Patient Preference and Adherence

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ORIGINAL RESEARCH

Medication Adherence During Pregnancy: A Hospital-Based Cross-Sectional Study in Bandung, Indonesia

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Background: Nonadherence to medication is common during pregnancy, as pregnant women often have concerns about the safety of the medications they are taking. This study aimed to assess medication adherence levels among pregnant women for various medications and to identify factors associated with nonadherence.

Methods: We conducted an observational cross-sectional study among pregnant women who had used at least one medication in the past month at a hospital in Bandung City, West Java, Indonesia. Medication adherence was assessed using the Medication Adherence Report Scale (MARS-5), while medication beliefs were measured with the Beliefs about Medicine Questionnaire (BMQ). Binary logistic regression was used to evaluate the association between medication beliefs, sociodemographic factors, and medication adherence. Odds ratios (ORs) with 95% confidence intervals (CIs) were reported.

Results: Among the 235 pregnant women, the adherence levels for each group were as follows: 60.5% for the pregnancy supplements and hormones group, 53.8% for the chronic condition medicines group, 100% for the antibiotics group, and 46.2% for the symptomatic medicines group. A small sample size led to perfect adherence in the antibiotics group. Factors associated with non-adherence were higher harm beliefs (OR 1.20, 95% CI 1.02–1.40) and negative beliefs (OR 2.42, 95% CI 1.09–5.33) for the pregnancy supplements and hormones group; negative beliefs (OR 5.16, 95% CI 1.44–18.4) for the chronic medication group; not being in the first pregnancy (23.92, 95% CI 1.08–530.55) and the use of more than two types of medicines (OR 29.55, 95% CI 1.06–825.08) for symptomatic medications.

Conclusion: Medication adherence during pregnancy, especially to chronic condition medications, remains low, highlighting the urgent need for intervention. One of the main factors associated with this low adherence during pregnancy is negative beliefs about medications. Tailored counselling on medication use during pregnancy is necessary to address these misconceptions and improve medication adherence in pregnancy.

Keywords: medication adherence, pregnant women, medication beliefs, pharmacotherapy

Introduction

Medication use during pregnancy is common. Research indicates that 81.2% of pregnant women utilize at least one form of medication, with 17% of this group using medication for chronic conditions.[1] Research conducted in Bandung, Indonesia, indicated that 35.5% of pregnant women utilize at least one type of medication during their pregnancy, primarily due to pre-existing medical conditions. Of this group, 89% utilize prescription medications for chronic and symptomatic treatment, while the remaining 11% pertains to self-medication with over-the-counter medications.[2]

Pregnant women with chronic diseases, particularly those with multiple comorbidities, are at a significant risk of adverse perinatal outcomes, such as fetal death, preterm birth, the need for caesarean section, and increased maternal morbidity and mortality.[3,4] Medication adherence in pregnant women with chronic diseases is crucial, as it correlates with improved outcomes for both the mother and the infant.[5,6]

Received: 24 December 2024
Accepted: 7 May 2025
Published: 25 May 2025

Pregnancy is a significant factor contributing to low medication adherence, as many pregnant women tend to avoid medication use. Numerous studies have assessed medication adherence among pregnant women, indicating a low adherence rate of around 50–60%.[7–10] Other research showed even lower adherence rates, failing below 50%.[11–13] Concerns regarding the safety and potential teratogenic effects of medications are common among pregnant women.[14] A qualitative study conducted in Bali, Indonesia, revealed that pregnant women perceive modern medicines as sometimes causing side effects, while they view traditional medicine as free from such issues, leading to a preference for traditional remedies.[15] Similarly, some pregnant women in Surabaya, Indonesia, believed that prescription medications from healthcare providers could do more harm than good and had addictive effects.[16] This corresponds with global trends demonstrating increased concerns about medication risks among pregnant women.[17] Nonadherence to prescribed medication can adversely impact maternal and child health and lead to overestimating medication use in perinatal pharmacoepidemiology study.[10] Suboptimal medication adherence in pregnant women with chronic diseases and pregnancy-related indications can negatively impact both maternal and perinatal outcomes.[18]

Previous studies have identified factors influencing medication adherence among pregnant women. A study by Lupattelli et al identified that pregnant women with prior childbirth experience were more likely to be nonadherent.[8] Furthermore, consuming multiple medications, combined with a lack of understanding about the importance and benefits of each drug, leads to poor adherence among pregnant women.[7] Furthermore, younger pregnant women with low educational backgrounds who experience side effects often exhibit lower levels of adherence.[19–23] Employed pregnant women may also face a higher risk of non-adherence due to elevated stress levels, limited time, and conflicting responsibilities.[24,25]

