



Factors Associated with Syphilis Infection Among Pregnant Women Attending Antenatal Care Facilities: A Cross-Sectional Study

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Abstract

Syphilis remains a major public health concern among pregnant women because of its serious maternal and neonatal consequences. However, factors associated with syphilis infection among pregnant women in Jayapura City, Indonesia, remain insufficiently understood. This study aimed to identify factors associated with syphilis infection among pregnant women in Jayapura City. An observational analytic study with a cross-sectional design was conducted at seven public health centers between July and August 2025 involving 161 pregnant women selected through purposive sampling. Data were collected using structured questionnaires and laboratory screening records and analyzed with Chi-square tests, Fisher's Exact tests, and multiple logistic regression. The findings demonstrated that 27.2% of respondents were diagnosed with syphilis. Bivariate analysis showed significant associations between syphilis infection and ethnicity ($p = 0.029$), occupation ($p = 0.009$), family income ($p = 0.015$), knowledge level ($p = 0.005$), history of sexually transmitted infections ($p = 0.013$), and risky sexual behavior ($p = 0.008$). Multivariable analysis identified ethnicity (AOR = 2.846; 95% CI: 1.243–6.514), occupation (AOR = 23.883; 95% CI: 2.356–242.064), and knowledge level (AOR = 2.637; 95% CI: 1.116–6.229) as independent factors associated with syphilis infection. These findings highlight the importance of socioeconomic and knowledge-related determinants in syphilis prevention and support culturally appropriate reproductive health education and community-based interventions. Given the cross-sectional design and purposive sampling, the findings should be interpreted as associations rather than causal relationships.

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1. INTRODUCTION

Syphilis is a sexually transmitted infection (STI) caused by the bacterium *Treponema pallidum*. The disease remains a major public health challenge because it can lead to severe adverse outcomes, particularly among pregnant women and their infants (Lawson, 2022). Untreated maternal syphilis is associated with miscarriage, stillbirth, preterm birth, low birth weight, congenital syphilis, and neonatal death (Schenkel & Gupta, 2021). According to the World Health Organization (WHO), approximately 700,000 cases of congenital syphilis and 390,000 adverse birth outcomes were reported globally in 2022, highlighting the substantial burden of the disease on maternal and child health (Zhang et al., 2022).

Early detection and treatment during pregnancy are essential strategies for preventing congenital syphilis (Keramat et al., 2022). Antenatal care services provide opportunities for screening and treatment of sexually transmitted infections, including syphilis, HIV, and hepatitis B (Magnani et al., 2010). However, many cases remain undiagnosed due to inadequate screening, delayed antenatal visits, and limited awareness of sexually transmitted infections (Shah et al., 2021). In Indonesia, syphilis continues to be a public health concern. Ministry of Health data reported that among pregnant women screened for syphilis in 2024, approximately 0.2% tested positive, indicating the continued need for effective prevention and control measures.

The burden of syphilis is also evident in Jayapura City, Papua Province. Data from the Jayapura City Health Office showed an increase in reported syphilis cases from 287 cases in 2023 to 292 cases in 2024, including 134 cases among pregnant women. Several public health centers, namely Waena, Elly Uyo, Emereuw, Twano Entrop, Abepura, Koya Barat, and Hamadi Health Centers, reported a high number of maternal syphilis cases, suggesting that the disease remains a persistent public health issue in the region.

Previous studies have identified several factors associated with sexually transmitted infections among pregnant women, including age, educational level, socioeconomic status, knowledge, history of sexually transmitted infections, and risky sexual behavior (Shangase et al., 2021). A study reported that younger age and lower educational attainment were significantly associated with sexually transmitted infections among pregnant women (Paul et al., 2024). However, most previous studies focused on sexually transmitted infections in general rather than specifically examining syphilis, which is one of the priority diseases targeted in Indonesia's Triple Elimination Program. Global and national maternal syphilis prevention initiatives, including Indonesia's Triple Elimination of Mother-to-Child Transmission of HIV, Syphilis, and Hepatitis B Program, emphasize universal antenatal syphilis screening and prompt treatment; however, program coverage and implementation vary considerably across regions, and evidence on the factors sustaining maternal syphilis transmission in specific high-burden settings such as Jayapura City remains limited.

