

Original Article



# Development and Psychometric Assessment of the Knowledge, Attitudes, and Practices Questionnaire Regarding Preeclampsia in Pregnant Women: A Sequential-Exploratory Mixed-Method Study

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**Abstract**

**Introduction:** Preeclampsia remains a leading cause of maternal mortality worldwide and is consistently identified as the second most frequent direct cause of death during pregnancy. Accurate assessment of pregnant women's knowledge, attitudes, and practices regarding preeclampsia requires rigorously developed and psychometrically sound instruments. This study aimed to develop and validate a reliable questionnaire to evaluate knowledge, attitudes, and practices related to preeclampsia among pregnant women.

**Methods:** This study employed a sequential-exploratory mixed-methods design, incorporating a systematic instrument development process to construct a questionnaire tailored to evaluate knowledge, attitudes, and practices related to preeclampsia among pregnant women.

**Results:** An initial pool of 34 candidate items was generated and subsequently refined to a concise 24-item instrument. The Scale Content Validity Index/Average (SCVI/Average) was 0.97, indicating outstanding content validity. Exploratory factor analysis yielded factor loadings ranging from 0.67 to 0.92, supporting the anticipated three-factor structure, with each dimension meeting established psychometric criteria. Test-retest reliability, assessed through repeated administration, yielded an intra-class correlation coefficient (ICC) of 0.90 for the total scale. Internal consistency, evaluated using Cronbach's alpha, demonstrated excellent reliability, with an overall coefficient of 0.92 and subscale coefficients ranging from 0.89 to 0.97.

**Conclusion:** The finalized questionnaire is a reliable and psychometrically robust instrument for assessing pregnant women's knowledge, attitudes, and practices regarding preeclampsia. It can be effectively utilized by healthcare administrators and policymakers to evaluate women's understanding, perceptions, and behavioral responses related to the condition.

**Keywords:** Psychometric evaluation, Knowledge, Attitudes, Practices, Preeclampsia, Pregnant women



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## Introduction

Preeclampsia is recognized as a major contributor to maternal mortality worldwide and is clinically defined as new-onset hypertension arising after 20 weeks of gestation, typically accompanied by proteinuria and potential maternal organ dysfunction (1). As the second leading cause of direct maternal death, it represents a significant

global health challenge (2). Nevertheless, a substantial proportion of preeclampsia-related deaths is preventable through timely, evidence-based clinical interventions. The effectiveness of such interventions depends largely on increasing women's knowledge and fostering positive attitudes toward prevention, early detection, and appropriate management of the condition (3).



According to the World Health Organization (WHO), the global prevalence of preeclampsia ranges from 1.8% to 16.7%, with substantial variation across populations and geographic regions (4). Promoting awareness among pregnant women and facilitating early identification of warning signs can prevent the majority of deaths attributable to preeclampsia, provided that rapid and effective interventions are implemented (5, 6). Despite advances in clinical care, evidence consistently indicates that many pregnant women often possess inadequate knowledge and hold misconceptions regarding preeclampsia (7, 8). Limited awareness and unfavorable attitudes remain significant contributors to maternal morbidity and mortality associated with the disorder. Additionally, shortages of adequately trained healthcare professionals and limited health-system capacity continue to impede the prediction, diagnosis, and management of preeclampsia, particularly in resource-constrained settings (8).

A 2021 study conducted in Ethiopia involving 423 pregnant women reported that only 118 participants (28.8%) demonstrated adequate knowledge of preeclampsia, while 120 (29.3%) exhibited positive attitudes toward the condition. Lower educational attainment and limited participation in educational sessions were strongly associated with inadequate knowledge (9). Similarly, a 2016 study in Tanzania evaluating preeclampsia awareness among 200 adult women revealed that 60% were unaware of the potential consequences of preeclampsia. Such knowledge deficits may increase engagement in high-risk behaviors and delay timely healthcare-seeking (7).

Given the objective of developing and rigorously validating a questionnaire to examine knowledge, attitudes, and practices regarding preeclampsia among pregnant women, a sequential-exploratory mixed-methods design was considered the most appropriate methodological approach. This design is particularly effective for elucidating the dimensional structure of complex constructs and ensuring thorough conceptual development (10). Accordingly, the instrument developed in this study was systematically constructed to assess pregnant women's knowledge, attitudes, and practices related to preeclampsia with methodological rigor and scientific precision.

