

Syphilis and associated factors among pregnant women attending antenatal care services at Yaya Gulale District public health facilities, Oromia Regional State, Ethiopia

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ABSTRACT

Background: Syphilis is the prevalent disease worldwide. Its screening is often conducted among pregnant women to prevent mother-to-child transmission. It is significantly rising in Ethiopia, although there is effective treatment. However, the prevalence of syphilis and its associated factors in pregnant women have not been well investigated in this study area. Therefore, this study aimed to assess prevalence of syphilis and associated factors among pregnant women attended antenatal care at Yaya Gulale District health facilities Oromia Regional State of Ethiopia.

Methods: A facility based cross-sectional study was conducted among 228 pregnant women from September 15 to October 15, 2022 in Yaya Gulale District, North Shewa Zone, Oromia Regional State of Ethiopia. A systematic random sampling technique was used to select the participants. A structured questionnaire was used to collect the data. The collected data was entered to EpiData version 3.1 and analyzed by SPSS version 26. Descriptive statistics was used to summarize the characteristics of the participants. Variables with P-values < 0.05 were considered statistically significant predictors of the dependent variable.

Results: The prevalence of syphilis was 2.6% 95% CI: (0.9–4.8) among the pregnant women. Married marital status (AOR = 7.9, 95% CI: (3.3–9.1), p = 0.006), having multiple sexual relation history (AOR = 4.8, 95% CI: (1.6–5.6), p = 0.004), and poor knowledge about syphilis (AOR = 3.2, 95% CI (2.4–7.65), p = 0.008) were significantly associated with syphilis infection.

Conclusion: The prevalence of syphilis was considerable in this study area. Interventions targeted married women with multiple sexual partners, and awareness creation to increase knowledge about syphilis are crucial to prevent syphilis infection among pregnant women.

Keywords: Women health, Antenatal care, Pregnant women, Syphilis.

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BACKGROUND

Syphilis is one of the most common sexually transmitted diseases (STIs) across the world (1,2). It is caused by *Treponema Pallidum* a bacterial agent (1,2). It can be diagnosed by signs and symptoms and laboratory tests (3,4). It causes serious health and psychological impacts and is a leading cause of acute condition and long term disability, and even death (2,6). Infertility and ectopic pregnancies, as well as adverse birth outcomes like prematurity and low birth weight, and syphilis related stillbirth are among the severe effect of that caused by undiagnosed and untreated syphilis (5). It affects a significant proportion of pregnant women, and is the major cause of infant and prenatal morbidity (7,8).

It also causes ulcerative genital lesion, that promotes the transmission of other STIs such as HIV/AIDS, gonorrhoea and Chlamydia (10). It is a major cause of reproductive morbidity and poor pregnancy outcomes (2,11).

Infected pregnant women could transmit the bacteria to their unborn children in more than 50% of the cases, which can result in adverse pregnancy outcomes such as fetal mortality, neonatal death, preterm births, fetal growth restriction, and congenital infection (6,12,13).

An estimated 661,000 cases of congenital syphilis, including 355,000 cases of adverse birth outcomes (ABO) and non-clinical syphilis were reported globally in 2016 with an estimated global maternal syphilis prevalence of 0.69% (14,15). The ABOs comprised 109,000 newborns with clinical congenital syphilis, 41,000 low-birth weight deliveries, 143,000 early fetal deaths and stillbirths, and 61,000 neonatal deaths (13). About 57% of ABOs occurred in pregnant women who attended antenatal care (ANC) but were not screened for syphilis; 74,000 (21%) occurred in mothers who were not enrolled in ANC; 55,000 (16%) occurred in mothers who were screened but not treated; and 23,000 (6%)

occurred in mothers who were enrolled, screened, and treated (14,16).