Jayapura City is characterized by a distinct sociodemographic profile, including a substantial proportion of Papuan ethnic communities, wide variation in socioeconomic conditions, and geographic barriers to healthcare access, which may produce patterns of syphilis risk that differ from those reported in other regions of Indonesia. Given the increasing number of syphilis cases among pregnant women in Jayapura City and the limited evidence regarding factors associated with maternal syphilis in this local context, further investigation is required. Therefore, this study aimed to identify the factors associated with syphilis infection among pregnant women attending selected public health centers in Jayapura City, Indonesia.

2. METHODS

This study employed an observational analytic design with a cross-sectional approach to examine factors associated with syphilis infection among pregnant women in Jayapura City, Indonesia. The study was conducted from July 14 to August 23, 2025, at seven public health centers (Puskesmas), namely Waena, Elly Uyo, Emereuw, Twano Entrop, Abepura, Koya Barat, and Hamadi Health Centers.

The study population consisted of 950 pregnant women who attended their first antenatal care (ANC) visit between January and April 2025 at the selected health centers. The sample size was calculated using Cochran's formula for finite populations, resulting in a minimum sample of 155 respondents. To increase data completeness, a total of 161 pregnant women were included in the study. Participants were selected using a purposive sampling technique based on predetermined inclusion criteria. The inclusion criteria were pregnant women who attended antenatal care services at one of the selected health centers during the study period, agreed to participate by signing informed consent, were able to understand and complete the questionnaire, and had documented laboratory screening results for syphilis. Pregnant women with medical conditions that impaired communication or their ability to provide information were excluded from the study. Although purposive sampling facilitated the recruitment of eligible participants within the study period, this non-probability approach may introduce selection bias and could limit the extent to which these findings can be generalized to the broader population of pregnant women in Jayapura City.

The dependent variable was syphilis infection status, determined based on laboratory screening records and physician diagnosis. Independent variables included maternal age, ethnicity, educational level, occupation, family income, knowledge regarding syphilis, history of sexually transmitted infections (STIs), and risky sexual behavior. Although the analysis included key demographic, socioeconomic, and behavioral variables, other potentially relevant factors, such as partner infection status, antenatal care utilization, and access to healthcare services, were not assessed and may act as unmeasured confounders in the observed associations.

Data were collected using a structured questionnaire and secondary data obtained from laboratory screening records. The questionnaire consisted of respondent characteristics, knowledge of syphilis, history of STIs, and risky sexual behavior. Knowledge regarding syphilis was assessed through 14 statements covering causes, transmission, symptoms, prevention, and treatment. Risky sexual behavior was measured using nine items related to sexual practices associated with STI transmission. The knowledge and risky sexual behavior sections of the questionnaire were adapted from instruments used in previous studies on syphilis and sexually transmitted infections and were pre-tested among pregnant women outside the study sites to assess clarity and content validity prior to data collection. For analysis, knowledge was categorized as adequate or inadequate, and sexual behavior was categorized as risky or not risky, based on the median score of each respective set of items. To minimize reporting bias for sensitive behavioral questions, interviews were conducted individually in private settings, and respondents were assured of the confidentiality and anonymity of their responses.

Data were processed and analyzed using Statistical Package for the Social Sciences (SPSS). Descriptive statistics were used to summarize respondents' characteristics and study variables. Bivariate analysis was performed using the Chi-square test or Fisher's Exact test when the assumptions for the Chi-square test were not met. Variables with a p-value < 0.25 in the bivariate analysis were included in the multivariable logistic regression model to identify the dominant determinants of syphilis infection. Statistical significance was determined at a p-value < 0.05.

Ethical approval for this study was obtained from the Health Research Ethics Committee, Faculty of Public Health, University of Cenderawasih, Jayapura, Indonesia (Approval No. 189/KEPK-FKM UC/2026). The study was conducted in accordance with ethical principles for research involving human participants. Written informed consent was obtained from all respondents before data collection. Participants were informed about the study objectives, procedures, confidentiality of personal information, and their right to withdraw from the study at any stage without consequences.

3. RESULTS AND DISCUSSION

Based on the characteristics of the 161 respondents, most were aged 17–25 years (48.4%) and 26–35 years (47.8%), while only 3.7% were aged 36–45 years. In terms of ethnicity, the distribution was relatively balanced between Papuan (51.6%) and non-Papuan respondents (48.4%). The majority had completed senior high school or vocational high school education (62.1%), followed by higher education (24.2%), whereas only 0.6% had no formal education. Most respondents were unemployed (77.0%), while 23.0% were employed. Regarding marital status, the majority were married (67.7%), and 32.3% were unmarried. Based on gestational age, most respondents were in the second trimester of pregnancy (45.3%), followed by the third trimester (41.0%) and the first trimester (13.7%). In terms of family income, slightly more than half of the respondents (53.4%) reported an income equal to or above the Regional Minimum Wage (UMK), while 46.6% had an income below the UMK. Overall, the study participants were predominantly young pregnant women, of Papuan ethnicity, with a senior high school/vocational high school educational background, unemployed, married, in their second trimester of pregnancy, and from families with income at or above the regional minimum wage.

