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Treponema pallidum Rapid Test Screening Results Among Laboring Women: Associations With Parity and Gestational Age at Delivery

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ABSTRACT

Syphilis during pregnancy can cause vertical transmission and adverse perinatal outcomes when not detected and treated early. The Treponema pallidum Rapid Test (TP Rapid) is used for syphilis screening within the Triple Elimination Program, particularly among pregnant and laboring women with unclear antenatal screening status. This study aimed to examine the association of parity and gestational age at delivery with TP Rapid screening results among laboring women at Sele Be Solu Regional Hospital, Sorong City, in 2024. This analytic observational study used a cross-sectional design and secondary data from medical records, delivery registers, and laboratory registers. A total of 762 laboring women were included through total sampling. Data were analyzed using univariate and bivariate analyses, including the Chi-square test and measures of association. Reactive TP Rapid results were found in 148 women (19.4%), whereas 614 women (80.6%) had nonreactive results. Parity was not significantly associated with TP Rapid results ($p = 0.459$). However, reactive TP Rapid results were more frequent in preterm than non-preterm deliveries (PR = 2.36; 95% CI: 1.78–3.12; OR = 3.09; 95% CI: 2.10–4.55; $p < 0.001$). Because TP Rapid is a treponemal screening test and this study used a cross-sectional design, reactive results should not be interpreted as active syphilis or causal evidence for preterm birth. Universal syphilis screening, confirmatory testing, treatment, newborn evaluation, and strengthened medical record documentation are recommended.

INTRODUCTION

Syphilis is a sexually transmitted infection caused by Treponema pallidum subspecies pallidum and remains an important concern in maternal and child health. During pregnancy, this infection has serious clinical consequences because it can be transmitted vertically from mother to fetus through the placenta, including during primary, secondary, and latent stages, as well as in undetected asymptomatic infection. Syphilis in pregnancy is often asymptomatic; therefore, pregnant women may be unaware of their infection status until serologic testing is performed. Delayed diagnosis and treatment may increase the risk of adverse pregnancy outcomes, including miscarriage, fetal death, stillbirth, preterm delivery, low birth weight, neonatal death, and congenital syphilis (Centers for Disease Control and Prevention [CDC], 2021; Desjardins et al., 2025; Gomez et al., 2013; Leslie et al., 2024; World Health Organization [WHO], 2024a).

The burden of maternal and congenital syphilis indicates that this infection is not only an individual clinical problem but also a public health issue that requires early detection, timely treatment, and a strong recording system. WHO estimated that in 2022 there were approximately 700,000 cases of congenital syphilis and approximately 390,000 adverse birth outcomes globally related to syphilis infection during pregnancy, including early fetal death, stillbirth, neonatal death, preterm birth or low birth weight, and infants with clinically diagnosed congenital syphilis (WHO, 2024a). Previous global estimates also showed that maternal syphilis contributes substantially to adverse birth outcomes, particularly in countries where antenatal screening coverage and treatment remain suboptimal (Korenromp et al., 2019). In Indonesia, the 2023 Indonesian Health Profile reported that 0.48% of screened pregnant women tested positive for syphilis, with the highest proportion reported in West Papua Province at 6.75% (Kementerian Kesehatan Republik Indonesia, 2024). This figure should be interpreted as the proportion of positive test results among pregnant women who underwent screening, rather than as an estimate of population prevalence. Nevertheless, this finding underscores the importance of strengthening early detection of maternal syphilis, particularly in eastern Indonesia.

The impact of syphilis on pregnancy is related to the ability of T. pallidum to infect the placenta and fetus. Maternal infection that is undiagnosed or inadequately treated may cause placental inflammation, impaired uteroplacental perfusion, intrauterine infection, fetal growth restriction, and perinatal complications. Biologically, maternal syphilis should be understood as a condition that may contribute to adverse obstetric outcomes, including preterm delivery, rather than the reverse. A meta-analysis by Gomez et al. (2013) showed that untreated maternal syphilis was associated with an increased risk of fetal loss, stillbirth, prematurity, low birth weight, neonatal death, and congenital syphilis. More recent evidence also indicates that detection and treatment of active syphilis during pregnancy with appropriate antibiotics, particularly penicillin, are associated with reduced risks of preterm birth, stillbirth, and low birth weight, although much of the evidence still comes from observational studies with potential confounding (Duarte et al., 2024; Tong et al., 2023). Therefore, the association between reactive TP Rapid screening results and gestational age at delivery should be interpreted within the framework of a possible relationship between maternal syphilis exposure and obstetric outcomes, particularly preterm delivery.