Multiple studies have confirmed that medication beliefs are critical determinants of medication adherence in pregnant women.[8,16] Elevated risk perceptions regarding medications are associated with reduced adherence among pregnant women, who often fear that medications could adversely affect their infants. Additionally, these women often overestimate the risks associated with medications and tend to recall negative information more frequently than positive reassurance.[26] A previous study showed that beliefs in necessity of medication had a positive correlation with adherence, whereas concern about medications had a negative correlation with medication adherence.[27]

Research on medication adherence during pregnancy in Indonesia largely focusses on adherence of pregnant women to iron (Fe) tablet consumption, with limited studies evaluating adherence to the full range of medications used by pregnant women. The medication adherence rate in Bandung, Indonesia may differ from those in other countries or other region in Indonesia due to regional disparities in healthcare access.[28] The *Jaminan Kesehatan Nasional* (JKN), Indonesia's national insurance scheme implemented within a framework of universal health coverage, has been met with community concerns about accessibility and satisfaction of health services. Issues such as inadequate physical access due to substandard facilities and poor social access stemming from strained relationships between patients and healthcare providers have been noted.[28,29] Additionally, cultural beliefs favoring herbal remedies as safer alternatives to conventional medications remain prevalent in Indonesia.[30,31] Medication adherence is critical for the health of both the expectant mother and her unborn child, particularly for pregnant women with chronic illnesses. Therefore, research is essential to identify the factors influencing medication adherence. The objective of this study is to assess medication adherence levels for each medication among pregnant women and to identify factors associated with non-adherence.

Methods

This study was reported in accordance with the guidelines of Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) for cross-sectional survey (Table S1).

Study Design and Data Collection

We conducted an observational cross-sectional study among pregnant women at a hospital in Bandung City, West Java, Indonesia. We collected data from August to October 2024 from patients who met the following inclusion criteria: pregnant women aged over 18 years, who had used at least one medicine in the past month, and who were willing to participate by providing informed consent. This study was conducted in accordance with the 2013 Declaration of Helsinki. The Health Research Ethics Committee of Universitas Padjadjaran, Indonesia, approved the study protocol (No. 822/UN6.KEP/EC/2024).

Minimum Sample Size Calculation

We calculated the minimum sample size using the Slovin formula [n= N/(1+N(e)^2)], where n represents the sample size, N is the total population, and e is the desired margin of error. The obstetric clinic in the hospital recorded an average of 450 monthly visits from pregnant women. We considered these monthly visits as the total population for our calculation, as the same women are believed to attend routine check-ups each month. At a significance level of 5%, the minimum required sample size was determined to be 235 pregnant women.

Outcomes

We assessed medication adherence using the Medication Adherence Report Scale (MARS). The Indonesian version of MARS has been demonstrated to be both valid and reliable, with a correlation value > 0.396 and a Cronbach's alpha of 0.803.[32] The MARS consists of five items related to forgetting, changing dosage, stopping, skipping, and taking less medication, measured on a 5-point Likert scale (5 = "never"; 4 = "rarely"; 3 = "sometimes"; 2 = "often"; 1 ="very often").[33] Nonadherence is defined as a score of 1–3 on any item, and adherence is defined as a score of 4–5 on all items.[34] This categorization differentiates between unintentional non-adherence, intentional non-adherence, and in part non-adherence. However, we combined these non-adherence types into a single category of "non-adherent" to simplify the analysis.

Potential Factors Related to Medication Adherence

We assessed patient's beliefs using the Beliefs about Medicine Questionnaire (BMQ). The Indonesian version of the BMQ was shown to be reliable, with a Cronbach's alpha of 0.819.[16] BMQ consists of 18 items designed to assess beliefs about medications in general and in certain specific conditions, allowing for a comprehensive investigation of perceptions of medications in general (BMQ-general) and perceptions related to specific conditions, such as chronic diseases (BMQ-specific).[35]

The BMQ-general consists of eight items divided into two subscales: the general-harm subscale, which evaluates beliefs regarding the harmfulness of medications, and the general-overuse subscale, which assesses the perception that doctors prescribe too many medications and place excessive trust in pharmacological treatments.[35]

The BMQ-specific comprises 11 items, which are divided into three subscales. The specific-concern scale assesses the perception of the likelihood of experiencing side effects from medication use, while the specific-necessity scale assesses patients' beliefs about the importance of adhering to their prescribed medications.[33] Based on the differences in concern and necessity scores, we categorized patients' beliefs about medication. Patients were classified as having positive beliefs if their necessity scores exceeded their concern scores, negative beliefs if their concern scores surpassed their necessity scores, and neutral beliefs if both scores were equal.[16] The third subscale, specific-side effect, is a single item to measure whether the patient is experiencing any side effects from their medication.[35]

The maternal sociodemographic factors include the mother's age at the time of questionnaire completion (18–29; 30–39; ≥40), highest level of education attained (elementary school; junior high school; senior high school; university), employment status (housewife or employed), gestational age (first, second, or third trimester), pregnancy history (first pregnancy or not), presence of comorbidities (yes or no), and the number of medications taken (1–2; 3–5; >5). Data were collected on all medications currently utilized by pregnant women and categorized into four groups: pregnancy supplements and hormones (e.g., folic acid, Fe tablets, progesterone), medications for chronic condition (e.g., antihypertensives, antiplatelets), antibiotics, and symptomatic medications (e.g., antiemetics, analgesics, cold and cough medications). The patients who used more than one type of drug were assigned to multiple categories. For example, a pregnant woman using both a supplement and an antihypertensive medication would be classified in both the pregnancy supplements and hormones group as well as the chronic condition medicines group.

