact tests
	No.	%	No.	%	
Fetal and Neonatal outcomes					
Neonatal death	0	0	3	3.4	X^2 =19.94 ≤0.001
Living healthy baby	54	79.4	30	44.1	
NICU admission	7	10.3	20	29.4	
Fetal distress	7	10..3	15	22.1	
Apgar score at delivery					
Normal	54	79.4	30	44.1	X^2 =17.94 ≤0.001
Abnormal	14	20.6	38	55.9	
Baby weight					
Less than 2500gm	55	80.9	32	47.1	X^2 =16.87 ≤0.001
More than 2500gm	13	19.1	36	52.9	

Discussion

Preeclampsia is a pregnancy-specific illness that causes severe morbidity and mortality in both the mother and the fetus. Preeclampsia in women, who are more likely to develop it, is preventable and treatable with early detection. Preeclampsia is a serious global maternal health problem that contributes significantly to both long-term cardiovascular disease (CVD) in the mother and preterm birth of the fetus, as well as severe morbidity and mortality in both.

According to socio-demographic characteristics:

The general features of the sample under investigation and the current study results revealed that the majority of participants in both the control and study groups were between the ages of eighteen and thirty-two years. In addition, most participants were married, and over two-thirds of both groups lived in cities. Furthermore, about half of the respondents had completed university education. This makes using the blood

pressure monitors mandatory. It's also important to note that over half of the study group had jobs and a stable income.

The findings of the current study are consistent with a study entitled "Impact of Self-Care Guideline on Women's Awareness and Identification of Early Signs and Symptoms." This study was conducted by **Pealing et al. (2022)** at Minia University Hospital, Egypt. The same sociodemographic characteristics had been used.

Regarding women's knowledge about preeclampsia:

The current study's findings on the overall knowledge score for blood pressure self-monitoring showed that, pre-intervention, there was no statistically significant difference between the study and control groups because most of them possessed sufficient knowledge. In the meantime, after educational sessions on preeclampsia and blood pressure self-monitoring, the study group's overall knowledge scores considerably improved in comparison to the control group.

The present study's results are consistent with those of **Johanna and Simangele (2021) (2022).** The researcher concluded that educational recommendations were useful in raising pregnant women's awareness of early symptoms and sign identification and in lowering preeclampsia morbidity and mortality rates among mothers and newborns. In the past, blood pressure monitoring has been used to detect pre-eclampsia and assess the health of the fetus. This confirmed that knowledge of something or ignorance of it.

The comparable overall characteristics found in the sample populations can be the reason for the alignment of the results from the two studies. Views and experiences with self-monitoring blood pressure during hypertensive pregnancy: Women considered self-monitoring of blood pressure to be practical and acceptable. They were highly motivated and proactive in their monitoring, indicating improved control, understanding of blood pressure, and reassurance, according to a qualitative review of women's and physicians' experiences by **Pealing et al. (2022)**. The perceived necessity to protect the pregnancy drove women's adherence to SMBP, especially those on hypertension drugs. The intervention was deemed acceptable by the clinicians, notwithstanding the possibility of uncertainty due to BP variability. To combine readings from the home and the clinic, clinicians employed various heuristics. Findings indicated that close collaboration between female clinicians and women was essential for raising awareness and management levels.

In the Gauteng area of South Africa**, Johanna and Simangele (2021)** carried out a knowledge and attitudes study on self-monitoring of blood pressure for patients with preeclampsia. The application of SMBP may alleviate overpopulation in public healthcare facilities, the researchers concluded. Self-monitoring by patients could encourage active engagement and a positive perspective on their pregnancies. Women from lower socioeconomic backgrounds may find it difficult to obtain and buy the equipment.

The results of the current study conflict with a study by **Chappell et al. (2022)** on the impact of self-monitoring blood pressure on blood pressure control in pregnant people with chronic or gestational hypertension. Using a randomized clinical trial with 454 participants, the researchers revealed that blood pressure self-monitoring with telemonitoring did not significantly improve clinic-based blood pressure control among pregnant individuals with chronic or gestational hypertension when compared to usual care. According to the researchers, this might be because the targeted population is different due to disparities in the assessment technique, prevalence of risk factors, and diagnostic criteria.

From the researcher's point of view, the researcher identifies a lack of knowledge among preeclamptic women during pre-training sessions due to inadequate prior education about preeclampsia symptoms, risk factors, and management strategies. This may be due to limited access to comprehensive prenatal education programs or insufficient emphasis on hypertensive disorders in antenatal care settings. However, after interventions, participants typically improve their knowledge levels. These interventions aim to bridge educational gaps, empower women to recognize symptoms early, adhere to monitoring protocols, and make informed healthcare decisions.

Regarding the practice about blood pressure self-monitoring

The total practice score about blood pressure self-monitoring presented in the current study demonstrated that the total practice mean score in blood pressure self-monitoring throughout the three phases was significantly improved in post-intervention study participants' women compared to pre-intervention study participants' women. This illustrates the value and impact of self-monitoring as well as the ease with which the same services may be obtained from home without the need to visit a clinic or other healthcare . In addition, results concerning differences between home measures and clinic measures were almost too close, with no wide-range variation (about 5 mmHg).