Efforts to prevent vertical transmission of syphilis rely heavily on timely screening, follow-up of reactive results, adequate maternal treatment, and evaluation and management of at-risk infants. Globally, WHO has positioned the elimination of mother-to-child transmission of HIV, syphilis, and hepatitis B as part of the global health sector strategies on HIV, viral hepatitis, and sexually transmitted infections for 2022–2030 (WHO, 2022, 2024b). In Indonesia, this policy is integrated into the Triple Elimination Program, which aims to prevent mother-to-child transmission of HIV, syphilis, and hepatitis B through screening of pregnant women, management of positive cases, and strengthening of referral and recording systems (Kementerian Kesehatan Republik Indonesia, 2017). However, program implementation continues to face challenges, particularly in screening coverage, delayed testing, incomplete documentation, and follow-up treatment. An evaluation by Azhali et al. (2023) showed that increased Triple Elimination screening coverage in Indonesia has not always been followed by optimal treatment coverage among positive cases. This finding emphasizes that screening must be followed by confirmation, therapy, partner treatment, result documentation, and monitoring of maternal and infant outcomes.

The Treponema pallidum Rapid Test, or TP Rapid, plays an important role in expanding access to syphilis screening because it is rapid, relatively simple, and does not always require complex laboratory facilities. This test belongs to the group of treponemal tests that detect antibodies against T. pallidum. In maternal health services, TP Rapid is useful as an initial screening tool, particularly in facilities with limited laboratory access or in situations requiring immediate clinical decision-making. A systematic review by Bristow et al. (2020) showed that rapid point-of-care treponemal tests have reasonably good diagnostic performance for detecting treponemal antibodies. In addition, the availability of rapid tests in primary care and antenatal settings plays an important role in preventing missed opportunities for the diagnosis and treatment of maternal syphilis, especially in areas with geographic, social, and health care access barriers (Bristow et al., 2020; Costa et al., 2024; Desjardins et al., 2025).

Nevertheless, the role of TP Rapid must be clearly distinguished from a definitive diagnosis of active syphilis. A reactive TP Rapid result indicates the presence of treponemal antibodies, but it does not necessarily distinguish active infection, past infection, or a previously treated infection. The CDC emphasizes that treponemal antibodies may generally persist after treatment; therefore, treponemal testing alone cannot determine disease activity or treatment response (Papp et al., 2024). Accordingly, reactive TP Rapid results should be followed up with quantitative nontreponemal tests, such as the Rapid Plasma Reagin (RPR) test or the Venereal Disease Research Laboratory (VDRL) test, and should be interpreted alongside treatment history, clinical symptoms, partner status, and risk factors for reinfection (CDC, 2021; Leslie et al., 2024; Papp et al., 2024). This distinction is essential so that findings from studies using TP Rapid are not directly equated with the prevalence of active syphilis.

Ideally, syphilis screening should be performed at the first antenatal care visit so that infection can be detected and treated as early as possible. The CDC (2021) recommends serologic screening for syphilis at the first prenatal visit, while repeat screening during the third trimester and at delivery may be considered for high-risk populations or in areas with a high burden of syphilis. Screening among laboring women remains clinically and programmatically valuable, particularly when women have never received antenatal care, antenatal screening results are unavailable, infection status is undocumented, or there is a possibility of new exposure during pregnancy. Guidelines for congenital syphilis also emphasize that mothers and newborns should not be discharged without documented maternal serologic status at least once during pregnancy (CDC, 2021). Thus, TP Rapid testing during labor can serve as a final safety mechanism to identify women with reactive results, ensure clinical follow-up, and reduce the risk of missed opportunities in preventing congenital syphilis.

Gestational age is an important indicator in assessing obstetric outcomes. Preterm delivery is generally defined as delivery before 37 weeks of gestation, whereas term delivery occurs within the gestational age range considered full term. In this study, gestational age should not be positioned as a cause of reactive TP Rapid results. Instead, gestational age at delivery can be analyzed as an obstetric characteristic associated with TP Rapid reactivity. If the proportion of reactive TP Rapid results is higher in the preterm group, the finding should be interpreted as indicating an association between syphilis screening reactivity and preterm delivery, but it cannot be used to infer causality because the study used a cross-sectional design and secondary data. Castilho et al. (2024) also emphasized that the association between prenatal syphilis and pregnancy outcomes may be influenced by other factors, including the quality of antenatal care, socioeconomic status, coinfection, and access to treatment.

Parity is also an important obstetric characteristic to consider in maternal health research. Biologically, parity is not a direct determinant of TP Rapid reactivity. However, parity may reflect reproductive experience, history of antenatal care utilization, health-seeking behavior, knowledge of pregnancy screening, and potential differences in social and behavioral risk exposure across groups of women. Primiparous women may have different antenatal care experiences from multiparous or grand multiparous women, whereas women with high parity may face challenges related to service access, socioeconomic burden, or delayed pregnancy care. Research on parity and pregnancy outcomes suggests that parity is associated with obstetric risk profiles, although its relationship with syphilis infection is not necessarily direct (Bai et al., 2002; Saifuddin, 2020). Therefore, analyzing parity remains relevant to determine whether TP Rapid reactivity differs according to maternal obstetric

profile, while also strengthening the argument that syphilis screening should be conducted universally regardless of the number of previous deliveries.