Data Analysis

We conducted analysis by therapeutic group, summarizing patient characteristics using descriptive statistics. Bivariate analysis was conducted using the chi-square with Exact-Fisher test or Kolmogorov–Smirnov test, when the chi square assumptions were not met, and the Mann–Whitney test to assess the differences between patient characteristics and medication non-adherence. Factors with a p-value of less than 0.25 from the bivariate analysis were included in the multivariate analysis. Multivariate analysis was conducted using binary logistic regression to obtain odds ratios (OR)

with a 95% confidence intervals (CI). Multivariate analysis was not conducted for the antibiotic group due to adherence being consistent among all participants. All data were analyzed using IBM SPSS Version 29.0.

Results

General Characteristics of Participants

A total of 241 pregnant women agreed to participate in this study (response rate 95%). However, 6 participants filled out the questionnaire incompletely, leaving 235 participants included in the final analysis. The majority of the pregnant women were aged between 18 and 29 years (60%), were housewives (61.3%), were pursued education up to the university level (46.4%). Most were in their third trimester of pregnancy (79.6%) and had experienced a previous pregnancy (66%). Additionally, 65.1% of the participants reported using 1–2 types of medications, and 26.8% had comorbidities. For medication beliefs, the median scores for overuse and harm beliefs were 11 (range: 10–13) and 10 (range: 9–12), respectively. Overall, most pregnant women had positive beliefs about medication (48.1%) (Table 1).

In the pregnancy supplements and hormones group, as well as the antibiotics group, the median necessity score was higher than the median concern score (12 vs 11 for pregnancy supplements and hormones, and 15 vs 12 for antibiotics). This

Table 1 Patient Characteristics

Characteristics	Total (N =235)		Pregnancy Supplements and Hormones (N = 185)		Chronic Condition Medicines (N = 65)		Antibiotics (N = 5)		Symptomatic Medicines (N = 26)	
	N	%	N	%	N	%	N	%	N	%
Age										
18–29	141	60	114	61.6	31	47.7	4	80	21	80.8
30–39	84	35.7	61	33	32	49.2	1	20	5	19.2
≥40	10	4.3	10	5.4	2	3.1	0	0	0	0
Working Status										
Housewife	144	61.3	110	59.5	44	67.7	3	60	13	50
Employed	91	38.7	75	40.5	21	32.3	2	40	13	50
Last Education Level										
Elementary School	9	3.8	7	3.8	2	3.1	0	0	1	3.8
Junior High School	17	7.2	15	8.1	2	3.1	0	0	3	11.5
Senior High School	100	42.6	74	40	29	44.6	2	40	10	38.5
University	109	46.4	89	48.1	32	49.2	3	60	12	46.2
Trimester of Pregnancy										
First Trimester	21	8.9	17	9.2	4	6.2	1	20	5	19.2
Second Trimester	27	11.5	18	9.7	14	21.5	0	0	3	11.5
Third Trimester	187	79.6	150	81.1	47	72.3	4	80	18	69.2
First Pregnancy										
Yes	80	34	67	36.2	14	21.5	4	80	13	50
No	155	66	118	63.6	51	78.5	1	20	13	50

(*Continued*)

Table 1 (Continued).

Characteristics	Total (N =235)		Pregnancy Supplements and Hormones (N = 185)		Chronic Condition Medicines (N = 65)		Antibiotics (N = 5)		Symptomatic Medicines (N = 26)	
	N	%	N	%	N	%	N	%	N	%
Comorbid										
No	172	73.2	146	78.9	27	41.5	0	0	20	76.9
Yes	63	26.8	39	21.1	38	58.5	5	100	6	23.1
Amount of Medicine Used										
1–2	153	65.1	124	67	25	38.5	2	40	16	61.5
3–5	79	33.6	59	31.9	38	58.5	3	60	10	38.5
>5	3	1.3	2	1.1	2	3.1	0	0	0	0
BMQ-Overuse Median (IQR)	11 (10–13)		11 (10–13)		11 (9–12)		12 (10–12.5)		11.5 (9–13)	
BMQ-Harm Median (IQR)	10 (9–12)		10 (9–12)		11 (9–13)		9 (8–15.5)		10 (8–13)	
Medication Beliefs										
Positive	113	48.1	91	49.2	25	38.5	5	100	15	57.7
Negative	72	30.6	48	25.9	33	50.8	0	0	10	38.5
Neutral	50	21.3	46	24.9	7	10.8	0	0	1	3.8

indicates that most participants had positive beliefs about pregnancy supplements, hormones, and antibiotic therapy. On the other hand, in the chronic condition medicines group, the median necessity score was lower than the median concern score (12 vs 14), suggesting most participants had negative beliefs towards these medications. For symptomatic medicines, participants had neutral beliefs, as the median necessity and concern scores were equal (12 vs 12) (Figure 1).

