

Development and Psychometric Evaluation of A Prenatal Medication Adherence Questionnaire (P-MASQ) for Use During Pregnancy

Fitri Nurussani Aulia^{1,2}, Eccita Rahestyningtyas³, Rista Fauziningtyas⁴,
Elida Zairina^{5,6,7*}

*Corresponding author : elida-z@ff.unair.ac.id

Affiliation:

¹ Master of Pharmaceutical Science Programme, Universitas Airlangga, Surabaya, Indonesia

² Department of Pharmacy, Faculty of Health Sciences, Institut Kesehatan Mitra Bunda, Batam, Indonesia

³ Department of Obstetrics and Gynecology, Hospital of Universitas Airlangga - Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia

⁴ Gerontic of Nursing Research Group, Faculty of Nursing, Universitas Airlangga, Surabaya, Indonesia

⁵ Department of Pharmacy Practice, Faculty of Pharmacy, Universitas Airlangga Surabaya, Indonesia

⁶ Innovative Pharmacy Practice and Integrated Outcomes Research (INACORE), Universitas Airlangga, Surabaya Indonesia

⁷ Center of Excellence for Patient Safety and Quality, Universitas Airlangga, Surabaya, Indonesia

Received: 20/08/2025

Accepted: 16/09/2026

Published: 12/10/2026

ABSTRACT

Background: This study aimed to develop and evaluate the psychometric properties of the Prenatal Medication Adherence Questionnaire (P-MASQ), designed to assess the degree of adherence to medications, vitamins, and supplements among pregnant women.

Methods: A one-month cross-sectional study was conducted at the obstetrics and gynecology outpatient clinic of the Universitas Airlangga Hospital, Surabaya. A total of 135 pregnant women using medications, vitamins, and/or supplements were recruited using convenience sampling. Reliability was assessed using Cronbach's alpha, while validity was evaluated using the Content Validity Index (CVI), Pearson's product-moment correlation, and Exploratory Factor Analysis (EFA). Data were analyzed using the IBM SPSS version 26.

Results: Construct validity was evaluated using exploratory factor analysis (EFA). The KMO value was 0.723, indicating adequate sampling adequacy, while Bartlett's test was significant ($p < 0.001$), confirming the suitability of the data for factor analysis. All items had factor loadings above 0.50, demonstrating acceptable construct validity. The questionnaire also showed good internal consistency (Cronbach's alpha > 0.70), and all items were valid based on significant Pearson's correlation coefficients ($p < 0.05$).

Conclusions: The 10-item P-MASQ demonstrated good validity and reliability and can be used to assess adherence to medications, vitamins, and supplements during pregnancy.

Keywords: Pregnancy; Medication adherence; Vitamins; Validity and Reliability

INTRODUCTION

Patient safety is an important aspect that must be understood by healthcare providers across disciplines, such as doctors, nurses, and pharmacists. In the pharmaceutical service system, patient safety is not only focused on preventing medication errors but also on the importance of protecting patients, especially vulnerable groups, such as pregnant women¹.

Multinational studies have reported that approximately 81.2% of pregnant women use at least one type of medication, with 17% requiring medication to control long-term medical condition². Findings in Surabaya, Indonesia, revealed that 35.1% of pregnant women used medication during pregnancy, either based on a doctor's prescription or through self-purchase (over-the-counter). Additionally, chronic illnesses, including asthma and hypertension, were found in approximately 4.3% of the pregnant population³.

Careful assessment is essential when prescribing or using medications during pregnancy, as the expected benefits should be balanced with potential risks⁴. Pregnant women with chronic illnesses have an elevated risk of adverse maternal and neonatal outcomes, such as premature birth and increased maternal morbidity and mortality. Therefore, adherence to the use of medications, vitamins, and supplements plays an important role in perinatal outcomes for both the mother and baby^{5,6}. Several studies have mentioned that adherence to medication use influences whether prescribed drugs are actually taken or not⁷. Furthermore, many pregnant women are concerned about the use of conventional medicine and prefer to consume herbal medicines to minimize drug side effects⁸. The same has been found in other parts of Indonesia; for example, an exploratory study conducted in Bali showed that pregnant women regard traditional medicines as a safer option with minimal side effects, especially when compared to medicines obtained from health professionals⁹. Therefore, an appropriate and accurate measurement tool is needed to assess the degree of adherence to medication, vitamin, and/or supplement use among pregnant women.