Even though there are several studies conducted in different parts of Ethiopia, there is limited evidence in literature on the prevalence of syphilis in pregnant women and its associated factors in rural context. To the knowledge of the authors there is no previous study that reported from this study area. Therefore, this study aimed to determine the prevalence of syphilis and its associated factors among pregnant women visiting ANC in Yaya Gulele District, North Shewa, Oromia Regional State of Ethiopia.

Methods

Study area and period

This study was conducted in public health facilities found in Yaya Gulale district, North Shewa Zone, Oromia Regional State of Ethiopia. Yaya Gulale District is located at 140 kilometers to the North West of Addis Ababa. The district has an estimated total population of 80332, of these 40,969 are females. According to 2022 population projection, 17,754 of females in the district are in reproductive age group.

The district has four public health centers, three private clinics, and 17 health posts. All government health institutions in the district are providing ANC services for pregnant women. The study was conducted in four health centers (from September 15, to October 15, 2022).

Sample size determination

The sample size was calculated using single population proportion formula. In sample size calculation, 95% confidence level, 5.1% true population proportion of syphilis among pregnant women (10), 3% margin of error, and 10% non-response rate. Accordingly, a total of 228 sample size was determined and included to this study.

Sampling technique and procedures

A systematic random sampling technique was used to select representative sample from the selected health facilities by using ANC registration as sampling frame. The desired number of participants at each health facility was proportionally allocated based on the of pregnant women number visited the health facilities in the same month of preceding year. Face-t-face interview was conducted using a structured and pretested questionnaire by trained data collectors. Written informed consent was obtained from each pregnant woman before data interview and specimen collection. Participants were sent to the laboratory with a requisition form in order to give blood sample for *Treponema palladium* antibody test and the laboratory test results were subsequently collected.

Data collection process

Structured questionnaire was developed based on literature review (7,10,13), and used for data collection. The questionnaire was developed in English and translated to local language (Afaan Oromo). The questionnaire covers socio-demographic, knowledge related to syphilis and women obstetrics related variables. Serological analyses of serum sample of four milliliters of venous blood in plain test tube was collected from each participant, and the laboratory test was conducted by Immunochromatographic (ICS) diagnostic test in accordance with the instructions and Guideline provided by the manufacture of the kit.

Data quality assurance

A one-day training was given for four midwives and four laboratory personnel who served as data collectors. The training was given on data collection tool, data collection technique; the relevance of the study, objective of the study, confidentiality of the data, ethical principles, and interview approach. Prior to data collection, a pre-test was performed at different health center from the selected health center on 5% of total sample size of the study to ensure the clarity and consistency of the questionnaire, and acceptability of the laboratory procedure.

Data processing and analysis

The collected data was cleaned, coded and entered into EpiData version 3.1 and exported to IBM Statistical Package for Social Sciences (SPSS) version 26 for analysis. Data was also checked for inconsistencies and missing values. After categorizing and defining variables, the data was analyzed and presented in frequency tables and figure. Descriptive statistics was used to compute summary statistics. A logistic regression model was used to assess factors associated with syphilis infection. Variables at a cut off p-value ≤ 0.25 on bivariable model were entered to multivariable logistic regression models. Odds ratios with 95% confidence interval (CI) were reported show statistical significance and level of association.

RESULTS

Socio-demographic characteristics of study population

A total of 228 pregnant women attended ANC services at study area were enrolled to this study with 100% response rate. Nearly, half (49.1%) of participants were in the age ranged of 20-29 years. Majority (92.1%) of the women were married, and 186 (81.6%) resided in rural area. More than half (55.7%) of the participants were housewives, while 45 (19.7%) were private employees. Of the total participants, 32.9% earned above 1000 Ethiopian Birr (ETB) per month, while 63 (27.6%) earned less than 1000 Ethiopian birr (Table 1).