Table 1. Distribution of socio-demographic characteristics of pregnant women in Jayapura City (n = 161).

Characteristics	Frequency (n)	Percentage (%)
Age (years)		
17–25	78	48.4
26–35	77	47.8
36–45	6	3.7
Ethnicity		
Papuan	83	51.6
Non-Papuan	78	48.4
Education Level		
No formal education	1	0.6
Elementary school	5	3.1
Junior high school	16	9.9
Senior high school/Vocational high school	100	62.1
Higher education	39	24.2
Occupation		
Unemployed	124	77.0
Employed	37	23.0
Marital Status		
Unmarried	52	32.3
Married	109	67.7
Gestational Age		

First trimester	22	13.7
Second trimester	73	45.3
Third trimester	66	41.0
Family Income		
< Regional Minimum Wage (UMK)	75	46.6
≥ Regional Minimum Wage (UMK)	86	53.4
Total	161	100.0

As shown in Table 2, ethnicity, occupation, family income, knowledge level, history of sexually transmitted infections, and risky sexual behavior were significantly associated with syphilis infection among pregnant women in Jayapura City ($p < 0.05$). Pregnant women from the Papuan ethnic group were 2.8 times more likely to be infected with syphilis than those from non-Papuan ethnic groups (PR = 2.819; 95% CI: 1.53–5.18). Similarly, unemployed women, women with lower family income, poor knowledge regarding syphilis, a history of sexually transmitted infections, and risky sexual behavior showed a significantly higher prevalence of syphilis infection. In contrast, age and educational level were not significantly associated with syphilis infection ($p > 0.05$).

Table 2. Association between independent variables and syphilis infection among pregnant women in Jayapura City (n = 161).

Risk Factors	Positive n (%)	Negative n (%)	Total n (%)	p-value	PR (95% CI)
Age					
≤ 25 years	24 (30.8)	54 (69.2)	78 (100)	0.440	1.277 (0.76–2.11)
> 25 years	20 (24.1)	63 (75.9)	83 (100)	Reference	
Ethnicity					
Papuan	33 (39.8)	50 (60.2)	83 (100)	0.001*	2.819 (1.53–5.18)
Non-Papuan	11 (14.1)	67 (85.9)	78 (100)	Reference	
Educational Level					
Low	6 (30.0)	14 (70.0)	20 (100)	0.985	1.113 (0.54–2.29)
High	38 (27.0)	103 (73.0)	141 (100)	Reference	
Occupation					
Unemployed	43 (34.7)	81 (65.3)	124 (100)	<0.001*	12.831 (1.82–90.03)
Employed	1 (2.7)	36 (97.3)	37 (100)	Reference	
Family Income					
< Regional Minimum Wage (UMK)	29 (38.7)	46 (61.3)	75 (100)	0.005*	2.217 (1.29–3.80)
≥ Regional Minimum Wage (UMK)	15 (17.4)	71 (82.6)	86 (100)	Reference	
Knowledge Level					
Poor	17 (47.2)	19 (52.8)	36	0.005*	2.187

			(100)		(1.35–3.53)
Adequate	27 (21.6)	98 (78.4)	125 (100)	Reference	
History of Syphilis/STIs					
Yes	5 (83.3)	1 (16.7)	6 (100)	0.006*	3.312 (2.11–5.19)
No	39 (25.2)	116 (74.8)	155 (100)	Reference	
Risky Sexual Behavior					
Risky	4 (66.7)	2 (33.3)	6 (100)	0.048*	2.583 (1.38–4.82)
Not Risky	40 (25.8)	115 (74.2)	155 (100)	Reference	

*Significant at $p < 0.05$.