The outcomes aligned with the cohort research conducted by **Katherine Tucker et al. in 2020**, which examined the feasibility of blood pressure self-monitoring during pregnancy. The study was conducted in two hospitals in Birmingham and Oxford. According to the study findings, a significant majority of women continued to self-monitor at twenty and thirty-six weeks of pregnancy, respectively, after most of them had home readings adequate for analysis. A notable proportion of the women who self-monitored and developed prenatal hypertension or pre-eclampsia had elevated blood pressure at home before it was detected in the clinic, serving as a perfect predictor.

For both systolic and diastolic blood pressure, self-monitored readings were comparable in value to contemporaneous matched clinic readings. The researcher concluded that self-monitoring of BP in pregnancy is feasible and has the potential to be useful in the early detection of gestational hypertensive disorders, but maintaining self-monitoring throughout pregnancy requires support and probably enhanced training. Also, this agreement was in accordance with **(Chappell et al., 2021).**

A systematic review conducted in a similar direction by **Ping et al. in 2022** sought to evaluate blood pressure self-monitoring in pregnant women with hypertensive conditions. Six studies on values and preferences, six studies on the effectiveness of SMBP, and one study on expenses were found to match the inclusion criteria. Overall, most end users and physicians preferred SMBP over clinic monitoring due to its ease of use, convenience, self-empowerment, and decreased anxiety. SMBP would reduce health sector expenses, according to one study.

Concurred with **Tucker and colleagues (2020)** Self-monitored data were more helpful for both systolic and diastolic blood pressure than contemporaneous matched clinic values because they exhibited overlapping confidence intervals and point estimates that were typically within 5 mmHg. In this investigation, a definitively elevated blood pressure before visiting the clinic was detected at home. Based on the sensitivity analysis, it was possible to diagnose hypertension more quickly in almost a sixth of cases by using lower home criteria. Every two days, women receive a reminder via WhatsApp about checking their blood pressure.

From a researcher's point of view, the study reveals a lack of self-blood pressure monitoring among preeclamptic women, largely due to inadequate prior education about preeclampsia symptoms, risk factors, and effective management strategies. Many women may not have received comprehensive education on this topic or were unaware of its importance in managing preeclampsia. However, targeted interventions can improve self-monitoring practices, emphasizing the importance of regular monitoring for detecting early signs of hypertension and facilitating timely medical intervention. This empowers women to take an active role in their health management during pregnancy, potentially improving maternal outcomes.

As regarding pregnancy outcomes

Regarding maternal outcomes, the results of the current studies show that antenatal maternal outcomes were reported in cases with episodes of elevated blood pressure, which decreased in the study group compared to more than two-thirds in the control group. This was very predictive for the study group, as they were immediately referred to and confirmed by clinic measurements. The study group also reported an obvious reduction in progression to severe preeclampsia and serious antenatal complications; only one of both items was reported in the study group as she had previously severe preeclampsia compared to the control group. Regarding the intrapartum and postpartum maternal outcomes, most of the pregnant women in the study group delivered full-term delivery, compared to more than two-thirds in the control group. Related to type of

delivery, more than four-fifth have normal vaginal delivery compared to more than half in the control group.

Therefore, it is clear that the case group, whether having normal or cesarean delivery, had a higher rate of full-term delivery than the comparison group. Cesarean sections done in the study group were related to non-hypertensive causes (cephalopelvic disproportion, twins' pregnancy, and previous caesarian section). While less than one-third of the control group had normal vaginal births, the majority of the study group experienced term births, compared to over two-thirds of the control group.

From a researcher's viewpoint, the study group showed better maternal health outcomes during labor and postpartum, with higher full-term deliveries and normal vaginal births. Cesarean sections were mostly due to non-hypertensive reasons, reducing complications related to hypertensive disorders. This suggests targeted interventions can improve maternal health by addressing non-hypertensive risk factors. This highlights the importance of promoting natural childbirth and minimizing cesarean sections, enhancing maternal well-being, and potentially reducing healthcare costs associated with pregnancy-related complications, indicating that this strategy has the potential for early detection and reduction of adverse outcomes. So, these findings support the research hypothesis, which was accepted.

Concerning fetal outcomes, While the control group's rate of NICU admission was around one-fifth of the research group's NICU admissions and three occurrences of stillbirth, the study group experienced fewer difficulties than the control group, and a minority of the study group displayed signs of fetal distress. While most members of the study group had normal Apgar scores, the majority of them weighed less than 2500 g, which is normal for preeclamptic women and less than one-third of the control group.

In accord, **Alotaibi et al. (2020)** investigated monitoring pregnancy management and awareness programs in Saudi Arabia and found that mobile health and telemonitoring raised the proportion of safe deliveries and lowered the ratio of issues affecting mothers to newborns. In addition, the ACOG and the International Society for the Study of Hypertension in Pregnancy recommend the use of self-measured BP in women with chronic or gestational hypertension, particularly when uncontrolled.