Figure 1: Sociodemographic characteristics of pregnant women attended ANC at Yaya Gulale District, Oromia Regional State, 2022 (n = 228)

Characteristics		Frequency	Percentage (%)
Age categories (years)	15-19	26	11.4
	20-29	112	49.1
	30-39	87	38.2
	40-49	3	1.3
Educational status	Illiterate	184	80.7
	High school	25	11.0
	Collage and above	19	8.3
Occupation of respondent	Housewife	127	55.7
	Government employee	21	9.2
	Merchant	35	15.4
	Private employee	45	19.7
	Merchant	56	24.6
Occupation of partner	Government employee	24	10.5
	Farmer	122	53.5
	Other	25	11.0
Average monthly income (birr)	500-1000	63	27.6
	1001-2000	73	32.
	2001-3000	62	27.2
	3001-10000	30	13.2
Marital status	Single	6	2.6
	Married	210	92.1
	Divorced	7	3.1
	Widowed	5	2.2
Place of residence	Urban	42	18.4
	Rural	186	81.6

Medical history, Obstetric and sexual behavior

Among the 228 respondents, 2.6%, 95% CI: (0.9–4.8) of pregnant women were sero-positive for syphilis. About 10 (4.4%) women reported a history of abortion, 9 (3.9%) had experienced neonatal death and 8 (3.5%) had experienced stillbirths. Majority of the participants (56.1%) were in second trimester, while 27.6% in their third trimesters of gestational age. Most (96.5%) of the

women had no prior history of STIs, and 211 (92.6%) had no exposure to multiple sexual activities.

Knowledge on syphilis

About 167 (73.2%) of women did not know as syphilis transmitted through unprotected sexual activities, while 171 (75%) were unaware of transplacental transmission of syphilis (Table 2). The majority (69.7%) of the women do not know how syphilis can be prevented (Table 2).

Table 2: Knowledge of pregnant women on syphilis infection Yaya Gulale District, Oromia Regional State, Ethiopia, 2022 (n = 228)

Knowledge related question	Yes, n (%)	No, n (%)
Syphilis symptoms	75 (32.9)	153 (67.1)
Transmitted through unprotected sex	61(26.8)	167 (73.2)
Mother to child transmission placentally	57 (25.0)	171(75.0)
Symptoms Meaning of syphilis	77 (33.8)	151 (66.2)
Prevention by condom use	69 (30.3)	159 (69.7)

Factors associated with syphilis infection

Being married (AOR = 7.9, 95% CI (3.3–9.1); $p = 0.006$), having history of previous sexually transmitted infection (AOR = 6.0, 95% CI (3.1–8.0); $p = 0.012$), having multiple sexual partner (AOR = 4.8, 95% CI (1.6–5.6); $p = 0.004$), having poor knowledge on syphilis infection (AOR = 3.2, 95% CI (2.4–7.7); $p = 0.008$, and having late first ANC visit (AOR = 3.2, 95% CI (2.3–9.7); $p = 0.005$) were significantly associated with syphilis infection among pregnant women (Table 3).

DISCUSSION

In the current study, the prevalence of syphilis among pregnant women was 2.6%. This finding is approximately similar to the findings reported from different countries including Ethiopia (7–9,11,12,18,19). It is also comparable with the findings reported from Jinka Town (4.4% (13), Addis Ababa (1.8%), and Gondar (1.9%) (20,21). However, the prevalence of syphilis in the present study is much higher than the previous reports from Nigeria (0.09%) (1). The prevalence of syphilis in the present study is also lower than the results of the previous study reported from Southern Ethiopia (5.1%) (10). These differences could be due to geographic locations and study period, socioeconomic status, access to syphilis diagnosis service, laboratory techniques used to detect syphilis and sample size.

In the current study, syphilis was found to be more common among middle aged pregnant women. Pregnant women in the age range of 20–29 had the highest syphilis seropositivity (2%), followed by the ages group (30–39 years) (1.8%). This study finding is in line with the result of previous study reported in Addis Ababa and Gondar (2,22). In contrast, the current study result is in

agreement with findings of previous study reported from Congo (7). This difference might be due to the high risk of syphilis exposure, which increased in the age group 20–29.