## Methods

### Design

This study employed a sequential-exploratory mixed-methods approach within a tool-development framework (11). Conducted between March and November 2024, the investigation unfolded in two integrated stages: an initial qualitative, formative phase aimed at generating and refining item content, followed by a quantitative phase devoted to the systematic psychometric evaluation of the resulting instrument.

### Phase One: Qualitative Stage

The formative phase utilized semi-structured, in-depth

individual interviews to capture pregnant women's lived experiences and to generate candidate questionnaire items. Through purposive sampling, 21 pregnant women were recruited. Each interview was conducted face-to-face and lasted approximately 45–60 minutes. Inclusion criteria comprised voluntary informed consent and a history of at least one prior pregnancy, whereas refusal to participate constituted the sole exclusion criterion. Interviews began with general demographic questions (e.g., "How old are you?") and progressed to concept-focused, open-ended questions such as: "Describe a typical day during your pregnancy," "From your perspective, what factors contribute to preeclampsia?" "Which warning signs should pregnant women recognize?", and "What actions should be taken when preeclampsia symptoms arise?" Investigators routinely used probing questions (e.g., "Could you elaborate on what you meant by...?", "Can you give an example or describe an experience?") to enhance the depth and precision of participants' narratives.

Transcripts were analyzed using conventional content analysis in accordance with the approach described by Graneheim and Lundman (12). Each transcript was read repeatedly to achieve immersion in the data and to obtain a comprehensive understanding of the material. Meaningful segments of text, ranging from individual words to extended passages, were identified as meaning units, condensed, and labeled with descriptive codes that reflected their core meaning. Codes were iteratively compared to identify similarities and differences, and conceptually similar codes were grouped into categories. Through successive cycles of constant comparison, abstraction, and reflective interpretation, these categories were synthesized into higher-order themes, which informed the construction of items for the preliminary questionnaire.

### Phase Two: Quantitative Stage (Psychometric Evaluation)

The second phase aimed to evaluate the psychometric properties of the developed instrument. Validity (face, content, and construct) and reliability were evaluated in accordance with the Consensus-based Standards for the Selection of Health Measurement Instruments (COSMIN) framework, and methodological rigor was appraised using the COSMIN checklist (13).

### Participants

Methodological guidelines recommend recruiting between 3 and 10 participants per item when conducting Exploratory Factor Analysis (EFA) (14). To enhance the stability and robustness of factor extraction, a total of 240 pregnant women residing in Fars Province, southern Iran, were recruited using convenience sampling. Inclusion criteria included gestational age of at least 20 weeks (15), sufficient literacy to complete the questionnaire independently, willingness to participate, absence of documented or self-reported psychological disorders, and provision of written informed consent. The only exclusion

criterion was withdrawal from the study at any stage.

### **Psychometric Properties (COSMIN Criteria)**

#### **Face Validity**

Qualitative face validity was examined through interviews with a panel of 15 stakeholders, including ten pregnant women, three obstetrician–gynecologists, and two Ph.D-level experts in reproductive health and instrument development. Panel members evaluated each item in terms of comprehensibility, relevance, difficulty, and overall clarity. Quantitative face validity was subsequently assessed by the same expert panel. Participants rated the importance of each item on a five-point Likert scale ranging from 1 (very unimportant) to 5 (very important). Items with an impact score greater than 1.5 were retained for further analysis (14).

#### **Content Validity**

##### **Qualitative Content Validity**

Qualitative content validity was established through review by 15 evaluators (ten pregnant women, three obstetrician–gynecologists, and two Ph.D experts in reproductive health). Each item was examined for grammatical accuracy, syntactic structure, linguistic clarity, cultural appropriateness, and conceptual relevance. Their feedback was incorporated iteratively to refine item wording and enhance cultural and contextual suitability.

##### **Quantitative Content Validity**

Quantitative content validity was assessed using the Content Validity Ratio (CVR) and Content Validity Index (CVI). For CVR computation, experts rated the necessity of each item on a three-point scale (1=not necessary, 2=useful but not essential, 3=necessary). The CVI was calculated based on ratings from 30 instrumentation specialists, who assessed item relevance, clarity, and simplicity using a four-point scale (1=not relevant to 4=completely relevant) (16). In accordance with established criteria, CVR values greater than 0.33 and CVI values exceeding 0.80 were considered indicative of satisfactory content validity (16).