Based on these findings, **Ahmad et al.'s 2019** study, "Risk factors and outcome of patients with eclampsia at a tertiary hospital in Egypt," comprised 21,690 women who gave birth there; a small percentage were diagnosed with eclampsia. A small percentage of these cases resulted in maternal deaths. The primary risk factors identified were young age, nulliparity, low educational attainment, inadequate prenatal attendance, and pre-existing medical issues. HELLP syndrome was the most frequent complication. All patients received magnesium sulfate therapy, but parenteral antihypertensive therapy was not provided. Vaginal delivery occurred in less than one-fifth of cases, assisted birth in less than one-tenth, cesarean sections in the majority, with primary cesarean sections in more than half, and intrapartum in a small fraction. Perinatal fatalities occurred in more than one-tenth of cases, primarily due to prematurity and inadequate newborn care. The study concluded that eclampsia has a high rate of morbidity and mortality in this environment and emphasized the need to improve self-management of prenatal, emergency, obstetric, and neonatal care to enhance outcomes.

In the same line Erkan **Kalafat et al. (2019)**. Adding to this, **Rachel et al. (2018**) revealed that a higher risk of adverse birth outcomes was linked to an increase in blood pressure from the second to the third trimester. Compared with women who did not experience hypertension during pregnancy, women with preeclampsia had increased risks of having children who were preterm, had a low birth weight, or were small for their gestational age. The results suggest that higher maternal blood pressure is associated with impaired fetal growth during the third trimester of pregnancy and increased risks of adverse birth outcomes.

From a researcher's perspective, the study found that an intervention group had fewer fetal complications, including reduced fetal distress and NICU admissions, compared to the control group. Infants in the intervention group had better Apgar scores, suggesting a positive impact on fetal outcomes despite preeclampsia challenges. The lower incidence of fetal distress and NICU admissions suggests improved fetal health

monitoring and management strategies. These findings emphasize the importance of early detection, monitoring, and proactive management of preeclampsia for optimizing maternal and fetal health outcomes.

When collectively taken together, these results reported that the interventional guideline had a highlighted and enhanced effect on improvement**,** empowerment, and control among preeclamptic women who attend the program and practice BLSM, as evidenced by improved knowledge, practice, and pregnancy outcomes, indicating that this strategy has the potential for early detection and reduction of adverse outcomes. So, these findings support the research hypothesis, which was accepted.

Conclusion

Based on the findings of the present study about the effect of educational blood pressure self-monitoring Guideline among preeclamptic women on pregnancy outcomes, preeclamptic women who receive educational blood pressure self-monitoring Guideline have a higher knowledge score regarding preeclampsia than those who do not receive them. This result accepts the first study hypothesis. Also, preeclamptic women who receive educational blood pressure self-monitoring Guideline have a higher blood pressure than those who do not receive them. This result accepts the second study hypothesis. In addition, preeclamptic women who receive educational blood pressure self-monitoring Guideline have better pregnancy outcomes compared to those who do not receive This result accepts the third study hypothesis. Therefore, the findings of this study proved that educational blood pressure self-monitoring Guideline among preeclamptic women accept the hypotheses.

Recommendations:

Considering the research findings on the effects of educational blood pressure self-monitoring Guideline among preeclamptic women on pregnancy outcomes, the following recommendations are suggested:

1. **Integration into Standard Care**: Nurse providers should integrate educational blood pressure self-monitoring Guideline into the standard care protocol for pregnant women with preeclampsia. This integration can enhance patient knowledge, improve blood pressure control, and lead to better pregnancy outcomes.
2. **Promotion of Patient Engagement**: Nurses and healthcare providers should actively promote patient engagement and self-advocacy by encouraging pregnant women to participate in their own care. This can be achieved through regular education sessions and continuous support, empowering women to monitor and manage their blood pressure effectively.
3. **Provision of Automated Blood Pressure Devices**: Hospitals and clinics providing antenatal care (ANC) should secure and provide automated blood pressure monitoring devices (preferably free) to patients with preeclampsia and those at high risk. Ensuring access to these devices will enable effective self-monitoring at home, contributing to better health management and pregnancy outcomes.
4. **Regular Training for Healthcare Providers**: Continuous training programs should be conducted for healthcare providers to keep them updated on the latest Guideline and best practices in managing preeclampsia. This will ensure that they are well-equipped to educate and support their patients effectively.
5. **Research and Feedback Mechanism**: Establish a mechanism for continuous research and feedback to evaluate the effectiveness of the educational Guideline and make necessary adjustments. Patient feedback should be regularly collected to improve the educational content and delivery methods.
6. **Public Health Campaigns**: Implement public health campaigns to raise awareness about the importance of blood pressure self-monitoring among pregnant women. These campaigns can help in early identification and management of preeclampsia, ultimately improving pregnancy outcomes on a broader scale.

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