The odds of syphilis infection among pregnant women with a previous history of abortion was three times greater than those without a history of abortion. This finding is in line with studies reported from Dilla and Gondar (3, 23). A study reported from Brazil is also revealed that syphilis is linked to a history of previous abortions and poor prenatal care services which are contributed to the high prevalence of syphilis (19). This might explain that the abortion occurred previously as a result of undetected and untreated syphilis, or that the infection was reacquired during the current pregnancy. It might also be due to the use of contaminated medical materials from syphilis patients during the abortion procedure.

The findings of this study suggest that married pregnant women are seven times more likely to be at risk of syphilis compared to women with other marital statuses. This finding is consistent with a report from a study conducted in Congo, Central Africa,

Among the total participants 68 (29.8%) had good knowledge on syphilis infection, while 160 (70.2%) had poor knowledge (Fig 1).

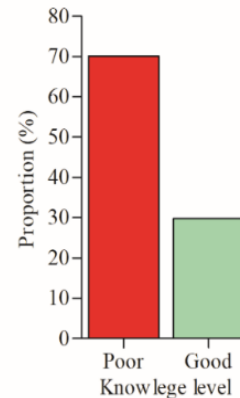


Figure 1: Knowledge level of pregnant women regarding syphilis in Yaya Gulele District, North Shewa, Oromia Regional State of Ethiopia, 202

Table 3: Multivariable analysis results on factors associated with syphilis infection among pregnant women attending ANC clinic, 2022

Characteristics		Syphilis infection status		COR (95%CI)	AOR (95%CI)	P -value
		Positive n (%)	Negative n (%)			
History of STI	Yes	1(12.5)	7(8)	6.1 (2.3–12.5)	5.99(3.1–8.0)	0.012*
	No	5(2.3)	215(97.7)	1	1	-
Marital status	Single	1(16)	5(84)	1	1	
	Married	3(1.4)	207(98.6)	13.8 (1.21–15.6)	7.93(3.3–9.1)	0.006*
	Divorced	1(14.3)	6(85.7)	1.20 (0.06–24.5)	2.52(0.20–2.9)	0.124
	Widowed	1(20)	4(80)	0.80(0.04–17.2)	2.42(0.12–3.8)	0.251
Partner STI	Yes	2(12.5)	14(87.5)	7.42 (8.1–9.0)	6.2(1.8–7.4)	0.513
	No	4(2)	208(98)	1	1	-
Multiple sexual partner	Yes	2(11.8)	15(88.2)	6.9 (7.6– 8.9)	4.8(1.6–5.6)	0.004*
	No	4(2)	207(98)	1	1	-
Stillbirth	Yes	1(12.5)	7(87.5)	6.1 (5.2–18.0)	2.6(1.2–16.2)	0.411
	No	5(2.3)	215(97.7)	1	1	-
Neonatal death	Yes	1(11)	8(89)	5.4 (4.7–15.3)	6.7(2.0–10.1)	0.307
	No	5(2.3)	214(97.7)	1	1	-
Abortion history	Yes	1(10)	9(90)	4.7 (7.6–9.3)	3.6(2.0–4.8)	0.003*
	No	5(2.3)	213(97.7)	1	1	-
Previous birth place	At Home	2(15.4)	11(84.6)	7.2 (2.3–9.3)	7.2(1.2–9.2)	0.002*
	Health Institution	5(2.4)	200(97.6)	1	1	-
Knowledge	Poor	3(2)	157(98)	2.4(1.1–9.5)	3.2(2.4–7.7)	0.008*
	Good	3(4.4)	65(95.6)	1		
ANC visit	ANC 1	3(2.8)	103(97.2)	2.0 (0.21–19.7)	3.2 (2.3–9.7)	0.005*
	ANC 2	1(1.4)	69(98.6)	0.90 (0.09–9.0)	1.3 (0.29–6.7)	0.651
	ANC 3	1(3.1)	31(96.9)	0.55(0.06–5.6)	0.45(0.06–5.6)	0.314
	ANC 4	1(5.3)	19(94.7)	1	1	-