Sele Be Solu Regional Hospital in Sorong City has a strategic role as a regional health care facility that provides delivery care and screening services for laboring women. In a region with particular concern regarding the burden of maternal infection and challenges in equitable access to antenatal care, hospital-based data can provide an initial overview of TP Rapid screening patterns among laboring women. However, local data on TP Rapid reactivity among laboring women in Sorong, as well as its association with obstetric characteristics such as parity and gestational age, remain limited. Addressing this information gap is important because the findings may support improvements in screening implementation, follow-up of reactive cases, and documentation within programs aimed at preventing vertical transmission of syphilis.

Based on this rationale, this study aimed to analyze the association of parity and gestational age at delivery with TP Rapid screening results among laboring women at Sele Be Solu Regional Hospital, Sorong City, in 2024. In accordance with the cross-sectional design and bivariate analysis used, this study was not intended to determine risk factors or causal relationships, but rather to identify associations between obstetric characteristics and TP Rapid reactivity. The findings are expected to contribute to strengthening maternal syphilis screening, preventing congenital syphilis, and improving the quality of documentation and follow-up of screening results in maternal and child health services.

METHODS

This study was a quantitative analytic observational study with a cross-sectional design. This design was used to analyze the association between parity and gestational age at delivery with Treponema pallidum Rapid Test (TP Rapid) screening results among laboring women. Because a cross-sectional design examines data within a single observation period and does not establish the temporal sequence between variables, this study was not intended to determine causal relationships, risk factors, or clinical predictors. Therefore, the interpretation of the findings was limited to the association between obstetric characteristics and TP Rapid screening results.

The study was conducted at Sele Be Solu Regional Hospital, Sorong City, Indonesia, using secondary data from 2024. The data collection period should be specified in detail, for example January to December 2024, if the data covered the entire year. Sele Be Solu Regional Hospital was selected as the study site because it is one of the regional health care facilities that provides delivery services and laboratory testing for laboring women, including syphilis screening as part of maternal health services and the prevention of mother-to-child transmission of infection.

The target population in this study consisted of all laboring women who underwent TP Rapid testing at Sele Be Solu Regional Hospital, Sorong City, during the study period. The accessible population included laboring women recorded in the laboratory register, delivery register, and hospital medical records. Based on the initial data review, 1,032 laboring women underwent TP Rapid testing during the study period. After verification based on the inclusion criteria, exclusion criteria, data completeness, and duplicate checking, 762 subjects were eligible and included in the final analysis.

The sampling technique used was total sampling, in which all laboring women who met the study criteria were included as study subjects. The inclusion criteria were women who delivered at Sele Be Solu Regional Hospital, Sorong City, during the study period; underwent TP Rapid testing upon admission to the delivery service or during the delivery care episode; and had complete data on TP Rapid results, parity, and gestational age. The exclusion criteria were women with a documented history of syphilis treatment, women with unreadable or invalid TP Rapid results if present, women with incomplete primary data, and women with HIV and/or hepatitis B coinfection recorded in the medical records. Women with HIV and hepatitis B were excluded to reduce the potential influence of coinfection on obstetric outcomes and the interpretation of syphilis screening results.

The dependent variable in this study was the TP Rapid screening result, categorized as reactive or nonreactive based on laboratory records. TP Rapid is a treponemal test that detects antibodies against Treponema pallidum. Therefore, a reactive result in this study was interpreted as a reactive screening result, not as a definitive diagnosis of active syphilis. When available, the type or brand of the TP Rapid kit, specimen type, result-reading procedure, competency of the laboratory personnel performing the test, and internal quality control mechanism should be described. If reactive results were not confirmed using nontreponemal tests such as RPR or VDRL, this should be explicitly stated as a methodological limitation.

The independent variables in this study were parity and gestational age at delivery. Parity was defined as the number of deliveries a woman had experienced at a gestational age that had reached the threshold of viability, according to obstetric records in the medical chart. In this study, parity was categorized as primiparous, multiparous, and grand multiparous. Primiparous referred to women who had delivered once, multiparous referred to women who had delivered two to four times, and grand multiparous referred to women who had delivered five or more times.

Gestational age was defined as the gestational age at delivery recorded in the medical record, delivery register, or antenatal care document. Gestational age determination should be based on the most valid available data source, such as early pregnancy ultrasonography, last menstrual period, or the clinical record used by health care providers at the time of delivery. In this study, gestational age was categorized as preterm, term, and post-term. Preterm delivery was defined as delivery at less than 37 weeks of gestation, term delivery as delivery at 37 to 41 weeks of gestation, and post-term delivery as delivery beyond 41 weeks of gestation or according to the cutoff used in the hospital obstetric guideline.