Two methods are used to quantify the degree of adherence: direct and indirect methods. Direct methods are conducted through direct observation, such as measuring drug levels in the blood to ensure adherence, whereas indirect methods use approaches such as patient self-reporting through questionnaires¹⁰. Several questionnaires are commonly used, including the Adherence to Refill and Medication Scale (ARMS), Brief Medication Questionnaire (BMQ), and Morisky Medication Adherence Scale (MMAS)¹¹. A comprehensive literature analysis identified 43 versions of adherence questionnaires in English. These scales can be categorized into several groups or domains: (i) solely medication-taking behavior; (ii) a combination of medication-taking behavior and barriers to adherence; (iii) only barriers to adherence; (iv) only beliefs related to medication adherence; and (v) barriers and beliefs related to medication adherence¹².

Numerous adherence studies conducted in Indonesia have primarily concentrated on supplementation, especially in the context of iron (Fe) tablets and supplementation deficiency. Meanwhile, studies appraising adherence to various types of medications, vitamins, and supplements used by pregnant women are limited. The tools used are also general, such as the MMAS-8, which was originally developed for patients with chronic diseases, not specifically for pregnant women. Pregnancy is a unique condition in which pregnant women have different concerns and experiences regarding medication therapy, vitamin, and supplement consumption.

Based on these gaps, this study aimed to develop and validate the Prenatal Medication Adherence Questionnaire (P-MASQ), an instrument specifically designed to measure adherence to medications, vitamins, and supplements during pregnancy.

METHODS

The Prenatal Medication Questionnaire (P-MASQ) was designed and validated in several phases. The first phase involved the design and development of the P-MASQ. The second phase involved obtaining feedback from experts in related fields. The final phase involved analyzing construct validity using exploratory factor analysis (EFA).

Design and Development Questionnaire

The Prenatal Adherence Medication Questionnaire (P-MASQ) was developed from various literature sources. Keywords such as “Compliance,” “Adherence,” “Medication adherence,” “Pregnancy,” “Development Questionnaire,” “Validation Questionnaire,” “Supplement in Pregnancy,” and “Vitamins in Pregnancy” were used for the search. Based on the literature review, questionnaire items were developed and organized into three domains: knowledge, attitude, and practice (KAP). The draft questionnaire was subsequently evaluated for content validity by a panel of experts using the Content Validity Index (CVI). The developed Prenatal Medication Adherence Questionnaire (P-MASQ) uses a Likert scale to calculate the score for each variable. A score of 1 was assigned for “never,” 2 for “rarely,” 3 for “sometimes,” 4 for “often,” and 5 for “always.” Based on the literature review, questionnaire items were developed and organized into three domains: knowledge, attitude, and practice (KAP). The draft questionnaire was subsequently evaluated for content validity by a panel of experts using the Content Validity Index (CVI).

Expert panel evaluation using the CVI

At this stage, content validity for the Prenatal Adherence Medication Questionnaire (P-MASQ) design was performed by seeking feedback from a panel of seven experts, consisting of one doctor, two pharmacists, and four professionals who were experienced in their respective fields and served as university lecturers. Content validity was assessed quantitatively. The content validity index (CVI) was evaluated by seven experts. The assessment was performed using a 4-point Likert scale. The I-CVI was determined by the proportion of experts who rated each item as ‘3’ or ‘4’ out of the total number of experts, giving the I-CVI a range of 0–1. With the number of experts in the range of 5–10 (7 in this study), an item was considered relevant if the I-CVI value was ≥ 0.78 , and the item was revised if the I-CVI value was < 0.78 . The average scale content validity index (S-CVI) is the average of the S-CVI, and the questionnaire is deemed relevant if the S-CVI is at least 0.90¹³.

