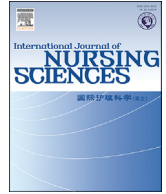




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## Review

## A review of clinical practice guidelines on the management of preeclampsia and nursing inspiration

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## ABSTRACT

**Objectives:** To review, evaluate, and synthesize the recommendations of guidelines on preeclampsia (PE) from a nursing perspective.**Methods:** This is a systematic review of international and national guidelines on PE. Electronic databases and related guideline websites were searched from 2013 to 2023. After systematic retrieval and screening, we used the AGREE II tool to appraise the methodological quality of guidelines that met the eligibility criteria. Then, we analyzed and summarized the recommendations using descriptive analysis and the framework method. Furthermore, we rated the quality of evidence and the strength of the recommendations using the GRADE approach.**Results:** Ten guidelines were included, among which eight were deemed “clinically useful” and records were extracted. In total, 31 recommendations, including 46 items on the nursing management of PE, were summarized from three aspects: 1) antenatal care (18 recommendations), including the assessment and regular monitoring of PE, standardized blood pressure (BP) measurement, prevention education for PE, antihypertensive agent monitoring, and magnesium sulfate (MgSO<sub>4</sub>) use; 2) intrapartum care (4 recommendations), including childbirth care; 3) postpartum care (9 recommendations), including regular nursing monitoring, breastfeeding care and longer-term health counseling. Most of the evidence was rated as “very low” (19/46) or “moderate” (15/46) quality. For the strength of the recommendations, 30 items were graded as “strong” and 16 items were rated as “weak”.**Conclusions:** This study provides professional, evidence-based nursing care resources both for preservice education for nursing staff and health care education for women with PE to help them detect and treat PE in a timely manner.© 2024 The authors. Published by Elsevier B.V. on behalf of the Chinese Nursing Association. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## What is known?

- Preeclampsia (PE) is the major cause of maternal and perinatal mortality among pregnant women with hypertension.
- Early recognition and timely interventions for PE are highly important for both maternal and fetal health.
- Clinical practice guidelines are helpful to achieve the best clinical outcomes. However, the evaluation of evidence-based nursing care resources for PE is lacking.

## What is new?

- About 41.30% of the evidence relevant to nursing observation, monitoring, and education was rated as “very low” in terms of quality, but the majority of the recommendations (65.22%) were strongly recommended for clinical nursing practice, indicating that nursing care plays important roles in PE management but lacks high-quality levels of evidence.
- Recommendations, including nursing assessments and regular monitoring, standardized BP measurements, prevention education, the use of MgSO<sub>4</sub>, and long-term health counseling, were consistent among the guidelines. Future studies on defining target BP for non-severe hypertension monitoring in women with PE are needed.

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## 1. Introduction

Preeclampsia (PE) is a pregnancy-specific multi-organ disease characterized by varying degrees of uteroplacental malperfusion and soluble factors released into the circulation [1,2]. According to worldwide reports [3,4], at least 12% of maternal deaths are triggered by PE, which is the major cause of maternal and perinatal mortality among pregnant hypertensive disorders (HDPs) [5]. PE significantly affects both maternal and fetal health [6,7], such as fetal growth restriction, placental abruption, hemolysis, elevated liver enzymes, low platelet syndrome (HELLPs), and postpartum hemorrhage. Additionally, it also can increase the incidence of PE in the next pregnancy and the risk of cardiovascular disease [8,9]. In recent decades, many efforts have been made to improve severe adverse health outcomes caused by PE because the substandard care for women with PE plays a non-negligible role in maternal death [10]. Seeking effective and consensual clinical guidance has become increasingly important for improving the quality of PE care.

To manage this situation, worldwide guidelines on HDPs have been developed by many professional associations of gynecologists and obstetricians [11–20] who are trying to standardize PE care; most of these guidelines focus on the classification, diagnosis, and treatment of PE. However, the evaluation of guidelines identified PE management from a nursing perspective is limited. Timely detection and careful screening by nursing staff are vital for the management of women with PE in health facilities. Studies have shown that practicing midwives lack knowledge of several aspects of PE diagnosis and care, and they strongly call for improved evidence-based care resources for PE management [21,22].

Therefore, we conducted this systematic review of international and national clinical practice guidelines on PE management from a nursing perspective to answer the following question: what is considered the best practice guidance for nursing management with regard to antenatal, intrapartum, and postpartum care with existing or at risk of developing PE? The following steps were undertaken.

- (1) The PE guidelines were systematically retrieved and screened, and the quality of the included guidelines was appraised using the Appraisal of Guidelines, Research and Evaluation II tool (AGREE II).
- (2) We synthesized the best evidence on PE nursing care from the included guidelines using descriptive analysis and the framework method.
- (3) We rated the recommendations using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) grading criteria to provide objective, evidence-based clinical guidance of PE for nursing staff.

## 2. Methods

This study was reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement [23] and the Reporting Items for practice Guidelines in Healthcare (RIGHT) checklist [24].

### 2.1. Search strategy

A systematic literature search was performed using medical subject headings and keywords on the English and Chinese databases, including PubMed, Embase, CINAHL, Web of Science, Cochrane Library, China National Knowledge Infrastructure (CNKI), WanFang, Very Important Person (VIP), and SinoMed. To comprehensively retrieve the PE guidelines, we also searched the

mainstream guideline databases and related organizations (Medical/Nursing societies, Cardiology organizations, Obstetrics & Gynaecology organizations). Considering that the regular update of guidelines is no more than ten years, the publications were limited from January 2013 to June 2022, and we subsequently updated them to December 2023. The search terms and search strategy are presented in [Appendix A](#). After removing all the duplicates, two reviewers independently conducted the initial and secondary screening of the search outputs. Disagreements were resolved via discussion with the third reviewer.

### 2.2. Eligibility criteria

We established the eligibility criteria using the “PICAR” statement [25], see [Table 1](#). Only guidelines that completely followed the criteria were considered, eliminating executive summaries and guideline interpretations.