Data were collected through document review of the laboratory register, delivery register, and patient medical records. Data linkage was performed by matching patient identity or medical record number, laboratory examination date, and delivery date. To maintain confidentiality, personal identifiers were not used in the analysis and were replaced with study codes. Data from multiple sources were cross-checked to ensure consistency in TP Rapid results, parity, gestational age, maternal age, coinfection status, and history of syphilis treatment. If duplicate records were identified, only the most complete record corresponding to the delivery episode during the study period was included in the analysis. Data management included completeness checking, editing, coding, data entry, duplicate checking, and data cleaning. Records with incomplete primary information, particularly TP Rapid results, parity, or gestational age, were excluded from the analysis.

Data were analyzed using SPSS version 22. Univariate analysis was used to describe the characteristics of the study subjects, including TP Rapid results, parity, gestational age, and additional available characteristics such as maternal age. Categorical data were presented as frequencies and percentages. Bivariate analysis was performed to examine the association between parity and TP Rapid results and between gestational age and TP Rapid results using the Chi-square test, with a significance level of $\alpha = 0.05$. The assumptions of the Chi-square test were assessed using the expected count in each cell. If cells with expected frequencies that did not meet the assumptions were identified, Fisher's exact test or clinically relevant category merging was considered, particularly for categories with very small sample sizes, such as post-term delivery.

This study received ethical approval from the Health Research Ethics Committee of Poltekkes Kemenkes Sorong under approval number DP.04.03/F.LIII.13.a./356/2026. Because this study used secondary data and did not involve direct contact with participants, the authors should state whether individual informed consent was waived by the ethics committee. All patient data were treated confidentially, anonymized before analysis, and used solely for scientific purposes. Access to the data was restricted to authorized members of the research team.

RESULTS OF STUDY

A total of 762 laboring women met the inclusion criteria and were included in the final analysis. The characteristics of the respondents are presented in Table 1. Of all respondents, 148 women (19.4%) had reactive TP Rapid screening results, while 614 women (80.6%) had non-reactive results. Based on parity, most respondents were multiparous, comprising 421 women (55.2%), followed by primiparous women with 244 women (32.0%) and grand multiparous women with 97 women (12.7%). Based on gestational age at delivery, most respondents delivered at term, totaling 580 women (76.1%), while 171 women (22.4%) delivered preterm and 11 women (1.4%) delivered post-term. Maternal age was also presented as a baseline characteristic, with most respondents aged 21–34 years, totaling 546 women (71.7%).

Table 1. Characteristics of Laboring Women Who Underwent TP Rapid Screeningy (n = 762)

Variable	Category	Frequency (n)	Percentage (%)
TP Rapid Screening Result	Reactive	148	19,4
	Non-reactive	614	80,6
Parity	Primiparous	244	32,0
	Multiparous	421	55,2
	Grand Multiparous	97	12,7
Gestational Age	Preterm	171	22,4
	Term	580	76,1
	Post-term	11	1,4
Maternal Age Group	< 20 years	81	10,6
	21 – 34 years	546	71,7
	> 35 years	135	17,7
	Total (Valid Cases)	762	100,0

Note. Percentages were calculated from the total sample of 762 respondents. Minor differences in total percentages may occur due to rounding.

The association between parity and TP Rapid screening results is shown in Table 2. Among primiparous women, 52 of 244 respondents (21.3%) had reactive TP Rapid results. Among multiparous women, 75 of 421 respondents (17.8%) had reactive results, while among grand multiparous women, 21 of 97 respondents (21.6%) had reactive results. The Pearson Chi-square test showed no statistically significant association between parity and TP Rapid screening results ($\chi^2 = 1.559$; df = 2; p = 0.459). Compared with primiparous women, multiparous women had a lower proportion of reactive TP Rapid results, but the association was not statistically significant (PR = 0.84; 95% CI: 0.61–1.15; OR = 0.80; 95% CI: 0.54–1.19). Grand multiparous women showed a similar proportion of reactive results compared with primiparous women (PR = 1.02; 95% CI: 0.65–1.59; OR = 1.02; 95% CI: 0.58–1.81). These findings indicate that the distribution of TP Rapid reactivity was relatively similar across parity groups.

Table 2. Association Between Parity and TP Rapid Screening Results Among Laboring Women (n = 762)

Parity	Reactive n (%)	Non-reactive n (%)	Total n (%)	PR (95% CI)	OR (95% CI)	p-value
Primiparous	52 (21.3)	192 (78.7)	244 (100.0)			
Multiparous	75 (17.8)	346 (82.2)	421 (100.0)	0.84 (0.61–1.15)	0.80 (0.54–1.19)	0.459
Grand multiparous	21 (21.6)	76 (78.4)	97 (100.0)	1.02 (0.65–1.59)	1.02 (0.58–1.81)	
Total	148 (19.4)	614 (80.6)	762 (100.0)			

Note. PR = prevalence ratio; OR = odds ratio; CI = confidence interval. The p-value refers to the Pearson Chi-square test for the overall association between parity and TP Rapid screening results.