#### **Construct Validity**

##### **Exploratory Factor Analysis**

Despite prevailing recommendations of three to ten respondents per item for EFA (17), a substantially larger sample ( $n=240$ ) was recruited to enhance the stability and robustness of factor extraction. EFA was conducted using principal component analysis with Varimax rotation. Factor retention decision was determined based on eigenvalues  $> 1$  and standardized factor loadings  $\geq 0.40$ . Sampling adequacy was evaluated using the Kaiser–Meyer–Olkin (KMO) measure and Bartlett’s test of sphericity. Construct validity was considered acceptable if the KMO value exceeded 0.70 and Bartlett’s test was statistically significant ( $P < 0.05$ ). Items with factor loadings below 0.40 were predetermined for removal. However, all items surpassed this threshold and were

therefore retained in the final factor structure.

#### **Reliability**

To ensure the robustness of the questionnaire assessing pregnant women’s knowledge, attitudes, and practices regarding preeclampsia, reliability was evaluated using two complementary approaches: internal consistency and temporal stability. Internal consistency was assessed using Cronbach’s alpha coefficient for the overall scale, with values exceeding 0.70 considered psychometrically acceptable (18). Temporal stability was assessed using a test–retest design. The questionnaire was administered twice to a subgroup of 100 pregnant women with a two-week interval. Stability was quantified using the intra-class correlation coefficient (ICC), with ICC values above 0.80 interpreted as indicative of satisfactory reliability (18).

#### **Data Analysis**

All statistical analyses were conducted using SPSS software (version 23). The normality of data distributions was assessed and confirmed via the Kolmogorov–Smirnov test.

#### **Ethical Considerations**

This study was conducted in strict accordance with the ethical principles of the revised Declaration of Helsinki. Written informed consent was obtained from all participants prior to enrollment. Confidentiality and anonymity of participant data were rigorously maintained, and participants were assured of their unrestricted right to withdraw from the study at any stage without consequences. The study protocol received formal approval from the Research Ethics Committee of Fasa University of Medical Sciences, Fars, Iran (IR.FUMS.REC.1401.247).

#### **Results**

A total of 240 pregnant women participated in the study, with a mean age of  $37.92 \pm 8.47$  years. Additional demographic characteristics are summarized in Table 1. From the initial pool of 34 items derived from qualitative data, 10 items were excluded during the psychometric evaluation process, six during face validity assessment, and four following content validation, resulting in a finalized 24-item instrument. Detailed procedures underlying these item reductions are described in the psychometric testing section.

#### **Face Validity**

Feedback from pregnant women, nursing specialists, obstetrician–gynecologists, and instrument development experts indicated strong consensus that the items were clear, comprehensible, and conceptually aligned with the study’s conceptual framework. Based on calculated impact scores, six items were removed. Consequently, 28 items advanced to the content validation stage.

#### **Content Validity**

Qualitative content evaluation involved 30 pregnant

**Table 1.** Frequency Distribution of Demographic Characteristics (N=240)

Variable		n	%
Age (years)	19-30	144	60
	31-44	96	40
Education Level	Primary school	30	12.5
	High school	55	22.91
	Diploma	120	50
	Upper than Diploma	35	14.58
Occupation	Housewife	168	70
	Government employee	72	30
Family History of Preeclampsia	Yes	96	40
	No	144	60
Place of Residence	Urban	168	70
	Rural	72	30
Gravidity	Primigravida	156	65
	Multigravida	84	35
Gestational Age (weeks)	20-35 Weeks	132	55
	>35 Weeks	108	45

women who reviewed the questionnaire for linguistic clarity and completeness in Persian. No modifications were required based on their feedback. Quantitative content validity was determined using the CVR, derived from expert ratings of item essentiality. According to Lawshe's criteria, a minimum CVR value of 0.33 was required, resulting in the removal of four items that did not meet this standard. The remaining 24 items, encompassing knowledge, attitudes, and practices related to preeclampsia, demonstrated excellent content validity, with CVR values ranging from 0.88 to 1. The item-level CVI ranged from 0.97 to 1.00, and the scale-level average CVI (S-CVI/Ave) was 0.97, confirming excellent content validity.

### Construct Validity

Sampling adequacy was evaluated using the KMO index, which yielded a value of 0.275. EFA demonstrated that all items had loadings above 0.40; therefore, no items were removed. The analysis identified a three-factor solution accounting for 58.44% of the total variance ( $\chi^2=385$ ,  $P<0.001$ ). The confirmed factor loadings ranged from 0.67 to 0.92 (Table 2).

### Reliability (Internal Consistency and Stability)

#### Internal Consistency

Internal consistency for the 24-item scale was measured using Cronbach's alpha, which demonstrated high reliability ( $\alpha=0.92$ ), indicating strong inter-item homogeneity (Table 3). Temporal stability was assessed using the ICC, which yielded a value of 0.90, further supporting the instrument's reliability (Table 4).