### 2.3. Quality assessment

Guidelines that met the eligibility criteria were included for quality assessment. Two reviewers appraised the qualities independently using the AGREE II Tool [26], which comprises six domains, including 23 items: scope and purpose (3 items), stakeholder involvement (3 items), rigor of development (8 items), clarity of presentation (3 items), applicability (4 items) and editorial independence (2 items). Each item was scored on a 7-point scale (1-strongly disagree to 7-strongly agree), and the total score and score for each domain were calculated via the formula given by the AGREE II group. In this study, we defined guidelines scoring above 50% as “clinically useful” and less than or equal to 50% as “not recommended for clinical use” according to the AGREE II group [26] and previous reviews [27,28]. The consistency between two independent reviewers was assessed by the intra-class correlation coefficient (ICC), for which a value greater than 0.75 was deemed acceptable [29].

### 2.4. Data extraction and evidence summary

Basic information, including the guideline title, publication year, region, publisher, developing methods, recommendations, and version, was extracted. We used descriptive analysis and the framework method [30] to summarize the recommendations. The specific steps were as follows: 1) preparation (selection and familiarization of recommendations); 2) organizing (analyzing, developing, and applying a working analytical framework); 3) reporting (charting data into the framework matrix and interpreting the data). During the whole process, two reviewers extracted the data, and the third reviewer rechecked the consistency among the recommendations. We also extracted the quality of evidence and strength of recommendation evaluation results if the guidelines used the GRADE grading criteria [31] to help nursing staff easily apply in clinical practice. According to the GRADE approach, the quality of the evidence is divided into four categories: “High” (benefits clearly outweigh risks and burdens, or vice versa); “Moderate” (a good basis for decision-making); “Low” (some basis for decision-making); “Very low” (little basis for decision-making). The strength of the recommendation is rated as “Strong” (benefits clearly outweigh risks and burdens, or vice versa) or “Weak” (benefits, risks and burdens are closely balanced). If another grading method was used in the included guidelines, we traced the data back to the original study and re-evaluated them using GRADE grading criteria.

**Table 1**  
Eligibility criteria.

| PICAR statement                | Contents  |
|--------------------------------|---|
| Population                     | Pregnant women with existing or at risk of developing PE  |
| Intervention (s)               | Management of PE  |
| Content of interest            | Best practice medical/nursing care on women with PE   |
| Attributes of the guidelines   | Publication year: 2013 to 2023<br>Language: Available in English or Chinese<br>Version: Latest version only<br>Publishing organization: By professional medical organizations or official governments<br>Scope: International and national<br>Purpose: Management care of PE<br>Development process: Evidence-based explicitly<br>Intended end-user: Women with potential/existing PE or health care professionals who provide care on PE |
| Recommendation characteristics | Within guidelines text, tables, and or decision paths.  |

Note: PE = preeclampsia.

**3. Results**

**3.1. Search results**

In total, 5,298 records from databases and 37 from related association websites were preliminarily identified. After removing duplicates, 3,811 records were screened by reading titles and abstracts, of which 78 were assessed for full-text. Among them, 63 were excluded (Appendix A), and a total of 10 [11–20] guidelines met the eligibility criteria, among which five topic-specific WHO recommendations were updated and integrated into the 2011 WHO guideline [32–36]. The flowchart for records selection is shown in Fig. 1.

**3.2. Characteristics of the included guidelines**

As shown in Appendix B (Table S1), 4 out of the 10 guidelines were from international organizations: the WHO, the Society of Obstetric Medicine of Australia and New Zealand (SOMANZ), the European Society of Cardiology (ESC), and the International Society for the Study of Hypertension in Pregnancy (ISSHP). The others were from national organizations: the Ministry of Health from New Zealand (MOHNZ), the American College of Obstetricians and Gynaecologists (ACOG) from the USA, the National Institute for Health and Care Excellence (NICE) from the UK, the Queensland

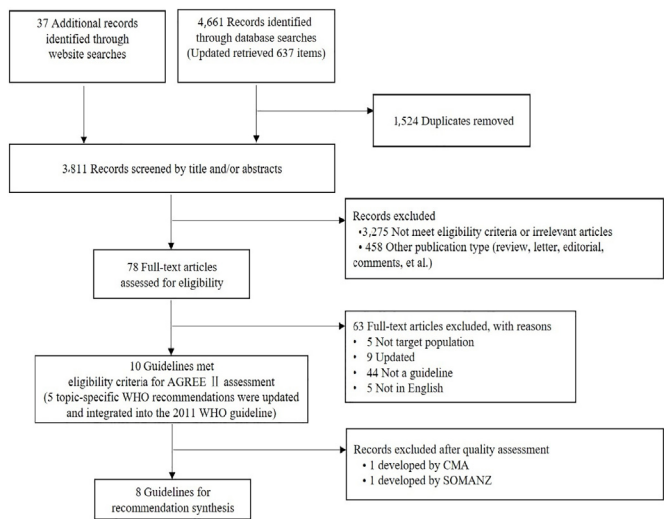
Clinical Guidelines Steering Committee (QCG) from Australia, the Chinese Medical Association (CMA) and the Society of Obstetricians and Gynaecologists of Canada (SOGC) from Canada. All the guidelines generally covered the diagnosis, prediction, prevention and treatment of HDPs. With regard to the quality of evidence and strength of recommendation assessment, five guidelines used the GRADE approach (WHO, MOHNZ, NICE, ISSHP, SOGC), ACOG used the evaluating method developed by the U.S. Preventive Services Task Force, the ESC used the grading method developed by the ESC committee, and the remaining three guidelines did not use any grading system (QCG, CMA, SOMANZ).

**3.3. AGREE II assessment results**

Overall, eight guidelines scored above 50% and were deemed “clinically useful” with records extracted, except for CMA and SOMANZ. The overall scores of the included guidelines and detailed scores of each domain are displayed in Appendix C, respectively. According to WHO guidelines, the MOHNZ and NICE groups had higher overall scores (above 80%). Six guidelines (WHO, MOHNZ, ESC, NICE, QCG, SOGC) scored above 50% in each domain. Among all the guidelines, the highest average score of each domain was for “Editorial Independence” (76%), followed by “Clarity of Presentation” (72%), “Scope and Purpose” (71%), “Stakeholder Involvement” (65%), “Rigour of Development” (60%) and “Applicability” (56%). The ICCs for each domain of the included guidelines ranged from 0.81 to 0.94 (scope and purpose: 0.82; stakeholder involvement: 0.86; rigor of development: 0.92; clarity of presentation: 0.81; applicability: 0.94; editorial independence: 0.89), indicating that the assessment consistency between the two reviewers was acceptable.