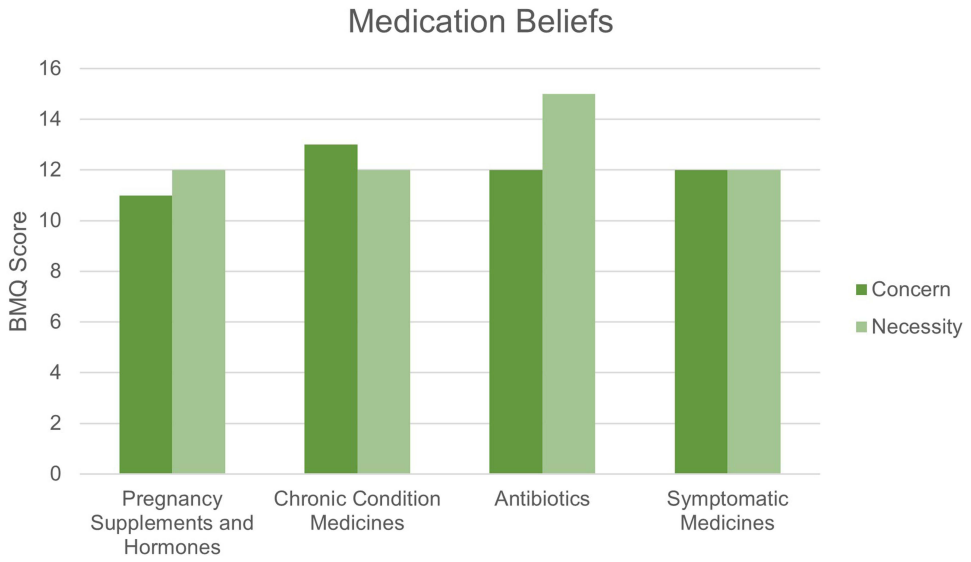

Figure 1 Comparison of Concerns and Necessity by Group.

https://doi.org/10.2147/PPA.S514046

Table 2 Profiles of Medication Usage Among Pregnant Women

Category	N (%)
Pregnancy Supplements and Hormones	185 (78.7)
Chronic Condition Medicines	65 (27.7)
Antibiotics	5 (2.1)
Symptomatic Medicines	26 (11.1)

Medication Use During Pregnancy

Regarding medication use during pregnancy, 185 participants (78.7%) reported using pregnancy supplements and hormones, 65 participants (27.7%) used medications for chronic condition, 5 participants (2.1%) used antibiotics, and 25 participants (11.1%) used symptomatic medicines (Table 2).

Adherence Levels per Group

Among the 185 participants in the pregnancy supplements and hormones group, 112 were adherent (60.5%). In the chronic condition medicines group, 35 out of 65 participants demonstrated adherence (53.8%). In the symptomatic medicines group, 12 out of 26 participants were adherent, accounting for 46.2%. All participants adhered to their antibiotic therapy. As all participants in this group demonstrated adherence, further analysis was not conducted (Figure 2).

Factors Associated with Non-Adherence

Pregnancy Supplements and Hormones

Several factors were identified as potential factors associated with non-adherence to pregnancy supplements and hormones, including working status, pregnancy history, comorbidities, overuse beliefs, harm beliefs, and medication beliefs. The results of the binary logistic regression showed that pregnant women with negative beliefs about pregnancy supplements and hormones were twice more likely to be non-adherent compared to those with positive beliefs (OR 2.42, 95% CI 1.09–5.33). Additionally, a higher score in harm beliefs (OR 1.20, 95% CI 1.02–1.40) was associated with non-adherence