*-Statistically significant association at p-value less than 0.05; 1-reference category; COR-Crude odds ratio, AOR-Adjusted odds ratio, CI-Confidence interval, ANC-Antenatal care

which indicated that married women are at a higher risk of acquiring syphilis compared to single women (7). In contrary to the finding of the current study a study reported from Cameron indicated that being single exposes the women to higher risk of infection compared to married women (24). The difference between the

studies might be due to more exposure of married women to unsafe sexual activities than single women.

The finding of the present study revealed that pregnant women having a history of STIs were five times more likely to be infected with syphilis compared to those without a history of STIs. This finding is similar with the

study reported from Wolaita Zone in which pregnant women with a history of STIs had a higher risk of acquiring syphilis than those who did not (25,26).

In the current study, the odds of syphilis infection were four times higher among pregnant women who had multiple sexual partners than those with single partner. This result is similar with the results of studies reported from different parts of Ethiopia (11,13,26,27). It is also supported by the result report from Dilla, Ethiopia (3). In contrary to the findings of the current study, the study reported from Southern Ethiopia indicated the absence of significant association between syphilis infection and multiple sexual activities (10). The difference between the findings of the current study and those of the previous studies is most likely due to the fact that people with several sexual partners are more likely to engage in unprotected intercourse, which exposes them to syphilis infection (26).

The odds of syphilis infection to occur were three times higher in pregnant women who had poor knowledge of syphilis than those with good knowledge, which is in line with a study reported from Southwest Ethiopia (28). However, it was in contrast with studies reported from different parts of Ethiopia (13,26). This difference might be due to less access to prevention measures, education, and media, as well as socioeconomic status.

Frequency of ANC follow up was significantly associated with syphilis infection among pregnant women in the present study. Pregnant women late first ANC visit had three times higher odds of syphilis infection than pregnant women who have more than one ANC follow up. This finding is similar with the results of previous studies (10,27,28).

The cross-sectional design of this study is a major limitation of the present study due to the inability to make causal inferences. In addition, since we employed the Venereal Disease Research Laboratory (VDRL) test instead of the recommended *Treponema pallidum* haemagglutination (TPHA) test, the results for syphilis infection could include false positives or negatives, which could over or under estimate the prevalence of syphilis.

CONCLUSION

The prevalence of syphilis among pregnant women in this study was 2.6%. Interventions targeting married women, who have a history of STIs, multiple sexual partners, late first ANC visit, poor knowledge of syphilis and a history of abortion are required to reduce the burden of syphilis infection among pregnant women.

List of abbreviations

ABO-Adverse birth outcomes; ANC-A antenatal care; AOR-Adjusted odds ratio; CI-Confidence interval; COR-Crude odds ratio; STDs-Sexually transmitted disease; STIs-Sexually transmitted infections

Declarations

Ethical consideration

This study was approved by ethical review committee of Salale University. Written informed consent was taken from each study participant prior to interview and blood sample collection. The data was collected anonymously and data security was assured by limiting access to data sources.

Consent for publication: Not applicable

Availability of data and materials

Data will be available upon request from the corresponding author.

Authors' contribution

DN- conception, designed study, acquisition, and analysis of data, and interpreted results, drafted the manuscript; MF- designed study, interpreted the results and critically revised the manuscript; GG, SG, DK and AG- data acquisition, and critically revised the manuscript. All authors approved the submission of the manuscript to this journal.