#### Assessment of Questionnaire Usability

Usability was evaluated by measuring the average time required for questionnaire completion as an indicator

of feasibility and practical applicability. Participants completed the questionnaire in approximately seven minutes, with individual completion times ranging from five to nine minutes. The non-response rate was below 5%, reflecting both satisfactory engagement and item clarity.

The finalized instrument comprises 24 items distributed across three conceptual domains: knowledge (10 items; items 1–10), attitude (5 items; items 11–15), and practice (9 items; items 16–24). All items are rated on a 5-point Likert scale ranging from *strongly agree* (5) to *strongly disagree* (1). Knowledge scores are interpreted as follows: 10–25 (low knowledge), 26–35 (moderate knowledge), and 36–50 (high knowledge). Attitude scores are interpreted as follows: 5–10 (negative attitude), 11–15 (neutral attitude), and 16–25 (positive attitude). Practice scores are interpreted as follows: 9–25 (poor practice), 26–35 (moderate practice), and 36–45 (good practice).

### Supplementary File

Final questionnaire assessed knowledge, attitudes, and practices regarding preeclampsia among pregnant women.

### Discussion

The primary objective of this study was to develop and conduct a rigorous psychometric evaluation of a comprehensive instrument designed to assess pregnant women's knowledge, attitudes, and practices regarding preeclampsia within the sociocultural context of southern Iran.

Previous investigations in this field reveal notable limitations in both methodological rigor and conceptual scope. Derakhshan et al, for example, evaluated the effects of educational interventions on Iranian pregnant women's knowledge and attitudes regarding preeclampsia using a 21-item instrument (15 knowledge items and 6 attitude items). However, their study did not report systematic procedures for establishing content or construct validity. Reliability was assessed via a two-week test-retest procedure with a sample of 20 participants, yielding a coefficient of 0.7. Moreover, the instrument did not measure behavioral adherence to recommended preventive or management practices, and the item pool was generated solely through literature review without subsequent validation procedures, particularly with respect to construct validity (19).

Similarly, Mekie et al examined knowledge and attitudes toward preeclampsia among pregnant women in Northwest Ethiopia using a researcher-developed questionnaire comprising 12 knowledge items and 11 attitude items. The study did not provide information on validity or reliability assessment, thereby limiting confidence in the methodological robustness of the instrument (9).

Fondjo et al evaluated knowledge of preeclampsia among pregnant women in Ghana using a 32-item instrument scored dichotomously (1=correct, 0=incorrect). Their

**Table 2.** Varimax Factor Loadings of the Instrument Items (N=240)

Factors' Names	Item	Factor Loading
Knowledge	1. Elevated blood pressure is a major symptom of preeclampsia.	0.78
	2. Preterm delivery is a complication of preeclampsia.	0.79
	3. Obesity and advanced maternal age play a role in the development of preeclampsia.	0.83
	4. Cerebral hemorrhage is a complication of preeclampsia.	0.69
	5. Seizures are symptoms of severe preeclampsia.	0.70
	6. Adequate calcium intake is effective in preventing preeclampsia.	0.69
	7. Sudden and excessive weight gain (more than 450 g per week in the third trimester) may indicate preeclampsia.	0.79
	8. Preeclampsia can occur after the 20th week of pregnancy and up to one week postpartum.	0.67
	9. Swelling of the hands and face is an early sign of preeclampsia.	0.81
	10. Preeclampsia is considered an obstetric emergency and requires prompt intervention.	0.77
Attitude	11. If I develop preeclampsia, it will adversely affect my health and that of my baby.	0.76
	12. If I develop preeclampsia, my mode of delivery may be affected.	0.89
	13. A history of hypertension in a previous pregnancy increases the risk of preeclampsia in the current pregnancy.	0.88
	14. Attending antenatal classes can facilitate early recognition of preeclampsia symptoms.	0.75
	15. Monitoring blood pressure and weight can help prevent preeclampsia.	0.88
Practice	16. I measure my blood pressure at every prenatal visit.	0.71
	17. I regularly monitor my weight gain during pregnancy.	0.89
	18. I consume a low-salt diet during pregnancy.	0.80
	19. I adopt preventive measures (e.g., dietary modifications or exercise) to reduce the risk of preeclampsia.	0.79
	20. If I experience symptoms of preeclampsia, I seek immediate medical attention.	0.92
	21. If prescribed antihypertensive medications by the physician, I adhere to the physician's recommendations.	0.90
	22. During medical visits, I discuss the risks of preeclampsia with my healthcare provider.	0.86
	23. I follow health and medical advice to prevent preeclampsia.	0.93
	24. If I experience symptoms of preeclampsia, I avoid self-treatment and traditional medicine.	0.86