**3.4. Summary of recommendations for the management of PE**

Eight clinical practice guidelines that scored above 50% were deemed “clinically useful” and related recommendations were extracted and integrated, see Appendix B (Table S2). In total, we summarized 31 recommendations, including 46 items on the management of PE from a nursing perspective, and other detailed information is shown in Appendix B (Table S3). The recommendations mainly included antenatal, intrapartum, and postpartum care. With respect to the quality of the evidence, the majority was rated as “very low” (41.30%), followed by “moderate” (32.61%), “high” (15.22%) and “low” (10.87%). For the strength of the recommendations, 30 items were graded as “strong,” and 16 items were rated as “weak”. We appraised two recommendations (recommendations 8 and 18) as very low-quality and weak recommendations because the included guidelines did not clearly grade



**Fig. 1.** The flowchart of selected guidelines. CMA = Chinese Medical Association. SOMANZ = Society of Obstetric Medicine of Australia and New Zealand.

these two items due to a lack of evidence. The remaining 29 recommendations summarized were all assessed using the GRADE approach by the guidelines.

### 3.4.1. Antenatal care

In this regard, the goal of care for PE is to achieve an ideal BP control, recognize PE early, and delay the progression to eclampsia during pregnancy. The specific recommendations were summarized into 18 recommendations, including the assessment and regular monitoring of PE ( $n = 6$ ), standardized BP measurement ( $n = 3$ ), prevention education for PE ( $n = 4$ ), antihypertensive agent monitoring ( $n = 3$ ), and magnesium sulfate ( $\text{MgSO}_4$ ) use ( $n = 2$ ), see [Appendix B \(Table S3\)](#).

#### 3.4.1.1. The assessment and regular monitoring of PE

- (1) Preconception counselling is suggested for women with pre-pregnancy hypertension to advise on individualized management during pregnancy (MOHNZ, SOGC) (Low, Weak).
- (2) Using a broad definition of PE for observing: hypertension arising de novo at  $\geq 20$  Weeks' gestation, accompanied by  $\geq 1$  new-onset maternal or fetal adverse conditions (including proteinuria; maternal organ dysfunctions, such as renal insufficiency, liver involvement, neurological complications, cardiorespiratory, and hematological complications; or uteroplacental dysfunctions) (all but WHO) (High, Strong).
- (3) For screening: Women should be screened for PE from early pregnancy (MOHNZ, ESC, NICE, QCG, ISSHP, SOGC) (Moderate, Strong); assessment should be performed by professionals with adequate training in managing PE (NICE, ISSHP) (Low, Strong); for screening content, at a minimum assessing the maternal clinical risk markers of PE; if testing available, using a combination of maternal clinical risk markers, BP, uterine artery pulsatility index, and placental growth factor to individualize the risk of developing PE when assessing (ISSHP, SOGC) (Moderate, Strong).
- (4) For women with PE, maternal assessment during pregnancy should include BP and proteinuria, as well as the components of the full PE integrated estimate of risk score (full PIERS) (used for any gestational age, including gestational age, chest pain/dyspnoea, pulse oximetry, platelet count, serum creatinine, and aspartate aminotransferase or alanine aminotransferase) when performed at least twice weekly to predict adverse outcomes during pregnancy (NICE, ISSHP, SOGC) (Moderate, Strong).
- (5) For fetal monitoring, regular fetal heart rate monitoring or cardiotocography performed 6 hourly where resources are limited, ultrasonographic assessment of fetal growth and liquor volume are recommended (QCG, ISSHP) (Moderate, Strong).
- (6) Observing and educating about abnormal signs and symptoms: educate women (and their families) fully about the need to contact their maternity medical care provider urgently if they experience symptoms of PE: severe headache; problems with vision, such as blurring or flashing before the eyes; severe epigastric or right upper quadrant pain; vomiting; sudden swelling of the face, hands or feet (MOHNZ, NICE, QCG) (Very low, Strong).

#### 3.4.1.2. Standardized BP measurement

- (7) Standardized BP measurement is recommended for diagnosing and monitoring PE (MOHNZ, ESC, ACOG, QCG, ISSHP, SOGC) (Moderate, Strong).
- (8) Measured on  $\geq 2$  consecutive occasions to confirm BP value at initial visit:  $\geq 4$  h apart for non-severe hypertension (MOHNZ, ACOG, QCG, ISSHP, SOGC) (Very low, Weak);  $\geq 15$  min/few minutes apart if severe hypertension ( $\text{BP} \geq 160/110$  mmHg) (MOHNZ, ESC, ACOG, ISSHP) (Very low, Weak).
- (9) Standardized BP measurement (Moderate, Strong): rest prior to measurement (MOHNZ, ACOG, QCG, SOGC); avoid tobacco or caffeine for 30 min preceding the measurement (ACOG, QCG); should be seated (MOHNZ, ESC, ACOG, QCG, ISSHP); arm at the level of the heart (MOHNZ, ESC, ACOG, QCG); measure on both arms at initial visit (QCG, ISSHP, SOGC); appropriate cuff size (MOHNZ, ESC, ACOG, QCG, ISSHP); the aneroid or automated device validated in pregnancy and PE is recommended (MOHNZ, ESC, QCG, ISSHP, SOGC).

#### 3.4.1.3. Prevention education for PE

- (10) Low-dose aspirin is recommended for women at high risk of developing PE (all eight guidelines) (High, Strong).
- (11) Weight management

For all pregnant women, exercise is recommended unless there is uncontrolled hypertension of any type to prevent PE (ISSHP, SOGC) (Moderate, Strong). The optimal weight gain is 5–9 kg (MOHNZ) or  $\leq 6.8$  kg (ESC) for obese women ( $\geq 30$  kg/m<sup>2</sup>) (Very low, Weak).