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REFERENCES

1. Lawi JD, Mirambo MM, Magoma M, Mushi MF, Jaka HM, Gumodoka B, et al. Sero-conversion rate of Syphilis and HIV among pregnant women attending antenatal clinic in Tanzania: A need for re-screening at delivery. *BMC Pregnancy Childbirth*. 2015;15(1):1–7.
2. Weldeesenbet H, Asrat D, Weldeamanuel Y. The prevalence and associated factors of *Treponema Pallidum* among HIV-positive and HIV-negative individuals who attended voluntary counseling and testing center of St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia: A cross-sectional s. *SAGE Open Med*. 2020;8:205031212090460.
3. Hailu K, Gebretsadik A. Determinants of Gonorrhoea and Syphilis infections among pregnant women attending antenatal clinic at Dilla University Referral Hospital, Ethiopia: Unmatched case-control study. *Women's Heal*. 2020;16.
4. Workowski KA, Bachmann LH, Chan PA, Johnston CM, Muzny CA, Park I, et al. Sexually Transmitted Infections Treatment Guidelines, 2021. Vol. 70, *MMWR Recommendations and Reports*. 2021. 1–187 p.
5. Taylor MM, Wi T, Gerbase A, Thwin SS, Gottlieb S, Babovic MT, et al. Assessment of country implementation of the WHO global health sector strategy on sexually transmitted infections (2016–2021). *PLoS One*. 2022;17(5 May):1–13.
6. Geremew H, Geremew D. Sero-prevalence of Syphilis and associated factors among pregnant women in Ethiopia: a systematic review and meta-analysis. *Syst Rev*. 2021;10(1):1–9: <https://doi.org/10.1186/s13643-021-01786-3>
7. Niama RF, Loukabou Bongolo NC, Bayonne Kombo ES, Yengo R, Mayengue PI, Kosso EBM, et al. Syphilis