Table 3 shows that ethnicity, occupation, and knowledge level significant determinants of syphilis infection among pregnant women in Jayapura City. Pregnant women from the Papuan ethnic group were 2.85 times more likely to be infected with syphilis than those from non-Papuan ethnic groups (AOR = 2.846; 95% CI: 1.243–6.514; $p = 0.013$). Unemployed pregnant women had a substantially higher likelihood of infection compared with employed women (AOR = 23.883; 95% CI: 2.356–242.064; $p = 0.007$). In addition, respondents with poor knowledge regarding syphilis were 2.64 times more likely to experience syphilis infection than those with adequate knowledge (AOR = 2.637; 95% CI: 1.116–6.229; $p = 0.027$). Although risky sexual behavior showed a positive association with syphilis infection (AOR = 12.115), the relationship did not reach statistical significance in the final model ($p = 0.057$). It should be noted that the notably wide confidence intervals observed for occupation and risky sexual behavior likely reflect the small number of respondents in certain subgroups, suggesting possible instability of these estimates; these findings should therefore be interpreted with caution.

Table 3. Final multiple logistic regression model of factors associated with syphilis infection among pregnant women in Jayapura City.

Variables	B	S.E.	p-value	Adjusted OR (Exp(B))	95% CI Lower	95% CI Upper
Ethnicity (Papuan vs. Non-Papuan)	1.046	0.422	0.013	2.846	1.243	6.514
Occupation (Unemployed vs. Employed)	3.173	1.182	0.007	23.883	2.356	242.064
Knowledge Level (Poor vs. Adequate)	0.970	0.439	0.027	2.637	1.116	6.229
Risky Sexual Behavior (Risky vs. Not Risky)	2.494	1.308	0.057	12.115	0.933	157.359

The prevalence of syphilis among pregnant women in this study was 27.2%, indicating that syphilis remains a significant public health concern in Jayapura City. This prevalence is considerably higher than national estimates reported among pregnant women in Indonesia and highlights the need for strengthened screening and prevention

strategies. Ethnicity emerged as a significant determinant of syphilis infection. Pregnant women from the Papuan ethnic group were more likely to be infected than their non-Papuan counterparts. Ethnic differences may reflect variations in sociocultural norms, health-seeking behavior, health literacy, and access to reproductive health services. Cultural beliefs and community practices may influence awareness, acceptance of screening programs, and utilization of antenatal care services (Kassie et al., 2019).

Occupation was also significantly associated with syphilis infection. Unemployed pregnant women were at greater risk than employed women. Employment may provide financial independence, broader social interaction, and better access to health information and healthcare services (Suresh et al., 2021). Conversely, women who are economically dependent on family members or partners may face barriers in accessing preventive healthcare and reproductive health information. These findings are consistent with previous studies that have identified unemployment and economic dependency as important social determinants of sexually transmitted infections, including syphilis (Jenks et al., 2023; Lawson, 2022; Lim et al., 2025). Several studies have reported that unemployed women are less likely to utilize antenatal care services, undergo routine screening, and access timely treatment due to financial constraints and limited health-seeking autonomy (Wood et al., 2022). Similarly, research conducted in resource-limited settings has shown that employment status is associated with greater exposure to health promotion activities and increased awareness of reproductive health issues, which may contribute to lower infection risk (Van Gerwen et al., 2022). However, some studies have found no independent association between occupation and syphilis infection after adjusting for socioeconomic and educational factors, suggesting that the influence of employment may operate through broader social and economic pathways (Barrow et al., 2026; Newmyer et al., 2022). Despite these variations, the existing evidence supports the importance of addressing socioeconomic vulnerabilities, including unemployment, as part of comprehensive strategies to prevent maternal syphilis and improve maternal health outcomes.

Knowledge level demonstrated a significant relationship with syphilis infection. Women with inadequate knowledge regarding syphilis were more likely to be infected than those with adequate knowledge. Knowledge plays a crucial role in shaping preventive behavior, encouraging participation in antenatal screening, and promoting early treatment-seeking practices. Improved health education may therefore contribute substantially to reducing the burden of maternal syphilis. These findings are consistent with previous studies that reported a significant association between knowledge of sexually transmitted infections (STIs) and syphilis prevention behaviors among pregnant women (Yosef, 2021). Several studies have shown that women with better knowledge of syphilis transmission, symptoms, and prevention are more likely to undergo antenatal screening and seek timely treatment, thereby reducing their risk of infection (Lendado et al., 2022; Seidu et al., 2022). Similarly, research conducted in low- and middle-income countries has demonstrated that limited awareness and misconceptions about syphilis are associated with delayed diagnosis and increased maternal infection rates (Voyiatzaki et al., 2021). Nevertheless, the overall evidence indicates that improving maternal knowledge through targeted health education interventions remains a key strategy for strengthening syphilis prevention and control efforts during pregnancy.