- (12) Not recommended to prevent PE

Salt restriction (WHO, MOHNZ, NICE) (Moderate, Strong); strict bedrest (WHO, MOHNZ, ACOG, SOGC) (Very low, Strong); restriction of physical activity (MOHNZ) (Very low, Strong).

- (13) Assess, address, and document women's need for psychological care and support, both antenatally and postpartum (MOHNZ) (Very low, Strong).

#### 3.4.1.4. Antihypertensive agent monitoring

- (14) Emphasize educating women so that they clearly understand the importance of taking their antihypertensive drugs as prescribed, the signs and symptoms of PE, and when to report them (MOHNZ) (Very low, Strong).
- (15) Antihypertensive agent: choice of antihypertensive agent for severe hypertension—the first line (Moderate, Strong): IV labetalol, oral nifedipine (all eight guidelines); IV hydralazine (MOHNZ, NICE, ACOG, QCG, ISSHP, SOGC); oral labetalol (NICE, ACOG, ISSHP, SOGC); choice of antihypertensive agent for non-severe hypertension—the first line (Moderate, Strong): methyldopa (all eight guidelines); labetalol, nifedipine (all but WHO); antihypertensive agents to avoid (Low, Strong): angiotensin-converting enzyme (ACE), angiotensin II receptor blockers (ARBs) (all eight guidelines).
- (16) Target BP on antihypertensive therapy: for severe hypertension: 130–150/80–100 mmHg (MOHNZ) (Moderate,



Weak);  $\leq 135/85$  mmHg (NICE) (Very low, Weak);  $\leq 150/100$  mmHg (ACOG) (Very low, Weak); a DBP of 85 mmHg, regardless of SBP (ISSHP, SOGC) (High, Strong). For non-severe hypertension:  $\leq 140/100$  mmHg (MOHNZ) (Moderate, Weak);  $\leq 135/85$  mmHg (NICE) (Very low, Weak); a DBP of 85 mmHg, regardless of SBP (ISSHP, SOGC) (High, Strong).

#### 3.4.1.5. $MgSO_4$ use

- (17)  $MgSO_4$  is recommended for first-line treatment of eclampsia (all eight guidelines) and prophylaxis against eclampsia (all but ESC) in women with PE and severe hypertension or adverse maternal conditions (High, Strong).
- (18) Each unit should have a standard protocol for clinical use and monitoring of  $MgSO_4$  (MOHNZ, QCG, ISSHP, SOGC) (Very low, Strong).

#### 3.4.2. Intrapartum care recommendations

As for intrapartum care, there were four recommendations summarized as follows.

- (19) Nursing staff should know the indications for birth regardless of gestational age (Moderate, Strong): abnormal neurological features such as eclampsia (MOHNZ, NICE, ACOG, QCG, ISSHP, SOGC), cardiorespiratory dysfunctions such as uncontrollable/worsening hypertension (refers that repeated episodes of severe hypertension despite maintenance treatment with three classes of antihypertensive agents) (WHO, NICE, ACOG, QCG, ISSHP, SOGC), severe renal complications such as acute kidney injury (ACOG, ISSHP, SOGC), hemolysis such as progressive thrombocytopenia or platelet count  $< 50 \times 10^9/L$  (NICE, QCG, ISSHP, SOGC), uteroplacental dysfunction such as placental abruption (NICE, ACOG, QCG, ISSHP, SOGC), or HELLP syndrome (MOHNZ, ACOG, QCG); and vaginal delivery should be considered unless a cesarean delivery is required for obstetrical indications (MOHNZ, ACOG, QCG, SOGC).
- (20) Use the left lateral recumbent during labor when measuring BP (MOHNZ, ESC, ACOG, QCG) (Very low, Weak).
- (21) Making the decision about the mode of birth with the woman and the medical team is recommended, and psychological support during delivery is emphasized (MOHNZ, NICE) (Very low, Weak).
- (22) The third stage of labor should be actively managed, and ergometrine should not be administered (MOHNZ, QCG, SOGC) (Very low, Strong).

#### 3.4.3. Postpartum care recommendations

In regard to postpartum care, nine recommendations were summarized, including regular nursing monitoring ( $n = 3$ ), breastfeeding care ( $n = 2$ ), and longer-term health counseling ( $n = 4$ ).

##### 3.4.3.1. Regular nursing monitoring

- (23) Postpartum PE monitoring: PE may worsen or appear for the first time postpartum (ACOG, QCG, ISSHP, SOGC) (Very low, Weak); those with new or worsening hypertension and/or symptoms of PE should be evaluated accordingly, such as measuring BP regularly (at least twice per day in the first two weeks) after delivery, asking women about severe headache and epigastric pain each time BP is measured (MOHNZ, NICE, QCG, ISSHP, SOGC) (Very low, Strong).

- (24) Evaluate women with PE and the need for postnatal preventive treatments for venous thrombus embolism (MOHNZ) (High, Strong).

- (25) Antenatal antihypertensive therapy should be continued (all but ESC), and it is recommended to switch from methyldopa (MOHNZ, ESC, NICE, ACOG, QCG, ISSHP) (Low, Weak).

##### 3.4.3.2. Breastfeeding care

- (26) Breastfeeding is recommended (NICE, ACOG, QCG, ISSHP, SOGC) (Moderate, Strong).
- (27) The recommended antihypertensive drugs for lactating women (Low, Weak): enalapril (NICE, ACOG, QCG, ISSHP, SOGC), labetalol (NICE, ACOG, QCG, SOGC), captopril (ACOG, QCG, ISSHP, SOGC), nifedipine (NICE, QCG, SOGC).

##### 3.4.3.3. Longer-term health counseling

- (28) Clinical follow-up should be provided for women with PE to ensure normalization of hypertension, clinical features, and laboratory test results (ESC, ACOG, QCG, ISSHP, SOGC) (Very low, Weak).
- (29) Following PE, counseling should be provided about the risks of PE in future pregnancy (MOHNZ, NICE, ACOG, QCG, ISSHP) (Very low, Weak).
- (30) Association between the PE and future health risk of diseases (particularly cardiovascular) for the mother and the offspring acknowledged (all but WHO) (Moderate, Strong).
- (31) Healthy lifestyle counseling is recommended to women and their offspring, including eating well, exercising, aiming for ideal body weight, living smoke-free, and aiming for BP  $< 120/80$  mmHg (all but WHO) (High, Strong).