Table 3. Association Between Gestational Age and TP Rapid Screening Results Among Laboring Women (n = 762)

Gestational age	Reactive n (%)	Non-reactive n (%)	Total n (%)	PR (95% CI)	OR (95% CI)	p-value
Preterm	60 (35.1)	111 (64.9)	171 (100.0)	2.42 (1.82–3.22)	3.19 (2.16–4.71)	
Term	84 (14.5)	496 (85.5)	580 (100.0)			<0.001
Post-term	4 (36.4)	7 (63.6)	11 (100.0)	2.51 (1.12–5.62)	3.37 (0.97–11.78)	
Total	148 (19.4)	614 (80.6)	762 (100.0)			

Note. PR = prevalence ratio; OR = odds ratio; CI = confidence interval. The p-value refers to the Pearson Chi-square test for the overall association between gestational age and TP Rapid screening results.

Table 4. Sensitivity Analysis of Preterm and Non-Preterm Deliveries According to TP Rapid Screening Results (n = 762)

Gestational age category	Reactive n (%)	Non-reactive n (%)	Total n (%)	PR (95% CI)	OR (95% CI)	p-value
Preterm	60 (35.1)	111 (64.9)	171 (100.0)	2.36 (1.78–3.12)	3.09 (2.10–4.55)	<0.001
Non-preterm	88 (14.9)	503 (85.1)	591 (100.0)	Reference	Reference	
Total	148 (19.4)	614 (80.6)	762 (100.0)			

Note. Non-preterm includes term and post-term deliveries. PR = prevalence ratio; OR = odds ratio; CI = confidence interval. The p-value refers to the Chi-square test; Fisher′s exact test also showed p < 0.001.

The association between gestational age and TP Rapid screening results is presented in Table 3. Reactive TP Rapid results were found in 60 of 171 preterm deliveries (35.1%), 84 of 580 term deliveries (14.5%), and 4 of 11 post-term deliveries (36.4%). The Pearson Chi-square test showed a statistically significant association between gestational age and TP Rapid screening results ($\chi^2 = 37.874$; df = 2; $p < 0.001$). Compared with term deliveries, preterm deliveries had a higher proportion of reactive TP Rapid results (PR = 2.42; 95% CI: 1.82–3.22; OR = 3.19; 95% CI: 2.16–4.71). The post-term group also showed a higher proportion of reactive results compared with the term group; however, this finding should be interpreted cautiously because the number of post-term subjects was very small (n = 11), resulting in a wide confidence interval (PR = 2.51; 95% CI: 1.12–5.62; OR = 3.37; 95% CI: 0.97–11.78).

The assumptions of the Chi-square test were also examined. In the analysis of gestational age, one cell (16.7%) had an expected count below 5, with a minimum expected count of 2.14. This condition was still within the generally acceptable range for the Pearson Chi-square test because fewer than 20% of cells had expected counts below 5 and no cell had an expected count below 1. However, because the post-term category contained only 11 respondents, an additional sensitivity analysis was conducted by combining term and post-term deliveries into a non-preterm category.

As shown in Table 4, the sensitivity analysis comparing preterm and non-preterm deliveries produced a consistent result. Reactive TP Rapid results were found in 60 of 171 preterm deliveries (35.1%) and in 88 of 591 non-preterm deliveries (14.9%). Preterm deliveries had a higher proportion of reactive TP Rapid results compared with non-preterm deliveries (PR = 2.36; 95% CI: 1.78–3.12; OR = 3.09; 95% CI: 2.10–4.55). The association remained statistically significant using the Chi-square test ($\chi^2 = 34.571$; df = 1; $p < 0.001$) and Fisher′s exact test ($p < 0.001$). This sensitivity analysis supports the robustness of the association between preterm delivery and reactive TP Rapid screening results.

DISCUSSION

This study demonstrated three main findings. First, most laboring women who underwent TP Rapid testing at Sele Be Solu Regional Hospital, Sorong City, had nonreactive results, whereas 19.4% had reactive results. Second, parity was not significantly associated with TP Rapid screening results. Third, reactive TP Rapid results were more frequently observed in the preterm delivery group than in the term delivery group, and this finding remained consistent after sensitivity analysis combining term and post-term deliveries into a non-preterm category. Overall, these findings indicate that TP Rapid reactivity among laboring women should be understood as an important indicator in maternal syphilis screening. However, its interpretation must remain cautious because this study used a cross-sectional design and secondary data (CDC, 2021a; Papp et al., 2024; WHO, 2024a).