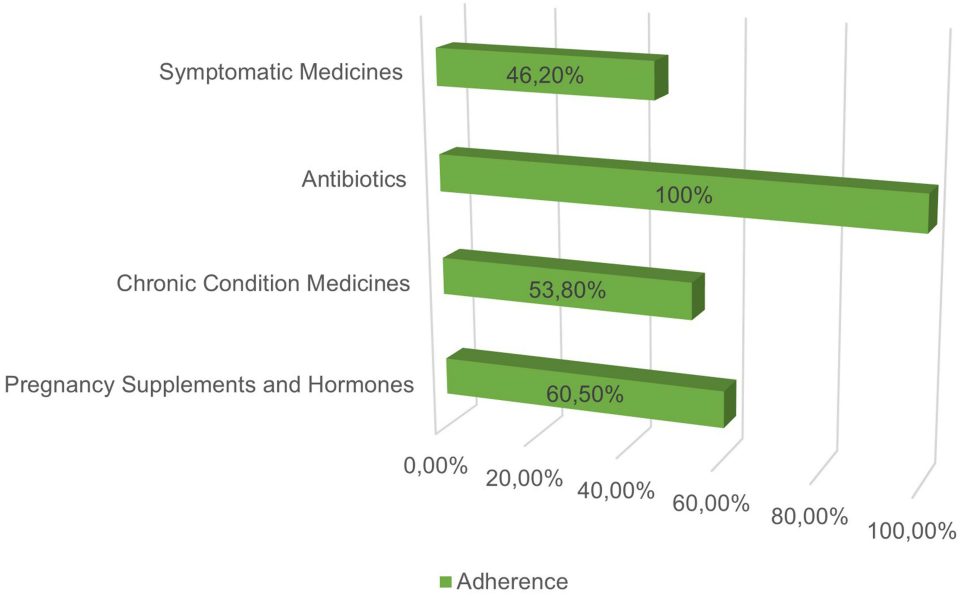

Figure 2 Medication Adherence Levels by Group.

to pregnancy supplements and hormones (Table 3). The result of the Hosmer-Lemeshow test indicated that the logistic regression model a good fit to the data (p-value > 0.05).

Chronic Condition Medicines

Several factors were selected from bivariate analysis as potential factors associated with non-adherence including working status, comorbidities, overuse beliefs, harm beliefs, side effects, and medication beliefs. The results of the binary logistic regression showed that pregnant women with negative beliefs about chronic condition medicines were five times more likely to be non-adherent compared to those with positive beliefs (OR 5.16, 95% CI 1.44–18.41) (Table 4). The results of the Hosmer-Lemeshow test indicated that the logistic regression model provided a good fit to the data (p-value > 0.05).

Table 3 Analysis of the Pregnancy Supplements and Hormones Group

Characteristics	Bivariate Analysis			Multivariate Analysis	
	Adherence N (%)	Non-Adherence N (%)	p-value	OR (95% CI)	p-value
Age					
18–29	68 (36.8)	46 (24.9)	0.813[a]	Not included	
30–39	37 (20)	24 (13)			
≥40	7 (3.8)	3 (1.6)			
Working Status					
Housewife	61 (33)	49 (26.5)	0.087[a]	Reference	
Employed	51 (27.6)	24 (13)		0.71 (0.36–1.38)	0.316
Last Education Level					
Elementary School	4 (2.2)	3 (1.6)	0.980[b]	Not included	
Junior High School	8 (4.3)	7 (3.8)			
Senior High School	43 (23.2)	31 (16.8)			
University	57 (31)	32 (17.4)			
Trimester of Pregnancy					
First Trimester	11 (5.9)	6 (3.2)	0.930[a]	Not included	
Second Trimester	11 (5.9)	7 (3.8)			
Third Trimester	90 (48.6)	60 (32.4)			
First Pregnancy					
Yes	48 (25.9)	19 (10.3)	0.020[a]	Reference	
No	64 (34.6)	54 (29.2)		1.71 (0.85–3.44)	0.134
Comorbid					
No	92 (49.7)	54 (29.2)	0.183[a]	Reference	
Yes	20 (10.8)	19 (10.3)		0.92 (0.43–2.13)	0.915

(*Continued*)

https://doi.org/10.2147/PPA.S514046

Table 3 (Continued).

Characteristics	Bivariate Analysis			Multivariate Analysis	
	Adherence N (%)	Non-Adherence N (%)	p-value	OR (95% CI)	p-value
Amount of Medicine Used					
1–2	74 (40)	50 (27)	1.000[b]	Not included	
3–5	37 (20)	22 (11.9)			
>5	1 (0.5)	1 (0.5)			
BMQ-Overuse Median (IQR)	11 (9–12)	12 (10–13)	0.046[c,*]	1.03 (0.88–1.22)	0.660
BMQ-Harm Median (IQR)	10 (8–12)	12 (10–13)	<0.001[c,*]	1.20 (1.02–1.40)	0.026*
BMQ-Side effect, Median (IQR)	2 (2–2)	2 (2–2)	0.942[c]	Not included	
Medication Beliefs					
Positive	64 (34.6)	27 (14.6)	0.002[a,*]	Reference	
Negative	19 (10.3)	29 (15.7)		2.42 (1.09–5.33)	0.029*
Neutral	29 (15.7)	17 (9.2)		1.10 (0.50–2.43)	0.808

Notes: [a]Chi-square test; [b]Kolmogorov–Smirnov test; [c]mann–Whitney test; *significant at p value<0.05. Multivariate analysis was validated by Hosmer-Lemeshow with p-value of 0.270 and R^2 value of 17%.
Abbreviation: OR, odds ratio.