## 4. Discussion

### 4.1. Quality analysis of evidence from clinical practice guidelines on the management of PE

In regard to the assessment of the included guidelines in this study, the domain with the highest average score was “editorial independence,” which was identified as the major flaw in a previous study [37], indicating that the guidelines are more rigorous and scientific about developing procedures than they were ten years ago. The domain with the lowest score was “applicability,” which was the same as that in previous studies [27,37], suggesting that organizations developing guidelines still need to provide more concrete application proposals for future users. It is worth mentioning that the guidelines developed by the WHO, MOHNZ, NICE, and QCG incorporated women representatives and fully considered their opinions during the guideline development process, which should be extensively promoted in other guideline development institutions. With respect to the quality of evidence and the strength of the recommendations, as summarized in the results and in, most of the quality of evidence on PE management from the nursing care perspective was rated as “very low”, indicating that the nursing evidence was mostly derived from expert opinions; further clarification is warranted in future studies. However, the majority of the strength of the recommendations

from the nursing aspect was graded as “strong” by guidelines, indicating that, despite the lack of high-quality evidence, PE progression observation and assessment, drug monitoring and evaluation, and health care education for women with PE from nursing care providers are essential during PE management.

#### *4.2. For antenatal care, nursing staff should accurately conduct PE progress assessment, antihypertensive treatment monitoring, and professional MgSO<sub>4</sub> administrating*

In regard to antenatal care, the broad definition, assessment and regular monitoring, and BP measurement recommendations were consistent. The WHO has recommended standard quality care for pregnant women and neonates throughout the pregnancy, delivery and postpartum periods. The main goals of managing PE include ideal BP control, early recognition of PE, and delaying the progression to eclampsia to optimize the time of birth; these goals are in agreement with the guidelines. First, using a broad definition of PE by medical staff can better identify the risk of adverse outcomes for women and babies [38]. Second, BP measurement and management are crucial for detecting PE progression and guiding medical decisions and care for women with PE [39]; therefore, medical staff should normatively conduct BP measurements. It is vital to note that because dynamic BP changes during pregnancy are distinct and often occur in a shorter time than people outside of pregnancy, BP self-monitoring during pregnancy and ambulatory BP monitoring in adults cannot be extrapolated for women with PE [40]. In addition, the device recommended for BP measurement is the aneroid or automated device validated for pregnancy and PE, and although the mercury sphygmomanometer has been used as the gold standard for measuring BP, mercury BP measurements are no longer used in some countries, such as Australia and New Zealand [17].

Although the first-line antihypertensive agents for treating hypertension were consistent, the guidelines differed in defining target BP for non-severe hypertension in women with PE but were basically similar for severe hypertension (< 135/85 mmHg), indicating that although due to the lack of evidence-based data regarding target BP during pregnancy, the normalization of BP may be the direction of treatment according to recent meta-analyses of randomized controlled trial [41]. Furthermore, nurses' standard observations on recognizing the main vital signs reflecting the progress of PE, such as headache, visual problems, continuous right upper abdomen pain, nausea, and vomiting, are highly important and strongly recommended by guidelines.

Another important factor is the role of MgSO<sub>4</sub> in preventing eclampsia among women with PE with different severe features and reducing the occurrence of recurrent seizures among women with eclampsia [42], which were recommended by all eight guidelines. However, studies have shown that MgSO<sub>4</sub> remains underused, especially in low- and middle-income countries [43], due to the lack of evidence-based resources and translation of knowledge into clear clinical practice guidance for nursing staff [44,45]. This study may provide related resources for improving MgSO<sub>4</sub> use in local clinical contexts, including dose, BP, pulse and respiratory rate monitoring, urine volume observation, deep tendon reflex checking, and toxicity assessment.

#### *4.3. For intrapartum care, nursing staff should provide psychological support at birth*

During the intrapartum part, nursing staff should know the indications for birth regardless of gestational age, such as eclampsia and HELLPs. The guidelines recommended making decisions about the mode of birth with the woman and the medical team, especially

to provide psychological support for women during labor. It is worth mentioning that the complications associated with PE can be very stressful, especially at birth, and the psychoeducational counseling of PE can decrease women's anxiety levels [46] and improve pregnancy outcomes and psychological well-being. It is therefore recommended to assess, address, and document PE and provide support for women during delivery. For example, decisions about the mode of birth should be made with the woman and the medical team. Nursing staff should note that because women with PE are at increased risk of developing postpartum hemorrhage [47], the third stage of labor should be actively managed.

#### *4.4. For postnatal care, nursing staff should actively conduct regular monitoring and be informed of longer-term health counseling for women and their families*

As we know, during the postpartum period, PE may worsen or appear for the first time; thus, medical staff should evaluate women with abnormal symptoms of PE and measure BP regularly. Furthermore, medical staff should be aware of postpartum eclampsia, such as asking women about severe headaches and epigastric pain each time BP is measured. Research has shown that there is a significant relationship between knowledge and PE, and educational interventions by medical staff can effectively improve the knowledge of women with PE [48]. In addition, studies have shown that educational programs combining evidence-based care and women's need for PE management have significant roles in promoting maternal and neonatal health and reducing maternal and perinatal mortality [49–51]. Due to the lack of recognition, women usually do not seek medical help in the first place, resulting in adverse health outcomes [52]; nursing staff should educate pregnant women and their families about abnormal signs or symptoms of PE both antenatally and postpartum.

In addition, antenatal antihypertensive therapy should be continued after birth, and breastfeeding is recommended with appropriate drugs. Therefore, nursing staff should accurately conduct regular postpartum antihypertensive therapy monitoring. The majority of guidelines recommend counseling after birth [53], regular clinical follow-up, risk of future cardiovascular disease and screening, lifestyle interventions, and counseling for future pregnancies, which were consistent among the guidelines. Women with PE who were aware of the future increased risk of cardiovascular disease were more likely to have regular risk factor assessments and adopt a healthy lifestyle [54], indicating that medical staff should educate women and their offspring on these four aspects to achieve a better life.