Construct Validity

Exploratory factor analysis (EFA) was employed to evaluate construct validity. Exploratory factor analysis was used to group instrument items into factors as desired by the researcher or in accordance with the theory¹⁴. EFA also serves to ascertain whether the collected data can be further tested using factor analysis if the value of the Kaiser-Meyer-Olkin (KMO) and Bartlett’s tests is fulfilled. The KMO and Bartlett’s tests were used to determine whether the sample used was good and sufficient to conduct factor analysis. Factor analysis can be performed if the KMO value is >0.5 and Bartlett’s test is <0.05 .

Study Design and Data Collection

This was an observational study with a cross-sectional design. Participants were eligible for this study based on the following criteria: pregnant patients who consumed medications, vitamins, and/or supplements, were able to communicate with the researcher, and agreed to participate in the study by providing informed consent. Participants were excluded if they had medical conditions that could potentially influence the research findings (for example, severe dementia, schizophrenia, and depression) and that may have interfered with pregnancy.

This study measured the validity of an adherence questionnaire containing ten questions. According to general guidelines, the ratio between the number of samples and the number of questionnaire items was 10:1. Therefore, this study used at least 135 samples. Samples were collected using convenience sampling from patients receiving treatment at the obstetrics and gynecology clinic at Airlangga University Hospital in Surabaya from November 2024 to December 2024 who met the established criteria.

Reliability Test

Reliability testing was conducted to analyze item consistency. The reliability test was performed by examining internal consistency, and its value was represented using Cronbach's alpha coefficient. Cronbach's alpha ranged from 0.00 to 1.00. Item reliability was considered acceptable if Cronbach's alpha was > 0.70 . In the context of social science research, a Cronbach's alpha value above 0.60 is considered acceptable¹⁵.

Pearson's Product-moment Correlation

Pearson's product-moment correlation analysis was used to determine the internal consistency of the components in each construct, Pearson's product-moment correlation analysis was utilized¹⁶. The correlation was regarded as perfectly positive if the coefficient reached a value of 1, whereas a coefficient of 0 suggested no correlation between variables¹⁷. In addition, the analysis was performed using IBM SPSS software version 26.

Ethical approval

This findings was granted by the Research Ethics Committee (KEP) of Airlangga University Hospital (number: 145/KEP/2024).

RESULT

Content Validity Index

The Prenatal Adherence Medication Questionnaire (P-MASQ) was assessed by seven experts and found to be relevant. The I-CVI for each item ranged from 0.83–1.00. The S-CVI score was 0.966. The I-CVI and S-CVI scores of the questionnaire are presented in Table 1.

In this study, the results from the pre-testing phase showed that the 10 items tested were understood by the respondents. There were no additions or revisions to any of the items in this questionnaire because each item was considered clear, easy to understand, and appropriate to the context of adherence to the use of medication, vitamins, and supplements in pregnant women. After the evaluation phase of the content validity index and pre-testing, the finalized instrument, as presented in Table 2, was approved by the research team.

Table 1. Score for Content Validity Index

Item	Item-Content Validity Index (I-CVI)
Q1	1
Q2	1
Q3	1
Q4	0.83
Q5	1
Q6	1
Q7	1
Q8	0.83
Q9	1
Q10	1
S-CVI = 0.966	

Pre-Testing

Table 2. Prenatal Adherence Medication Questionnaire (P-MASQ)

	Item Statement
Q1	I use medication, vitamins, or supplements according to the dosage recommended by my doctor or a healthcare professional.
Q2	The information I received from healthcare professionals about medicine and supplements was clear and easy to comprehend.
Q3	I always take my medicines, vitamins, and supplements on time.
Q4	I often forget to take my medicine, vitamins, and supplements.
Q5	I always remember to take my medicines, vitamins, and supplements.
Q6	Taking medications and supplements has become a part of my daily routine.
Q7	I can easily obtain the medicines, vitamins, and supplements that I need.
Q8	The cost of medicines, vitamins, and supplements during pregnancy is affordable for me.
Q9	My husband or family supports me in taking medicine, vitamins, or supplements during pregnancy.
Q10	My family helps me to remember to take my medicines and supplements regularly.