Table 4 Analysis of the Chronic Condition Medicines Group

Characteristics	Bivariate Analysis			Multivariate Analysis	
	Adherence N (%)	Non-Adherence N (%)	p-value	OR (95% CI)	p-value
Age					
18–29	14 (21.5)	17 (26.2)	0.761[b]	Not included	
30–39	19 (29.2)	13 (20)			
≥40	2 (3.1)	0			
Working Status					
Housewife	21 (32.3)	23 (35.4)	0.152[a]	Reference	
Employed	14 (21.5)	7 (10.8)		0.57 (0.15–2.09)	0.392
Last Education Level					
Elementary School	1 (1.5)	1 (1.5)	1.000[b]	Not included	
Junior High School	1 (1.5)	1 (1.5)			
Senior High School	15 (23.1)	14 (21.5)			
University	18 (27.7)	14 (21.5)			

(*Continued*)

Table 4 (Continued).

Characteristics	Bivariate Analysis			Multivariate Analysis	
	Adherence N (%)	Non-Adherence N (%)	p-value	OR (95% CI)	p-value
Trimester of Pregnancy					
First Trimester	4 (6.2)	0	0.507[b]	Not included	
Second Trimester	9 (13.8)	5 (7.7)			
Third Trimester	22 (33.8)	25 (38.5)			
First Pregnancy					
Yes	6 (9.2)	8 (12.3)	0.352[a]	Not included	
No	29 (44.6)	22 (33.8)			
Comorbid					
No	17 (26.2)	10 (15.4)	0.214[a]	Reference	
Yes	18 (27.7)	20 (30.8)		1.54 (0.49–4.98)	0.468
Amount of Medicine Used					
1–2	12 (18.5)	13 (20)	0.999[b]	Not included	
3–5	22 (33.8)	16 (24.6)			
>5	1 (1.5)	1 (1.5)			
BMQ-Overuse Median (IQR)	10 (9–11)	12 (10–13)	0.034[c]	1.14 (0.83–1.58)	0.412
BMQ-Harm Median (IQR)	10 (8–13)	11 (10.5–12)	0.080[c]	1.03 (0.76–1.40)	0.841
BMQ-Side effect, Median (IQR)	2 (2–2)	2 (2–3)	0.230[c]	1.23 (0.56–2.70)	0.611
Medication Beliefs					
Positive	20 (30.8)	5 (7.7)	0.010[b]	Reference	
Negative	12 (18.5)	21 (32.3)		5.16 (1.44–18.41)	0.011*
Neutral	3 (4.6)	4 (6.2)		3.32 (0.40–27.65)	0.267

Notes: [a]Chi-square test; [b]Kolmogorov–Smirnov test; [c]mann–Whitney test; *significant at p value<0.05. Multivariate analysis was validated by Hosmer-Lemeshow with p-value of 0.964 and R^2 value of 27%.
Abbreviation: OR, odds ratio.

Symptomatic Medicines

Bivariate analysis identified several potential factors associated with non-adherence to symptomatic medicines, including pregnancy history, the number of medications used, overuse beliefs, and harm beliefs. The binary logistic regression indicated having prior pregnancies (OR 23.92, 95% CI 1.08–530.55) and using more than two types of medications (OR 29.55, 95% CI 1.06–825.08) were significantly associated with non-adherence to symptomatic medicines (Table 5). The results of the Hosmer-Lemeshow test indicated that the logistic regression model provided a good fit to the data (p-value > 0.05).

Table 5 Analysis of the Symptomatic Medicines Group

Characteristics	Bivariate Analysis			Multivariate Analysis	
	Adherent N (%)	Non-Adherent N (%)	p-value	OR (95% CI)	p-value
Age					
18–29	10 (38.5)	11 (42.3)	1.000[b]	Not included	
30–39	2 (7.7)	3 (11.5, 1)			
≥40	0	0			
Working Status					
Housewife	5 (19.2)	8 (30.8)	0.431[a]	Not included	
Employed	7 (26.9)	6 (23.1)			
Last Education Level					
Elementary School	0	1 (3.8)	1.000[c]	Not included	
Junior High School	1 (3.8)	2 (9.1)			
Senior High School	6 (23.1)	4 (15.4)			
University	5 (19.2)	7 (26.9)			
Trimester of Pregnancy					
First Trimester	3 (11.5)	2 (7.7)	1.000[c]	Not included	
Second Trimester	1 (3.8)	2 (7.7)			
Third Trimester	8 (30.8)	10 (38.5)			
First Pregnancy					
Yes	9 (34.6)	4 (15.4)	0.047[a]	Reference	
No	3 (11.5)	10 (38.5)		23.92 (1.08–530.55)	0.045*
Comorbid					
No	9 (34.6)	11 (42.3)	1.000[b]	Not included	
Yes	3 (11.5)	3 (11.5)			
Amount of Medicine Used					
1–2	10 (38.5)	6 (23.1)	0.051[b]	Reference	
3–5	2 (7.7)	8 (30.8)		29.55 (1.06–825.08)	0.046*
>5	0	0			
BMQ-Overuse Median (IQR)	9.5 (8–12)	12 (10.25–13.75)	0.020[d]	1.63 (0.63–4.23)	0.319
BMQ-Harm Median (IQR)	10 (8–10.5)	12 (9.25–13.75)	0.078[d]	1.18 (0.51–2.71)	0.697
BMQ-Side effect, Median (IQR)	2 (2–2)	2 (2–2)	0.806[d]	Not included	