#### *4.5. Strengths and limitations*

This is the first study to identify, evaluate, and analyze clinical practice guidelines relevant to PE from a nursing perspective. In this study, we systematically reviewed guidelines from literature databases and related association websites and summarized consensus and discrepant recommendations. The entire process was conducted by two independent reviewers, and all the research team members participated in resolving inconsistencies by negotiation. To apply the recommendations more conveniently and easily in clinical practice, we leveled the quality and rated the strength of the recommendations for each piece of evidence using the GRADE approach. This systematic review is not without limitations. Because we included guidelines for PE in English or Chinese, PE management among the general population or other languages was not evaluated, and there may have been potential selection bias. In addition, the majority of the evidence relevant to nursing observation, monitoring, and education was classified as

“very low,” and more studies need to be designed to produce high-quality evidence for nursing education in the future.

#### 4.6. Implications for clinical nursing practice

Timely detection, careful monitoring, and accurate observation of PE progress by nurses and midwives are important. This study provided professional, evidence-based nursing care resources for PE patients from the antenatal, intrapartum, and postnatal periods, which can be used in preservice education to support the participation of nursing staff in PE care. Moreover, these resources can help nursing staff to educate women about the severity of PE, clearly understand the importance of observing abnormal signs and symptoms, and know when to report them.

### 5. Conclusions

In this study, we first systematically and comprehensively identified and evaluated clinical practice guidelines relevant to PE from the perspective of nursing. Ten guidelines were included, among which eight guidelines were deemed “clinically useful.” In total, 31 recommendations, including 46 items on the nursing management of PE, were summarized from three aspects: 1) antenatal care, including the assessment and regular monitoring of PE, standardized BP measurement, prevention education for PE, antihypertensive agent monitoring, and MgSO<sub>4</sub> use; 2) intrapartum care, including childbirth care; 3) postpartum care, including regular nursing monitoring, breastfeeding care, and longer-term health counseling. Our study provided professional, evidence-based nursing care resources both for preservice education for nursing staff and health care education for women with PE to help them detect and treat PE in a timely manner.

#### CRedit authorship contribution statement

**Ruiyang Sun:** Conceptualization, Methodology, Validation, Formal analysis, Data extraction, Writing - original draft, Writing - review & editing. **Xiu Zhu:** Conceptualization, Methodology, Validation, Formal analysis, Writing - review & editing, Supervision, Project administration. **Junying Li:** Methodology, Validation, Formal analysis, Data extraction. **Ting Zhang:** Methodology, Validation, Formal analysis, Data extraction. **Hong Lu:** Conceptualization, Methodology, Validation, Writing - review & editing, Supervision, Project administration.

#### Data availability statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

#### Declaration of competing interest

The authors have declared no conflict of interest or any potential competing interest.

#### Appendices. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijnss.2024.10.010>.

### References

- [1] Chappell LC, Cluver CA, Kingdom J, Tong S. Pre-eclampsia. *Lancet* 2021;398(10297):341–54. [https://doi.org/10.1016/s0140-6736\(20\)32335-7](https://doi.org/10.1016/s0140-6736(20)32335-7).
- [2] Burton GJ, Redman CW, Roberts JM, Moffett A. Pre-eclampsia: pathophysiology and clinical implications. *BMJ* 2019;366:l2381. <https://doi.org/10.1136/bmj.l2381>.
- [3] Say L, Chou D, Gemmill A, Tunçalp Ö, Moller AB, Daniels J, et al. Global causes of maternal death: a WHO systematic analysis. *Lancet Global Health* 2014;2(6):e323–33. [https://doi.org/10.1016/S2214-109X\(14\)70227-X](https://doi.org/10.1016/S2214-109X(14)70227-X).
- [4] Kassebaum NJ, Bertozzi-Villa A, Coggeshall MS, Shackelford KA, Steiner C, Heuton KR, et al. Global, regional, and national levels and causes of maternal mortality during 1990–2013: A systematic analysis for the Global Burden of Disease Study 2013. *Lancet* 2014;384(9947):980–1004. [https://doi.org/10.1016/S0140-6736\(14\)60696-6](https://doi.org/10.1016/S0140-6736(14)60696-6).