**Table 3.** Internal Consistency of the Knowledge, Attitudes, and Practices Questionnaire Regarding Preeclampsia in Pregnant Women

Factors	Subscale	Number of Items	Cronbach's Alpha
1	Knowledge	10	0.97
2	Attitude	5	0.89
3	Practice	9	0.95
Entire Questionnaire		24	0.92

methodology did not explicitly report procedures for evaluating content, construct, or criterion validity. Reliability was reported based on a sample of only 30 participants, yielding a coefficient of 0.81. Notably, the instrument assessed knowledge exclusively, without capturing attitudes or practices related to preeclampsia (20).

In Saudi Arabia, Bahkali et al investigated awareness of preeclampsia among pregnant women in the Western Region using a 42-item knowledge-based questionnaire. The study did not report whether content, construct, or criterion validity assessments were conducted. Reliability, determined using Cronbach's alpha, was reported as 0.81 (21).

Collectively, these prior instruments illustrate a recurring limitation in preeclampsia research: existing tools often fail to integrate all three critical domains—knowledge, attitudes, and practices—while frequently lacking comprehensive validation procedures. The

**Table 4.** ICC Values for the Knowledge, Attitudes, and Practices Questionnaire Regarding Preeclampsia in Pregnant Women

Factor	Subscale	Mean ± SD	ICC	Confidence Interval	P-value
1	Knowledge	32.92 ± 8.47	0.97	0.84 - 0.98	P < 0.05
2	Attitude	10.06 ± 3.26	0.88	0.78 - 0.89	P < 0.05
3	Practice	16.77 ± 7.25	0.92	0.81-0.94	P < 0.05
Entire Questionnaire (Total)		50.98 ± 14.26	0.90	0.79 - 0.92	P < 0.05

Note. ICC: Intra-class correlation coefficient; SD: Standard deviation.

instrument developed in the present study addresses these gaps by incorporating a systematic, multi-stage psychometric evaluation process, thereby enhancing both conceptual comprehensiveness and methodological rigor.

**Limitations**

The questionnaire was designed and validated specifically within the cultural and social context of southern Iran. Therefore, its applicability to other populations may require careful cultural adaptation and re-validation. Additionally, this study did not examine pregnancy-related clinical outcomes, such as the incidence or severity of preeclampsia, gestational hypertension, or preterm birth. Future longitudinal research employing this instrument is recommended to investigate potential associations between measured knowledge, attitudes, and practices and relevant maternal-fetal health outcomes.

## Conclusion

The findings of this study indicate that the developed questionnaire demonstrates strong validity and reliability for assessing pregnant women's knowledge, attitudes, and practices regarding preeclampsia. Accordingly, this instrument provides healthcare policymakers and program planners with a robust and methodologically sound tool for evaluating these critical domains within target populations.

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## Authors' Contribution

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## Competing Interests

The authors declare no competing interests.

## Data Availability Statement

The data supporting the findings of this study could be obtained from the corresponding author upon reasonable request.

## Ethical Approval

This study was conducted in strict accordance with the ethical principles outlined in the revised Declaration of Helsinki. Written informed consent was obtained from all participants prior to enrollment. Participant confidentiality was rigorously maintained, and participants were informed of their right to withdraw at any stage without penalty. The study protocol was approved by the Research Ethics Committee of Fasa University of Medical Sciences, Fars, Iran (IR.FUMS.REC.1401.247).