(*Continued*)

Table 5 (Continued).

Characteristics	Bivariate Analysis			Multivariate Analysis	
	Adherent N (%)	Non-Adherent N (%)	p-value	OR (95% CI)	p-value
Medication Beliefs					
Positive	8 (30.8)	7 (26.9)	0.994[c]	Not included	
Negative	3 (11.5)	7 (26.9)			
Neutral	1 (3.8)	0			

Notes: [a]Chi-square test; [b]Exact Fisher test; [c]Kolmogorov–Smirnov test; [d]mann–Whitney test; *significant at p value<0.05. Multivariate analysis was validated by Hosmer-Lemeshow with p-value of 0.950 and R^2 value of 62.8%.
Abbreviation: OR, odds ratio.

Discussion

Around half of pregnant women in our study, particularly those using medications for chronic conditions, exhibited nonadherence. In contrast, adherence to antibiotic regimens was notably high. Negative beliefs and higher harm beliefs were linked to nonadherence to pregnancy supplements and hormones. Similarly, negative beliefs were also associated with nonadherence to medications for chronic conditions.

The beliefs that pregnant women hold about medication have a substantial impact on their adherence to prescribed treatments.[8] In our study, the majority of pregnant women held positive beliefs regarding medication. A study conducted by Nordeng et al revealed that the majority of women held a favourable view of medication; however, they also believed that pregnant women should have greater restrictions on medication use compared to non-pregnant women.[36] In our study, the majority of pregnant women utilized only pregnancy supplements or hormones. Pregnant women generally perceive long-term supplement consumption as non-harmful, which is reflected in their relatively low concern scores.[15] Furthermore, those experiencing vulnerable pregnancies, perceive hormonal medications as crucial for sustaining their pregnancy, resulting in higher necessity scores.[15]

On the contrary, pregnant women using medications for chronic conditions often held negative beliefs regarding medication. A previous study found that over fifty percent of pregnant women expressed negative beliefs regarding medication.[16] Many pregnant women tend to overestimate the teratogenic risks associated with medications.[17] For instance, Amundsen et al discovered that women with migraines significantly overestimated the risks linked to migraine medications and expressed concerns regarding their use during pregnancy and breastfeeding.[37] This perception can lead to increased concern and a lower necessity score for these medications.

Pregnant women with higher scores of harm beliefs were more likely to be nonadherent to pregnancy supplements and hormones. Consistent with our finding, a study by Munoz et al showed that pregnant women who used medication had lower harm subscales scores than those who did not use any medications.[38] Furthermore, other studies in the general population indicates that higher harm beliefs are associated with lower medication adherence.[39–42] According to a study by Tefera et al, pregnant women often believed that all medications are harmful during pregnancy.[43] This belief may lead to hesitation in using medications during pregnancy.

Our findings suggest that pregnant women with negative beliefs were more likely to exhibit nonadherence, showing a twofold increase in the likelihood of skipping pregnancy supplements and hormones, and a fivefold increase in the likelihood of avoiding medications for chronic conditions. In the general population with chronic illness, necessity beliefs positively impact adherence, whereas concern beliefs negatively affect it.[44] Pregnant women utilizing medications for chronic illnesses exhibited elevated necessity belief scores.[38] For instance, a study conducted by Murphy et al involving pregnant women with asthma demonstrated a significant association between higher necessity scores, higher necessity-concern differentials, and improved adherence to asthma medication.[45] Additional research has shown a correlation between adherence and positive beliefs regarding medication.[26,27] Pregnant women may be reluctant to comply with the

treatment due to their fear and lack of motivation to use medications, which may be as a result of a higher level of concern and lower level of necessity beliefs[46,47]