Demographic characteristic

Table 3. Characteristics of the respondent (n=135)

Characteristics	n (%)
Age (years)	
17-20	7 (5.2)
21-30	84 (62.)
31-40	43 (31.8)YU
>40	1 (0.7)
Occupations	
None	70 (51.9)
Private	24 (17.8)
Public officer	9 (6.6)
Other	32 (23.7)
Education	
None	3 (2.2)
Elementary school	7 (5.2)
Junior high school	23 (17.0)
Senior high school	78 (57.8)
Diploma	22 (16.3)
Bachelor and above	2 (1.5)
Total Gravidity	
1	50 (37.0)
2	43 (31.9)
3	30 (22.2)
4	5 (3.7)
Other	7 (5.2)
Trimester of Pregnancy	
1	18 (13.3)
2	36 (26.7)
3	81 (60.0)
Source of Healthcare Financing	
National Health Coverage (BPJS)	126 (93.3)
Private Insurance	9 (6.7)
Out of Pocket	
Illness during Pregnancy	
None	99 (73.3)
Chronic	36 (26.7)

The sociodemographic characteristics of the 135 participants who consented to participate in this study are presented in Table 3. The average age of the respondents was 28.42 years (SD: 4.80), and the majority of respondents were pregnant women with a gestational age of over 28 weeks (third trimester), accounting for 60% of the sample size.

Construct Validation

Exploratory factor analysis (EFA) was used for construct validation testing. The coefficients of Bartlett's test were 0.000, and the Kaiser-Meyer-Olkin (KMO) test result was 0.723. Table 4 presents the loading factor data and the final results of the factor analysis using varimax rotation¹⁴.

Item	Loading Factor		
	1	2	3
Q1	0.743		
Q2	0.541		
Q3	0.796		
Q4	0.583		
Q5		0.869	
Q6		0.855	
Q7		0.424	
Q8		0.595	
Q9			0.744
Q10			0.824

The construct of the Prenatal Medication Adherence Questionnaire (P-MASQ) was validated or explored using Exploratory Factor Analysis (EFA). The loading factors for all items were <0.3 ¹⁸. Therefore, the 10-item questionnaire was subjected to reliability and validity testing using Pearson's product-moment correlations.

Pearson's Product-Moment Correlation & Reliability Test

According to the validity test results using Pearson's correlation, 10 items in the questionnaire yielded values ranging from 0.224 to 0.761, with a significance value > 0.005 . Cronbach's alpha values ranged from 0.817 to 0.869, with a total Cronbach's alpha of 0.843. Table 5 presents the findings of the validity and reliability tests using Pearson's product-moment correlation.

Item	Significance	Coefficient Pearson's Correlation	Cronbach's alpha if item deleted
Q1	0.000	0.656	0.827
Q2	0.000	0.722	0.820
Q3	0.000	0.725	0.820
Q4	0.000	0.224	0.869
Q5	0.000	0.625	0.830
Q6	0.000	0.538	0.843
Q7	0.000	0.761	0.817
Q9	0.000	0.737	0.818
Q10	0.000	0.728	0.819

DISCUSSION

This instrument was developed to assess the degree of compliance with the use of medications, vitamins, and supplements during pregnancy. The instrument was developed through a comprehensive literature review. The preliminary version of this instrument underwent a content validity index assessment and pretesting. The CVI was evaluated by seven experts and showed results that met the

criteria, with an I-CVI score of ≥ 0.78 and an S-CVI score of ≥ 0.90 . In the pre-testing stage, the 10 items on the questionnaire were deemed clear, easy to understand, and suitable for the context of adherence to medication and vitamin and supplement use during pregnancy. The results of the evaluation and adjustments from the pre-testing stage produced the final version of the Prenatal Medication Adherence Questionnaire (P-MASQ).