The proportion of reactive TP Rapid results, 19.4%, is an important finding from the perspective of maternal and child health services. However, this result should not be directly interpreted as the prevalence of active syphilis among laboring women. TP Rapid is a treponemal test that detects antibodies against Treponema pallidum. Treponemal antibodies may remain reactive for a long period, even after adequate treatment; therefore, a single treponemal test cannot distinguish active infection, past infection, or a previously treated infection (Papp et al., 2024; Workowski et al., 2021). Thus, reactive TP Rapid results in this study are more appropriately described as screening reactivity rather than a definitive diagnosis of active syphilis. Stronger clinical interpretation requires follow-up testing with nontreponemal tests, such as the Rapid Plasma Reagin (RPR) test or the Venereal Disease Research Laboratory (VDRL) test, as well as information on treatment history, partner status, and the possibility of reinfection during pregnancy (CDC, 2021a, 2021b; Papp et al., 2024; Workowski et al., 2021).

Although reactive results do not always indicate active infection, this finding still has important clinical and programmatic implications. Syphilis during pregnancy is often asymptomatic, making screening a key component in preventing vertical transmission and congenital syphilis. WHO estimated that in 2022 there were approximately 700,000 cases of congenital syphilis and 390,000 adverse birth outcomes globally associated with maternal syphilis, including early fetal death, stillbirth, neonatal death, preterm birth or low birth weight, and infants with clinically diagnosed congenital syphilis (WHO, 2024a). Previous global estimates also showed that the burden of maternal and congenital syphilis is largely related to missed opportunities in antenatal care, such as pregnant women not receiving ANC, not being screened, or being screened but not receiving adequate treatment (Korenromp et al., 2019). Therefore, reactive screening results among laboring women should not stop at laboratory documentation but should be followed by confirmation, clinical management, documentation, and monitoring of both mother and infant (CDC, 2021b; Desjardins et al., 2025; WHO, 2022, 2024b).

In the Indonesian context, the findings of this study are relevant to the implementation of the Triple Elimination Program, which aims to prevent mother-to-child transmission of HIV, syphilis, and hepatitis B. This program emphasizes screening among pregnant women, management of positive cases, and strengthening of service documentation (Kementerian Kesehatan Republik Indonesia, 2017). The Indonesian Health Profile also indicates that syphilis detection among pregnant women remains an important issue in maternal health services, particularly in regions with a higher proportion of positive screening results (Kementerian Kesehatan Republik Indonesia, 2024). However, program implementation still faces challenges. Azhali et al. (2023) showed that increased screening coverage under the

Triple Elimination Program in Indonesia has not always been accompanied by optimal treatment coverage among positive cases. This finding reinforces the importance of continuity of care, including screening, confirmation, treatment, partner tracing, infant evaluation, and integration of laboratory data and medical records (Azhali et al., 2023; Costa et al., 2024; WHO, 2024b).

This study found that parity was not significantly associated with TP Rapid screening results. The proportion of reactive results was relatively similar among primiparous, multiparous, and grand multiparous women. This finding suggests that the number of previous deliveries was not a major determinant of TP Rapid reactivity in this population of laboring women. Epidemiologically, the risk of syphilis is more likely to be influenced by other factors, such as sexual behavior, the number and infection status of sexual partners, history of sexually transmitted infections, condom use, access to and quality of antenatal care, education, socioeconomic status, and delays in screening and treatment (CDC, 2021a; Costa et al., 2024; Sunguya et al., 2023; Tareke et al., 2019; Workowski et al., 2021). Because these variables were not available in the analyzed data, the nonsignificant association between parity and TP Rapid results should be interpreted cautiously.

The findings regarding parity in this study are consistent with several studies showing that behavioral factors and access to care are more dominant than obstetric characteristics alone in explaining syphilis infection during pregnancy. Tareke et al. (2019) reported that factors such as having more than one sexual partner and delayed first antenatal care visit were associated with syphilis seropositivity among pregnant women. Meanwhile, Sunguya et al. (2023) showed that syphilis infection among pregnant women in Tanzania varied by region and was associated with certain sociodemographic factors, including age, education, and parity. Costa et al. (2024) also emphasized that the quality of prenatal care and socioeconomic indicators were associated with syphilis in pregnancy and congenital syphilis. Differences across studies may be explained by variations in social context, population characteristics, antenatal screening coverage, case definitions, types of tests used, and availability of risk factor data. Therefore, the findings of this study are better understood as evidence that parity alone is not sufficient to identify which women should be screened. Syphilis screening should remain universal for all pregnant and laboring women regardless of parity (ACOG, 2024; CDC, 2021a; USPSTF, 2025).

The association between gestational age and TP Rapid results in this study should be discussed with an appropriate clinical direction. The findings showed that reactive TP Rapid results were more frequently observed among women with preterm delivery than among those with term delivery. Thus, the more appropriate interpretation is not that gestational age affects TP Rapid results, but rather that syphilis screening reactivity was more frequently found in the preterm delivery group. This is consistent with the biological understanding that maternal syphilis may contribute to adverse obstetric outcomes through placental infection, inflammation, impaired uteroplacental perfusion, fetal infection, and increased risk of preterm delivery, low birth weight, stillbirth, or neonatal death (Duarte et al., 2024; Gomez et al., 2013; Korenromp et al., 2019; WHO, 2024a).