- [5] Folk DM. Hypertensive disorders of pregnancy: overview and current recommendations. *J Midwifery Wom Health* 2018;63(3):289–300. <https://doi.org/10.1111/jmwh.12725>.
- [6] Wilson DA, Mateus J, Ash E, Turan TN, Hunt KJ, Malek AM. The association of hypertensive disorders of pregnancy with infant mortality, preterm delivery, and small for gestational age. *Healthcare (Basel)* 2024;12(5):597. <https://doi.org/10.3390/healthcare12050597>.
- [7] Tadese M, Damesa WA, Solomon GS, Wakie GE, Tessema SD, Endale A. Maternal outcomes of pre-eclampsia with severe features and its determinants at abebch gobena mothers and childrens health and saint peter's specialized hospital, addis ababa, Ethiopia: a cross-sectional study. *BMJ Open* 2024;14(3):e081901. <https://doi.org/10.1136/bmjopen-2023-081901>.
- [8] Giorgione V, Ridder A, Kalafat E, Khalil A, Thilaganathan B. Incidence of postpartum hypertension within 2 years of a pregnancy complicated by pre-eclampsia: a systematic review and meta-analysis. *BJOG* 2021;128(3):495–503. <https://doi.org/10.1111/1471-0528.16545>.
- [9] Ackerman-Banks CM, Lipkind HS, Palmsten K, Ahrens KA. Association between hypertensive disorders of pregnancy and cardiovascular diseases within 24 months after delivery. *Am J Obstet Gynecol* 2023;229(1):65.e1–65.e15. <https://doi.org/10.1016/j.ajog.2023.04.006>.
- [10] Schutte JM, Schuitemaker NWE, van Roosmalen J, Steegers EAP, Committee DMM. Substandard care in maternal mortality due to hypertensive disease in pregnancy in The Netherlands. *BJOG* 2008;115(6):732–6. <https://doi.org/10.1111/j.1471-0528.2008.01702.x>.
- [11] Hypertensive disorders in pregnancy subgroup, Chinese society of Obstetrics and gynecology, Chinese medical association. Diagnosis and treatment of hypertension and pre-eclampsia in pregnancy: a clinical practice guideline in China. *Zhonghua Fu Chan Ke Za Zhi* 2020;55(4):227–38. <https://doi.org/10.3760/cma.j.cn112141-20200114-00039>. 2020.
- [12] Lowe SA, Bowyer L, Lust K, McMahon LP, Morton M, North RA, et al. SOMANZ guidelines for the management of hypertensive disorders of pregnancy 2014. *Aust N Z J Obstet Gynaecol* 2015;55(5):e1–29. <https://doi.org/10.1111/ajo.12399>.
- [13] WHO. WHO recommendations for prevention and treatment of pre-eclampsia and eclampsia. Geneva: World Health Organization; 2011. <http://www.who.int/en/>. [Accessed 6 August 2022].
- [14] MOHNZ. Diagnosis and treatment of hypertension and pre-eclampsia in pregnancy in New Zealand. <http://www.healthnz.co.nz/MinistryofHealth>. [Accessed 6 August 2022]. New Zealand.
- [15] Regitz-Zagrosek V, Roos-Hesselink JW, Bauersachs J, Blomstrom-Lundqvist C, Cifkova R, De Bonis M, et al. ESC Guidelines for the management of cardiovascular diseases during pregnancy. *Kardiol Pol* 2018;77(3):245–326. <https://doi.org/10.5603/kp.2019.0049>. 2019.
- [16] ACOG. Gestational hypertension and preeclampsia: ACOG practice bulletin, number 222. *Obstet Gynecol* 2020;135(6):e237–60. <https://doi.org/10.1097/AOG.0000000000003891>.
- [17] QCG. Maternity and neonatal clinical guideline: hypertension and pregnancy. <https://www.health.qld.gov.au/qcgQueenslandClinicalGuideline>. [Accessed 6 August 2022]. Australia.
- [18] Magee LA, Brown MA, Hall DR, Gupta S, Hennessy A, Karumanchi SA, et al. The 2021 International Society for the Study of Hypertension in Pregnancy classification, diagnosis & management recommendations for international practice. *Pregnancy Hypertens* 2022;27:148–69. <https://doi.org/10.1016/j.preghy.2021.09.008>.
- [19] Magee LA, Smith GN, Bloch C, Côté AM, Jain V, Nerenberg K, et al. Guideline No. 426: hypertensive disorders of pregnancy: diagnosis, prediction, prevention, and management. *J Obstet Gynaecol Can* 2022;44(5):547. <https://doi.org/10.1016/j.jogc.2022.03.002>. 71.e1.
- [20] NICE. Hypertension in pregnancy: diagnosis and management. [www.nice.org.uk/guidance/ng133](http://www.nice.org.uk/guidance/ng133). [Accessed 20 January 2024]. NICE guideline, UK.
- [21] Garti I, Gray M, Bromley A, Tan JYB. Midwives' experiences of providing pre-eclampsia care in a low- and middle-income country - a qualitative study. *Women Birth* 2024;37(2):332–9. <https://doi.org/10.1016/j.wombi.2023.11.001>.
- [22] Garti I, Gray M, Tan JY, Bromley A. Midwives' knowledge of pre-eclampsia management: a scoping review. *Women Birth* 2021;34(1):87–104. <https://doi.org/10.1016/j.wombi.2020.08.010>.