Before use, the questionnaire underwent validity and reliability testing. The tests were conducted using a sample of pregnant women at Universitas Airlangga Hospital¹⁹. A total of 135 pregnant women participated in this study. In terms of age and education, the participants were representative of pregnant women in urban areas of Indonesia, particularly Surabaya. Most of them were between 21 and 30 years old, which is reproductive age for pregnancy and childbirth²⁰. The participants in this study came from a variety of educational backgrounds, and education level did not prevent participants from completing the questionnaire, demonstrating that the questionnaire can be used across various demographic groups of pregnant women.

The construct of the Prenatal Adherence Medication Questionnaire (P-MASQ) was validated or explored using Exploratory Factor Analysis (EFA). The loading factors for all items were > 0.3 ¹⁸. Therefore, the 10-item questionnaire was subjected to reliability and validity testing using Pearson's product-moment correlation.

The final reliability assessment confirmed that the P-MASQ (final version) is a reliable instrument, with domain-level and total Cronbach's alpha values exceeding 0.70, meeting the acceptable standard for internal consistency. These values are comparable to, though slightly lower than, those reported for adherence instruments in other pregnancy-related populations. For instance, Lupattelli et al²¹, in a study involving more than 9,400 pregnant women across 18 countries, reported a Cronbach's alpha of approximately 0.83 for the MMAS-8 in assessing adherence to chronic therapy during pregnancy. Similarly, Walsh et al²², reported an alpha of approximately 0.80 using a modified Medication Adherence Self-Report Inventory (MASRI) among pregnant women with HIV, while Hisam et al⁵, reported an alpha of 0.78 for a Health Belief Model-based instrument assessing adherence to iron and folic acid supplementation in Bangladesh. Unlike these instruments, which primarily focus on medication adherence alone, the P-MASQ was specifically developed to assess adherence not only to medications but also to supplements and vitamins commonly consumed during pregnancy, reflecting the broader and more complex nature of adherence behavior in this population. The slightly higher alpha values in the comparator studies may therefore be attributable to their narrower therapeutic focus and more homogeneous item content, whereas the P-MASQ's broader scope across medication, supplement, and vitamin-related domains can moderately reduce internal consistency while enhancing content validity and ecological relevance. Taken together, these comparisons suggest that the P-MASQ's reliability is consistent with, and psychometrically comparable to, established adherence instruments used in similar maternal health contexts, while offering a more comprehensive assessment of adherence behavior among pregnant women.

Based on the reliability and validity results of this study, the P-MASQ appears suitable for assessing medication, supplement, and vitamin adherence among pregnant women in Indonesia. The questionnaire covers three domains: knowledge, attitude, and practice, which were confirmed through factor loading during instrument development. Knowledge refers to how well pregnant women understand the use of medication, supplements, and vitamins, while attitude relates to their beliefs about why adherence matters during pregnancy. Practice covers the actual behavior of taking medication or supplements on time and consistently, along with related factors such as access to medication and support from family members that influence this behavior. These three domains were chosen not only because they are commonly used in adherence research, but also because the factor analysis in this study confirmed that the items naturally grouped into these constructs. This structure keeps the P-MASQ

relatively simple to use while still covering the main aspects that influence adherence behavior in pregnant women, which fits the practical needs of maternal health settings in Indonesia.

The main weakness of this study was the paucity of long-term observations, which may not reflect long-term behavioral changes. The number of respondents who reported their use of medications, vitamins, and supplements may include some underreporting. The convenience sampling method limits the ability to generalize the findings to the broader population of expectant mothers, as the sample was taken from only one healthcare facility in Surabaya.

CONCLUSION

The Prenatal Medication Adherence Questionnaire (P-MASQ) is a valid and reliable instrument for assessing adherence to medications, vitamins, and supplements among pregnant women, providing a context-specific tool that addresses the limitations of existing adherence measures.