- and HIV infections among pregnant women attending antenatal clinics in Republic of Congo. *Pan Afr Med J.* 2017;28:1–8.
8. Kebede A, Addis Z. Magnitude of HIV and Syphilis seroprevalence among pregnant women in Gondar, Northwest Ethiopia: A cross-sectional study. *HIV/AIDS. Res Palliat Care.* 2015;7:175–82.
 9. Biadgo B, Hassen A, Getaneh M, Tesfa H, Jaleta KN, Eshetu T, et al. Syphilis and Human Immunodeficiency Virus infections among pregnant women attending antenatal care clinic of Gondar family guidance association, Northwest Ethiopia: Implication for prevention of mother to child transmission. *Reprod Health.* 2019;16(1):1–8.
 10. Amsalu A, Ferede G, Assegu D. High seroprevalence of syphilis infection among pregnant women in Yiregalem hospital southern Ethiopia. *BMC Infect Dis.* 2018;18(1):1–6.
 11. Tareke K, Munsha A, Nibret E. Seroprevalence of Syphilis and its risk factors among pregnant women attending antenatal care at Felege Hiwot Referral Hospital, Bahir Dar, northwest Ethiopia: A cross-sectional study. *BMC Res Notes.* 2019;12(1):1–7.:
<https://doi.org/10.1186/s13104-019-4106-6>
 12. Hoque M, Hoque ME, Hal G van, Buckus S. Prevalence, incidence and seroconversion of HIV and Syphilis infections among pregnant women of South Africa. *South African J Infect Dis.* 2021;36(1):1–8.
 13. Enbiale M, Getie A, Haile F, Tekabe B, Miskir D. Magnitude of syphilis sero-status and associated factors among pregnant women attending antenatal care in Jinka town public health facilities, Southern Ethiopia, 2020. *PLoS One.* 2021;16(9 September):1–12:
<http://dx.doi.org/10.1371/journal.pone.0257290>
 14. Hussen S. Prevalence of Syphilis among Pregnant Women in Sub-Saharan Africa: A Systematic Review and Meta-Analysis. *Biomed Res Int.* 2019;16:2019:4562385.
 15. Korenromp EL, Rowley J, Alonso M, Mello MB, Wijesooriya NS, Mahiané SG, et al. Erratum: Global burden of maternal and congenital syphilis and associated adverse birth outcomes—Estimates for 2016 and progress since 2012 *PLoS One* 2019;14:2: e0211720.
 16. Korenromp EL, Rowley J, Alonso M, Mello MB, Wijesooriya NS, Mahiané SG, et al. Global burden of maternal and congenital syphilis and associated adverse birth outcomes — Estimates for 2016 and progress since 2012. *PLoS One.* 2019 27;14(2):e0211720.
 17. Hussen S, Tadesse BT. Prevalence of Syphilis among pregnant women in Sub-Saharan Africa: A systematic review and meta-analysis. *Biomed Res Int.* 2019;16:2019:4562385.
 18. Olugbenga I, Taiwo O, Laverty M, Ngige E, Anyaie C, Bakare R, et al. Clinic-based evaluation study of the diagnostic accuracy of a dual rapid test for the screening of HIV and syphilis in pregnant women in Nigeria. *PLoS One.* 2018;13(8): e0202122.
 19. Benedetti KCSV, Da Costa Ribeiro AD, De SáQueiroz JHF, Melo ABD, Batista RB, Delgado FM, et al. High prevalence of Syphilis and inadequate prenatal care in Brazilian pregnant women: A cross-sectional study. *Am J Trop Med Hyg.* 2019;101(4):761–6.
 20. Genetu K, Abere K, Tachbele E. Magnitudes and Correlates of Human Immunodeficiency Virus, Hepatitis B Virus, and Syphilis among Pregnant Mothers Attending Antenatal Care in Addis Ababa, Ethiopia. *Infect Dis Obstet Gynecol.* 2022 Feb 16;2022:6156613.
 21. Yitbarek GY, Ayele BA. Prevalence of Syphilis among Pregnant Women Attending Antenatal Care Clinic, Sede Muja District, South Gondar, Northwest Ethiopia. *J Pregnancy.* 2019;2019:1–5.
 22. Assefa A, Sciences H. A Three Year Retrospective Study on Seroprevalence of Syphilis among Pregnant Women at Gondar University Teaching Hospital, Ethiopia. *Afr Health Sci.* 2014 Mar;14(1):119–24.
 23. Endris M, Deressa T, Belyhun Y, Moges F. Seroprevalence of syphilis and human immunodeficiency virus infections among pregnant women who attend the University of Gondar teaching hospital, Northwest Ethiopia: A cross sectional study. *BMC Infect Dis.* 2015;15(1):1–7.
 24. Kengne-Nde C, de Dieu Anoubissi J, Loni-Ekali G, Nguéfeu-Nkenfou C, Moussa Y, Messeh A, et al. Highlighting a population-based re-emergence of Syphilis infection and assessing associated risk factors among pregnant women in Cameroon: Evidence from the 2009, 2012 and 2017 national sentinel surveillance surveys of HIV and syphilis. *PLoS One.* 15(11): e0241999.2020;
 25. Mwatelah, Ruth, et al. "Mechanisms of sexually transmitted infection-induced inflammation in women: implications for HIV risk." *Journal of the International AIDS Society* 22 (2019): e25346.
 26. Lendado TA, Tekle T, Dawit D, Daga WB, Diro CW, Arba MA, et al. Determinants of syphilis infection among pregnant women attending antenatal care in hospitals of Wolaita zone, Southern Ethiopia, 2020. *PLoS One.* 2022;17(6): e0269473.
 27. Yitbarek GY. Prevalence of Syphilis among Pregnant Women Attending Antenatal Care Clinic, Sede Muja District, South Gondar, Northwest Ethiopia. *J Pregnancy.* 2019 Jul 14;2019:1584527.
 28. Befekadu B, Shuremu M, Zewdie A. Seroprevalence of syphilis and its predictors among pregnant women in Buno Bedele zone, southwest Ethiopia: a community-based cross-sectional study. *BMJ Open.* 2022;12(8):e063745.