Pathophysiologically, T. pallidum can cross the placenta and infect the fetus during pregnancy. Undetected or untreated infection can cause placentitis, fetal growth restriction, intrauterine inflammation, and perinatal complications (Desjardins et al., 2025; Duarte et al., 2024; Leslie et al., 2024). In a systematic review and meta-analysis, Gomez et al. (2013) showed that untreated maternal syphilis was associated with an increased risk of fetal loss or stillbirth, neonatal death, prematurity or low birth weight, and clinical manifestations of congenital syphilis in infants. Global findings by Korenromp et al. (2019) also confirmed that maternal syphilis remains an important preventable cause of adverse birth outcomes through timely screening and treatment. Recent evidence also shows that appropriate antibiotic treatment for syphilis during pregnancy is associated with reduced risks of preterm birth, stillbirth, and low birth weight (Tong et al., 2023).

The findings of this study are also consistent with evidence that diagnosis and treatment of syphilis during pregnancy can reduce the risk of adverse birth outcomes. Tong et al. (2023) reported that treatment of active syphilis during pregnancy was associated with reduced risks of preterm birth, stillbirth, and low birth weight. Desjardins et al. (2025) emphasized that early recognition, diagnostic confirmation, and adequate treatment among pregnant women are essential components in preventing congenital syphilis and perinatal complications. ACOG (2024) also affirmed that benzathine penicillin G is an effective treatment for syphilis during pregnancy and for the prevention of congenital syphilis. However, because this study did not include data on the timing of infection, RPR/VDRL confirmation, treatment history, treatment adherence, or partner status, the association between TP Rapid reactivity and preterm delivery cannot be interpreted as causal.

The post-term group in this study included a very small number of subjects; therefore, the proportion of reactive results in this group should be interpreted with great caution. A small number of cases can produce unstable estimates and wide confidence intervals. Therefore, sensitivity analysis combining term and post-term deliveries into a non-preterm group was an appropriate step to assess the consistency of the findings. The sensitivity analysis continued to show that TP Rapid reactivity was more frequently found in the preterm group than in the non-preterm group. This finding strengthens the signal of an association between syphilis screening reactivity and preterm delivery, although it is still insufficient to establish causality because there was no adequate temporal information regarding when infection occurred, when screening was performed, and whether treatment was provided before delivery (Castilho et al., 2024; Gomez et al., 2013; Tong et al., 2023).

Potential confounding factors should be considered when interpreting the findings of this study. Preterm delivery is a multifactorial obstetric outcome that may be influenced by maternal infections other than syphilis, nutritional status, anemia, hypertensive disorders of pregnancy, premature rupture of membranes, previous history of preterm delivery, maternal age, socioeconomic status, quality of antenatal care, and delayed detection and treatment during pregnancy (Castilho et al., 2024; Costa et al., 2024; Desjardins et al., 2025). Castilho et al. (2024) showed that the association between prenatal syphilis and pregnancy outcomes may change after accounting for other factors, particularly in populations with comorbidities and variations in access to care. In this study, several important confounding factors were not analyzed due to the limitations of secondary data. Therefore, the findings should be understood as preliminary bivariate associations that require confirmation through further studies using cohort designs or more comprehensive multivariable analyses.

These findings have practical relevance for maternity care services. Ideally, syphilis screening should be performed at

the first antenatal care visit so that infection can be detected and treated as early as possible. The CDC recommends syphilis screening at the first prenatal visit, with repeat screening during the third trimester and at delivery for high-risk populations or in areas with a high burden of syphilis (CDC, 2021a; Workowski et al., 2021). ACOG (2024) further emphasizes the importance of screening at the first prenatal visit, during the third trimester, and at delivery or birth in response to increasing cases of congenital syphilis. The USPSTF (2025) also recommends early universal screening for all pregnant individuals, and when screening is not performed early in pregnancy, testing should be conducted at the first available opportunity. In the context of Sele Be Solu Regional Hospital, TP Rapid testing during labor can serve as a final safety mechanism, particularly when antenatal screening status is unknown, undocumented, or when there is a possibility of new exposure during pregnancy (CDC, 2021a, 2021b; USPSTF, 2025).

The availability of TP Rapid testing must also be accompanied by a strong follow-up system. Rapid testing can expand access to screening because it is relatively simple and can be used in settings with limited laboratory capacity. Bristow et al. (2020) showed that rapid point-of-care treponemal tests have reasonably good diagnostic performance for detecting treponemal antibodies. However, because treponemal testing alone is insufficient to determine disease activity, reactive results should be followed up with quantitative nontreponemal testing, assessment of treatment history, guideline-based therapy, partner tracing and treatment, and evaluation of the newborn (CDC, 2021b; Papp et al., 2024; Workowski et al., 2021). Without such a follow-up system, screening may produce only administrative findings without achieving its maximum impact in preventing vertical transmission (Azhali et al., 2023; Costa et al., 2024; WHO, 2024b).