In our study, pregnant women demonstrated the highest adherence to antibiotics among the four groups analyzed, achieving a perfect adherence rate of 100%. This group's small sample size, consisting of only 5 participants, contributed to this perfect adherence. However, this discovery might not accurately reflect the larger population. This finding indicates that pregnant women understand the importance of adhering to antibiotic treatment to prevent resistance. Adherence to antibiotics is essential for enhancing patient outcomes and reducing the risk of antibiotic resistance.[48]

Among the four groups, pregnant women exhibited the lowest adherence to symptomatic medicines. This may be because they often only take these medications when symptoms are present, leading to a perception that adherence is unnecessary. Factors such as reduced medication use and being in the first pregnancy were linked to adherence to symptomatic medications. Interestingly, first-time pregnant women demonstrated higher adherence to symptomatic medications compared to those with prior pregnancies. Previous research indicates that pregnant women who had prior children are more likely to exhibit low adherence, which aligns with our findings.[8,49,50] This may occur as they may assume medication is unnecessary due to the successful outcome of previous pregnancies, despite possibly irregular medication use during those times.[49,50] Furthermore, this study revealed that expectant mothers who take a higher number of medications are more likely to be nonadherent to symptomatic treatments. Previous research involving pregnant women and the general population supports this finding.[51–54] The increased likelihood of nonadherence among those taking multiple medications is often linked to the perceived burden and psychological factors associated with managing various prescriptions. Pregnant women may find it challenging to keep track of all the medications they are taking, leading to feelings of overwhelm and a higher probability of forgetting doses, as highlighted in a qualitative study by Shanmugalingam et al.[51] Moreover, the use of multiple medications increases the probability of experiencing side effects, leading to increased concerns among patients.[55–57] Additionally, potential drug-drug interactions can further complicate medication management, exacerbating negative experiences and contributing to nonadherence.[57]

Several strategies are urgently needed to improve medication adherence among pregnant women. Tailored-counselling on medication use during pregnancy is necessary to improve adherence to pregnancy supplements, hormones, and medications for chronic conditions. Evidence-based counselling should be provided to address misunderstandings, alleviate fears, and ultimately enhance medication adherence. Research indicates that pregnant women recognize the need for accurate information on medication use during pregnancy.[58,59] However, studies have shown that knowledge about medication use during pregnancy among pregnant women in Indonesia is often inadequate.[60,61] Additionally, false information from media and other sources can cause increased anxiety in pregnant women.[62] Establishing a positive relationship and maintaining effective communication with healthcare providers are essential for improving adherence to all prescribed regimen. Regular reminders about the importance of their medications can significantly increasing the likelihood of adherence.[51] For those taking symptomatic medicines, particularly pregnant women using multiple medications, reminder techniques can be particularly beneficial. Research has demonstrated that the use of reminder techniques, such as pill boxes and smartphone apps, can significantly improve adherence rates.[51]

The strength of this study lies in its comprehensive analysis of adherence rates and medication beliefs across different therapeutic groups. This approach allows for the identification of which therapeutic groups exhibit higher adherence rates, along with the varying beliefs among these groups. In addition, we examined the factors associated with non-adherence within each therapeutic category.

This study may be limited by small sample sizes in certain groups, resulting in wide confidence intervals and reduced statistical power. The finding of this study may not be generalizable to other regions in Indonesia with distinct characteristics, especially in healthcare access. The overall association in our models was relatively low, suggesting the possibility of unmeasured factors that may affect non-adherence. In addition, the reliance on self-reported data may introduce bias. Other potential confounders, such as communication with healthcare providers, literacy levels, and previous adverse drug experiences, were not addressed in this study. Moreover, this study did not consider different types of non-adherence, such as intentional, unintentional, or in part intentional non-adherence. Furthermore, the cross-sectional nature of the study makes it challenging to establish causality between determinant and outcomes.

A longitudinal follow-up study is recommended to assess whether adherence behaviors change over time or in response to educational interventions.

Conclusion

Medication adherence during pregnancy, especially to chronic condition medications, remains low, highlighting the urgent need for intervention. One of the main factors associated with low medication adherence during pregnancy is negative beliefs about medications. Therefore, tailored-counselling on medication use during pregnancy is necessary to address misconceptions and improve medication adherence rates in pregnancy.

Acknowledgments

The authors would like to express their gratitude to the Ministry of Education, Culture, Research, and Technology, Republic of Indonesia, for funding this research through the Master Thesis Research Grant for the year 2024; all students who helped in data collection (N. Anna Sakinah Liana R., Devita Salsa Maharani, and Virgiana Keisha Rajabi); and all pregnant women who participated in this study.

Funding

This study was supported by the Master Thesis Research Grant from the Ministry of Education, Culture, Research, and Technology, Republic of Indonesia (No. 074/E5/PG.02.00.PL/2024). This funding body did not have any role in designing the study, writing this article, or deciding to submit it for publication.

Disclosure

The authors declare no conflicts of interest regarding the publication of this article.

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