Although family income, history of STIs, and risky sexual behavior were significantly associated with syphilis infection in the bivariate analysis, these variables did not remain significant in the final multivariable model. This finding suggests that their effects may be partially explained by stronger predictors such as ethnicity, occupation, and knowledge level. Nevertheless, these factors remain important considerations in comprehensive

syphilis prevention programs. Similar findings have been reported in previous studies, where socioeconomic status, prior STI history, and sexual risk behaviors showed significant associations with syphilis infection in unadjusted analyses but lost statistical significance after adjustment for other demographic and behavioral factors (Huda et al., 2022; Menza et al., 2020). This suggests the presence of confounding or mediating relationships among these variables. For example, individuals with lower income may also have limited access to health information and healthcare services, while risky sexual behaviors may be influenced by educational attainment and awareness levels. However, other studies have identified family income, previous STI history, and high-risk sexual practices as independent predictors of syphilis infection, highlighting the variability of these associations across different populations and settings (Kranzer et al., 2021). Such inconsistencies may reflect differences in cultural contexts, healthcare accessibility, study design, and population characteristics. Therefore, despite their lack of significance in the final model, these factors should not be overlooked, as they may still contribute indirectly to syphilis risk and remain relevant targets for integrated prevention and control strategies. The attenuation of these variables in the multivariable model may also reflect collinearity among socioeconomic and behavioral factors, as several of these variables are conceptually and empirically interrelated, as well as residual confounding that could not be fully accounted for given the sample size and study design.

This study has several limitations that should be acknowledged. First, the cross-sectional design does not allow determination of the temporal sequence between exposures and the outcome; therefore, the factors identified should be interpreted as associations rather than causal determinants. Second, the use of purposive, non-probability sampling may have introduced selection bias and limits the generalizability of the findings beyond the seven participating health centers. Third, several potentially important confounders, including partner infection status, antenatal care utilization, and access to healthcare services, were not measured and may have contributed to residual confounding in the observed associations. Fourth, the attenuation of family income, history of sexually transmitted infections, and risky sexual behavior in the multivariable model may reflect collinearity among socioeconomic and behavioral variables, or residual confounding by stronger predictors such as ethnicity, occupation, and knowledge level, rather than the absence of a true relationship. Fifth, the wide confidence intervals observed for occupation and risky sexual behavior in the final model suggest possible instability of the regression estimates due to small subgroup sizes, and these results should be interpreted with caution. Finally, although the questionnaire was adapted from previously used instruments and pre-tested prior to data collection, formal psychometric validation in this population was not conducted, and self-reported responses to sensitive behavioral questions may remain subject to social desirability and reporting bias despite measures taken to protect confidentiality.

4. CONCLUSION

This study identified several factors associated with syphilis infection among pregnant women in Jayapura City. Bivariate analysis showed that ethnicity, occupation, family income, knowledge level, history of sexually transmitted infections, and risky sexual behavior were significantly associated with syphilis infection. Multivariable logistic regression analysis further indicated that ethnicity, occupation, and inadequate knowledge were the factors most strongly associated with syphilis infection; however, given the cross-sectional design of this study, these findings should be interpreted as associations rather than causal determinants. Specific recommendations arising from these findings include

developing culturally tailored, community-based syphilis education programs for Papuan communities, strengthening targeted outreach and antenatal screening for unemployed pregnant women who may face greater barriers to healthcare access, and reinforcing pre- and post-test counselling to improve knowledge of syphilis transmission and prevention among pregnant women attending antenatal care. Further longitudinal studies incorporating probability-based sampling and additional covariates, such as partner infection status and healthcare access, are warranted to confirm these associations and to better establish the causal pathways underlying syphilis infection among pregnant women in Jayapura City.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Dolfinus Yufu Bouway conceptualized the study, developed the methodology, conducted the investigation, curated and analyzed the data, and prepared the original draft of the manuscript. Fatimah Rahma Nurul Janna contributed to the study methodology, validated the findings, supervised the research process, and critically reviewed and edited the manuscript. Inriyanti Assa contributed to the investigation, provided resources, managed the project administration, supervised the study, and reviewed and edited the manuscript. All authors read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

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DECLARATION OF ARTIFICIAL INTELLIGENCE USE

The authors declare that artificial intelligence (AI)-assisted tools were used solely to improve the language, grammar, and readability of the manuscript. All scientific content, study design, data collection, data analysis, interpretation of findings, and conclusions were developed and verified by the authors. The authors take full responsibility for the accuracy, integrity, and originality of the work and have carefully reviewed and approved the final manuscript before submission.

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