- [23] Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *PLoS Med* 2021;18(3):e1003583. <https://doi.org/10.1371/journal.pmed.1003583>.
- [24] Chen YL, Yang KH, Marušić A, Qaseem A, Meerpohl JJ, Flottorp S, et al. A reporting tool for practice guidelines in health care: the RIGHT statement. *Ann Intern Med* 2017;166(2):128–32. <https://doi.org/10.7326/M16-1565>.
- [25] Johnston A, Kelly SE, Hsieh SC, Skidmore B, Wells GA. Systematic reviews of clinical practice guidelines: a methodological guide. *J Clin Epidemiol* 2019;108:64–76. <https://doi.org/10.1016/j.jclinepi.2018.11.030>.
- [26] Brouwers MC, Kho ME, Browman GP, Burgers JS, Cluzeau F, Feder G, et al. Agree II: advancing guideline development, reporting, and evaluation in health care. *Prev Med* 2010;51(5):421–4. <https://doi.org/10.1016/j.ypmed.2010.08.005>.
- [27] Scott G, Gillon TE, Pels A, von Dadelszen P, Magee LA. Guidelines-similarities and dissimilarities: a systematic review of international clinical practice guidelines for pregnancy hypertension. *Am J Obstet Gynecol* 2022;226(2S):S1222–36. <https://doi.org/10.1016/j.ajog.2020.08.018>.
- [28] Zhao Y, Lu H, Zang Y, Li X. A systematic review of clinical practice guidelines on uncomplicated birth. *BJOG* 2020;127(7):789–97. <https://doi.org/10.1111/1471-0528.16073>.
- [29] Koo TK, Li MY. A guideline of selecting and reporting intraclass correlation coefficients for reliability research. *J Chiropr Med* 2016;15(2):155–63. <https://doi.org/10.1016/j.jcm.2016.02.012>.
- [30] Gale NK, Heath G, Cameron E, Rashid S, Redwood S. Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC Med Res Methodol* 2013;13:117. <https://doi.org/10.1186/1471-2288-13-117>.
- [31] Holger SJB, Gordon G, Andrew O. Handbook for grading the quality of evidence and the strength of recommendations using the GRADE approach. Updated, <https://gdt.gradeapro.org/app/handbook/handbook.html>. [Accessed 6 September 2024].
- [32] WHO. WHO recommendations on antiplatelet agents for the prevention of pre-eclampsia. World Health Organization; 2021. <http://www.who.int/en/>. [Accessed 6 August 2022].
- [33] WHO. WHO recommendations on drug treatment for non-severe hypertension in pregnancy. World Health Organization; 2020. <http://www.who.int/en/>. [Accessed 6 August 2022].
- [34] WHO. WHO recommendation on Calcium supplementation before pregnancy for the prevention of pre-eclampsia and its complications. World Health Organization (WHO); 2020. <http://www.who.int/en/>. [Accessed 6 August 2022].
- [35] WHO. WHO recommendations Policy of interventionist versus expectant management of severe pre-eclampsia before term. World Health Organization (WHO); 2018. <http://www.who.int/en/>. [Accessed 6 August 2022].
- [36] WHO. WHO recommendations Drug treatment for severe hypertension in pregnancy. World Health Organization (WHO); 2018. <http://www.who.int/en/>. [Accessed 6 August 2022].
- [37] Luitjes SHE, Wouters MGAJ, König T, Hollander KW, van Os ME, van Tulder MW, et al. Hypertensive disorders in pregnancy: a review of international guidelines. *Hypertens Pregnancy* 2013;32(4):367–77. <https://doi.org/10.3109/10641955.2013.808663>.
- [38] Lai J, Syngelaki A, Nicolaides KH, von Dadelszen P, Magee LA. Impact of new definitions of preeclampsia at term on identification of adverse maternal and perinatal outcomes. *Am J Obstet Gynecol* 2021;224(5):518.e1–518.e11. <https://doi.org/10.1016/j.ajog.2020.11.004>.
- [39] Overton E, Tobes D, Lee A. Preeclampsia diagnosis and management. *Best Pract Res Clin Anaesthesiol* 2022;36(1):107–21. <https://doi.org/10.1016/j.bpa.2022.02.003>.
- [40] Ashworth DC, Maule SP, Stewart F, Nathan HL, Shennan AH, Chappell LC. Setting and techniques for monitoring blood pressure during pregnancy. *Cochrane Database Syst Rev* 2020;8(8):CD012739. <https://doi.org/10.1002/14651858.CD012739.pub2>.
- [41] Attar A, Hosseinpour A, Moghadami M. The impact of antihypertensive treatment of mild to moderate hypertension during pregnancy on maternal and neonatal outcomes: an updated meta-analysis of randomized controlled trials. *Clin Cardiol* 2023;46(5):467–76. <https://doi.org/10.1002/clc.24013>.
- [42] de Oliveira L, Korkes H, Rizzo M, Siallys MM, Cordioli E. Magnesium sulfate in preeclampsia: broad indications, not only in neurological symptoms. *Pregnancy Hypertens* 2024;36:101126. <https://doi.org/10.1016/j.preg-ghy.2024.101126>. Epub 2024/04/25.
- [43] Katageri G, Charantimath U, Joshi A, Vidler M, Ramadurg U, Sharma S, et al. Availability and use of magnesium sulphate at health care facilities in two selected districts of North Karnataka, India. *Reprod Health* 2018;15(Suppl 1):91. <https://doi.org/10.1186/s12978-018-0531-6>.
- [44] Chikalipo MC, Phiri LK, Mndolo N, Mbiza CR, Khisi P, Golombe E, et al. Perception of midwives towards magnesium sulfate use at chatinkha maternity wing in Blantyre, Malawi: a qualitative study. *Int J Womens Health* 2020;12:187–96. <https://doi.org/10.2147/IJWH.S223029>.
- [45] Eddy KE, Vogel JP, Zahroh RI, Bohren MA. Factors affecting use of magnesium sulphate for pre-eclampsia or eclampsia: a qualitative evidence synthesis. *BJOG* 2022;129(3):379–91. <https://doi.org/10.1111/1471-0528.16913>.
- [46] Umamah F, Santoso B, Yunitasari E, Nisa F, Wulandari Y. The effectiveness of psychoeducational counseling in pregnant women with preeclampsia: a systematic review. *J Public Health Res* 2022;11(3):22799036221104161. <https://doi.org/10.1177/22799036221104161>.
- [47] Cagino KA, Wiley RL, Ghose I, Ciomperlik HN, Sibai BM, Mendez-Figueroa H, et al. Risk of postpartum hemorrhage in hypertensive disorders of pregnancy: stratified by severity. *Am J Perinatol* 2024. <https://doi.org/10.1055/a-2297-8790>.
- [48] Gholami K, Norouzkhani N, Kargar M, Ghasemirad H, Ashtiani AJ, Kiani S, et al. Impact of educational interventions on knowledge about hypertensive disorders of pregnancy among pregnant women: a systematic review. *Front Cardiovasc Med* 2022;9:886679. <https://doi.org/10.3389/fcvm.2022.886679>.
- [49] Sharma DD, Chandresh NR, Javed A, Girgis P, Zeeshan M, Fatima SS, et al. The management of preeclampsia: a comprehensive review of current practices and future directions. *Cureus* 2024;16(1):e51512. <https://doi.org/10.7759/cureus.51512>.
- [50] Stan D, Dobre CE, Mazilu DC, Brătilă E. Practices, attitudes and knowledge of midwives and nurses regarding gestational diabetes and pregnancy-induced hypertension. *J Med Life* 2023;16(2):227–34. <https://doi.org/10.25122/jml-2023-0021>.
- [51] Miller MJ, Butler P, Gilchrist J, Taylor A, Lutgendorf MA. Implementation of a standardized nurse initiated protocol to manage severe hypertension in pregnancy. *J Matern Fetal Neonatal Med* 2020;33(6):1008–14. <https://doi.org/10.1080/14767058.2018.1514381>.
- [52] Main EK, McCain CL, Morton CH, Holtby S, Lawton ES. Pregnancy-related mortality in California: causes, characteristics, and improvement opportunities. *Obstet Gynecol* 2015;125(4):938–47. <https://doi.org/10.1097/AOG.0000000000000746>.
- [53] Atkinson J, Simpson G, Walker SP, Tong S, Hastie R, Lindquist A. The long-term risk of cardiovascular disease among women with a history of hypertensive disorders of pregnancy: a systematic review of clinical practice guidelines. *BMC Cardiovasc Disord* 2023;23(1):443. <https://doi.org/10.1186/s12872-023-03446-x>.
- [54] Atkinson J, Wei W, Potenza S, Simpson G, Middleton A, Walker S, et al. Patients' understanding of long-term cardiovascular risks and associated health-seeking behaviours after pre-eclampsia. *Open Heart* 2023;10(1):e002230. <https://doi.org/10.1136/openhrt-2022-002230>.