Strengths and Limitations

The strength of this study lies in its use of hospital-based data with a relatively large sample size and its focus on laboring women, a key population in the prevention of congenital syphilis. This study also provides local evidence on TP Rapid reactivity at Sele Be Solu Regional Hospital, Sorong City, which may serve as a preliminary basis for strengthening documentation and follow-up in maternal syphilis screening programs. In addition, the sensitivity analysis for gestational age categories helped support the consistency of the association between reactive TP Rapid results and preterm delivery.

However, this study has several limitations. First, the cross-sectional design did not allow determination of the temporal sequence between TP Rapid reactivity and preterm delivery; therefore, the findings cannot be interpreted as causal. Second, the use of secondary data means that the quality of the analysis depended on the completeness and accuracy of medical records, delivery registers, and laboratory registers. Third, reactive TP Rapid results were not confirmed with RPR/VDRL data or nontreponemal titers; thus, this study could not distinguish active infection, past infection, or previously treated infection. Fourth, data on syphilis treatment, treatment adherence, partner treatment, ANC history, timing of antenatal screening, sexual behavior, socioeconomic status, history of sexually transmitted infections, obstetric complications, and neonatal outcomes were not available for analysis. Fifth, the reduction from the initial number of eligible records to the final analytic sample may have introduced selection bias if the characteristics of excluded cases differed from those included in the analysis. These limitations should be considered when interpreting the findings and designing future studies.

Implications for Practice

The findings of this study support the need to strengthen universal syphilis screening among pregnant and laboring women, regardless of parity or gestational age. Health care facilities should ensure that screening is performed at the first ANC visit, repeated in the late trimester or during labor when infection status is unknown, and consistently documented in medical records and maternal health documents (ACOG, 2024; CDC, 2021a; USPSTF, 2025). Women with reactive TP Rapid results should receive confirmatory testing according to the applicable clinical algorithm, immediate treatment based on guidelines, counseling, partner tracing and treatment, and newborn evaluation to prevent congenital syphilis (CDC, 2021b; Desjardins et al., 2025; Papp et al., 2024; Workowski et al., 2021). At the service level, integration of laboratory registers, medical records, delivery registers, and the Triple Elimination Program reporting system should be strengthened so that screening results are not disconnected from clinical follow-up. Future studies using cohort designs, confirmatory serologic data, treatment information, and neonatal outcomes are needed to more robustly assess the temporal relationship between maternal syphilis and preterm delivery.

CONCLUSIONS AND RECOMMENDATION

This study showed that most laboring women at Sele Be Solu Regional Hospital, Sorong City, in 2024 had nonreactive TP Rapid screening results. Parity was not significantly associated with TP Rapid screening results; therefore, the number of previous deliveries should not be used as a basis for determining which women should be screened. In contrast, reactive TP Rapid results were more frequently observed among women with preterm delivery than among those with non-preterm delivery. However, because TP Rapid is a treponemal screening test and this study used a secondary data-based cross-sectional design, reactive results cannot be directly interpreted as active syphilis or as evidence of a causal relationship with preterm delivery. These findings underscore the importance of universal syphilis screening among pregnant and laboring women, confirmatory testing for reactive results, appropriate clinical management, newborn evaluation, and strengthened medical record documentation and follow-up systems within the Triple Elimination Program.

DECLARATION

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This research received no external funding and was conducted independently by the authors.

Conflicts of interest

The authors declare that they have no conflicts of interest related to this study.

Ethics approval and consent to participate

This study utilized secondary data obtained from existing records and did not involve direct interaction with human participants during data collection. The data were analyzed in accordance with applicable ethical principles, with measures taken to ensure confidentiality, anonymity, and the protection of participants' privacy. Any required ethical approval and permissions for the use of secondary data were obtained in accordance with institutional and regulatory requirements.

Consent for publication

Not applicable. The manuscript does not contain any individual person's data in any form (including images, videos, or personal details).

Availability of data and materials

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

Artificial Intelligence-Assisted Technology

The authors declare that no artificial intelligence–assisted technology was used in the design, data collection, analysis, or interpretation of the study results.

Authors' contributions:

Firel Ferliandy Jabiy contributed to the development of the research idea, formulation of the study design, data collection, data processing, initial data analysis, and preparation of the first draft of the manuscript. Muhammad Syafri Busra provided methodological guidance, contributed to the interpretation of the findings, and critically reviewed the manuscript to strengthen its scientific rigor. Hamdiah Ahmar contributed to the statistical analysis, verification of the analytical results, and refinement of the manuscript content. Rachmawati Abdul Hafid supervised the overall research process, reviewed the final version of the manuscript, and provided approval for submission. Tuti Sukini contributed to the statistical verification and validation of the study results. All authors reviewed and approved the final manuscript.

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ADDITIONAL INFORMATION

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