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## References

- Rana S, Lemoine E, Granger JP, Karumanchi SA. Preeclampsia: Pathophysiology, Challenges, and Perspectives. *Circ Res* 2019;124(7):1094–112. doi:10.1161/circresaha.118.313276
- Palma C, Jellins J, Lai A, Salas A, Campos A, Sharma S, et al. Extracellular Vesicles and Preeclampsia: Current Knowledge and Future Research Directions. *Subcell Biochem* 2021;97:455–82. doi:10.1007/978-3-030-67171-6\_18
- Mihu D, Razvan C, Malutan A, Mihaela C. Evaluation of maternal systemic inflammatory response in preeclampsia. *Taiwan J Obstet Gynecol* 2015;54(2):160–6. doi:10.1016/j.tjog.2014.03.006
- Belay AS, Wudad T. Prevalence and associated factors of preeclampsia among pregnant women attending anti-natal care at Mettu Karl referral hospital, Ethiopia: cross-sectional study. *Clin Hypertens* 2019;25:14. doi:10.1186/s40885-019-0120-1
- Vidler M, Charantimath U, Katageri G, Ramadurg U, Karadiguddi C, Sawchuck D, et al. Community perceptions of pre-eclampsia in rural Karnataka State, India: a qualitative study. *Reprod Health* 2016;13 Suppl 1(Suppl 1):35. doi:10.1186/s12978-016-0137-9
- Sutan R, Hassan H, Shamsuddin K. Health information seeking behaviour among hypertensive disorder in pregnancy (HDP) high risks antenatal mothers. *Womens Health Gynecol*. 2016;2(7):1-6.
- Savage AR, Hoho L. Knowledge of pre-eclampsia in women living in Makole Ward, Dodoma, Tanzania. *Afr Health Sci* 2016;16(2):412–9. doi:10.4314/ahs.v16i2.9
- Osungbade KO, Ige OK. Public health perspectives of preeclampsia in developing countries: implication for health system strengthening. *J Pregnancy* 2011;2011:481095. doi:10.1155/2011/481095
- Mekie M, Addisu D, Bezie M, Melkie A, Getaneh D, Bayih WA, et al. Knowledge and attitude of pregnant women towards preeclampsia and its associated factors in South Gondar Zone, Northwest Ethiopia: a multi-center facility-based cross-sectional study. *BMC Pregnancy Childbirth* 2021;21(1):160. doi:10.1186/s12884-021-03647-2
- Ivankova NV, Creswell JW, Stick SL. Using Mixed-Methods Sequential Explanatory Design: From Theory to Practice. *Field Methods* 2006;18(1):3–20. doi:10.1177/1525822X05282260
- Onwuegbuzie A, Bustamante R, Nelson J. Mixed Research as a Tool for Developing Quantitative Instruments. *Journal of Mixed Methods Research* 2010;4:56–78. doi:10.1177/1558689809355805
- Graneheim UH, Lundman B. Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse Educ Today* 2004;24(2):105–12. doi:10.1016/j.nedt.2003.10.001
- Mokkink LB, Terwee CB, Knol DL, Stratford PW, Alonso J, Patrick DL, et al. The COSMIN checklist for evaluating the methodological quality of studies on measurement properties: a clarification of its content. *BMC Med Res Methodol* 2010;10:22. doi:10.1186/1471-2288-10-22
- Polit-O'Hara D, Yang FM. *Measurement and the Measurement of Change: A Primer for the Health Professions*. Wolters Kluwer; 2016.
- Alnuaimi K, Abuidhail J, Abuzaid H. The effects of an educational programme about preeclampsia on women's awareness: a randomised control trial. *Int Nurs Rev* 2020;67(4):501–11. doi:10.1111/inr.12626
- Lawshe CH. A quantitative approach to content validity. *Personnel Psychology* 1975;28(4):563–75. doi:10.1111/j.1744-6570.1975.tb01393.x
- Watkins MW. *Exploratory Factor Analysis: A Guide to Best Practice*. *Journal of Black Psychology* 2018;44(3):219–46. doi:10.1177/0095798418771807
- Wetzel AP. Factor analysis methods and validity evidence: a review of instrument development across the medical education continuum. *Acad Med* 2012;87(8):1060–9. doi:10.1097/ACM.0b013e31825d305d
- Derakhshan E, Shadzi S, Derakhshan F, Behjatian Z. Effects of targeted education on knowledge and attitude of pregnant women regarding eclampsia. *J Health Syst Res* 2011;6(3):443–9. [Persian]
- Fondjo LA, Boamah VE, Fierti A, Gyesi D, Owiredo EW. Knowledge of preeclampsia and its associated factors among pregnant women: a possible link to reduce related adverse outcomes. *BMC Pregnancy Childbirth* 2019;19(1):456. doi:10.1186/s12884-019-2623-x
- Bahkali NM, Ghamri KA, Aladwani LF, Alzaydi TH, Aljarid FA, Alamoudi N, et al. Awareness of pre-eclampsia and measurement of risk factors in women from the Western region of Saudi Arabia: a cross-sectional study. *Int J Womens Health Reprod Sci*. 2024;12(1):8-15. doi:10.15296/ijwhr.2024.6002