ACKNOWLEDGEMENTS

The authors would like to thank the Department of Pharmaceutical Sciences, Faculty of Pharmacy, Universitas Airlangga, which supervised this research, and Universitas Airlangga Hospital, which granted permission to conduct this study.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

REFERENCES

1. Ragusa A, Ushiro S, Svelato A, Strambi N. Obstetric Safety Patient. *Textbook of Patient Safety and Clinical Risk Management* 2021; 205–212.
2. Lupattelli A, Spigset O, Nordeng H. Adherence to Medication for Chronic Disorders During Pregnancy: Results From a Multinational Study. *Int J Clin Pharm* 2014; 36: 145–153.
3. Zairina E, Nugraheni G, Ahmad GNV, Yuda A, Nita Y, Wardhana MP *et al.* Medication use during pregnancy in Surabaya: A cross-sectional study. In: *Unity in Diversity and the Standardisation of Clinical Pharmacy Services*. CRC Press, 2017, pp 371–374.
4. Alani AHHDA, Hassan BAR, Suhaimi AM, Mohammed AH. Use, Awareness, Knowledge and Beliefs of Medication During Pregnancy in Malaysia. *Osong Public Health Res Perspect* 2021; 11: 373–379.
5. Hisam A, Rahman MU, Mashhadi SF. Knowledge, attitude and practice regarding folic acid deficiency; A hidden hunger. *Pak J Med Sci* 2014; 30: 583–588.
6. Admon LK, Winkelman TNA, Heisler M, Dalton VK. Obstetric outcomes and delivery-related health care utilization and costs among pregnant women with multiple chronic conditions. *Prev Chronic Dis* 2018; 15: E21.
7. Matsui D. Adherence with drug therapy in pregnancy. *Obstet Gynecol Int* 2012; 2012: 796590.
8. Nugraheni G, Sulistyarini A, Zairina E. Beliefs About Medicines in Pregnancy: A Survey Using the beliefs About Medicines Questionnaire in Indonesia. *Int J Clin Pharm* 2020; 42: 57–64.
9. Wulandari LPL, Whelan AK. Beliefs, attitudes and behaviours of pregnant women in Bali. *Midwifery* 2011; 27: 867–871.

10. Kılıç H, Güneş ED. Patient adherence in healthcare operations: A narrative review. *Socioecon Plann Sci* 2024; 91: 101795.
11. Intilangelo A, Majic S, Palchik V, Traverso ML. [Translated article] Validated questionnaires on medication adherence and associated factors in chronic patients: A systematic review. *Farmacia Hospitalaria* 2024; 48: T185–T192.
12. Lam WY, Fresco P. Medication adherence measures: an overview. *Biomed Res Int* 2015; 2015: 217047.
13. Almanasreh E, Moles R, Chen TF. Evaluation of methods used for estimating content validity. *Res Social Adm Pharm* 2019; 15: 214–221.
14. Gaskin CJ, Happell B. On exploratory factor analysis: a review of recent evidence, an assessment of current practice, and recommendations for future use. *Int J Nurs Stud* 2014; 51: 511–521.
15. Mohamad MM, Sulaiman NL, Sern LC, Salleh KM. Measuring the Validity and Reliability of Research Instruments. *Procedia Soc Behav Sci* 2015; 204: 164–171.
16. Taherdoost H. Validity and Reliability of the Research Instrument; How to Test the Validation of a Questionnaire/Survey in a Research. *International Journal of Academic Research in Management* 2016; 5: 28–36.
17. Schober P, Boer C, Schwarte LA. Correlation Coefficients: Appropriate Use and Interpretation. *Anesth Analg* 2018; 126: 1763–1768.
18. Yusoff MSB. ABC of Content Validation and Content Validity Index Calculation. *Education in Medicine Journal* 2019; 11: 49–54.
19. Li X, Duan X, Tan D, Zhang B, Xu A, Qiu N *et al.* Iron deficiency and overload in men and woman of reproductive age, and pregnant women. *Reprod Toxicol* 2023; 118: 108381.
20. Tavakol M, Wetzel A. Factor Analysis: a means for theory and instrument development in support of construct validity. *Int J Med Educ* 2020; 11: 245–247.
21. Lupattelli A, Spigset O, Nordeng H. Adherence to Medication for Chronic Disorders During Pregnancy: Results From a Multinational Study. 2014; : 145–153.
22. Walsh JC, Mandalia S, Gazzard BG. Responses to a 1 month self-report on adherence to antiretroviral therapy are consistent with electronic data and virological treatment outcome. *Aids* 2002; 16: 269–277.