

Seroprevalence of Syphilis among Pregnant Women Attending Antenatal Care in Yaqshiid District, Mogadishu, Somalia

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Abstract

Background: The prevalence of syphilis among pregnant women in Somalia has been poorly studied, despite its significant impact on maternal and fetal health. In Somalia, the last syphilis study was conducted approximately 30 years ago, leaving a critical knowledge gap regarding the current epidemic of syphilis among pregnant women.

Materials and methods: From January 2023 to April 2023, a hospital-based cross-sectional study was conducted on maternal and child health. A total of 300 pregnant women were included in the study, and the seroprevalence of syphilis was determined using the Venereal Disease Research Laboratory. This one-step quick diagnostic test cassette was used as the preliminary screening tool, and Positive results were confirmed using the full chemiluminescence immunoassay (CLIA) analyzer MAGLUMI. A structured questionnaire was used to collect demographic characteristics and knowledge regarding syphilis transmission and mother-to-child transmission. SPSS Version 27.0 was used to analyze the gathered data. Statistical significance was set at $p < 0.05$.

Results: Overall, 5.3% (16/300) of pregnant women had syphilis seroprevalence. Seroprevalence rates were higher in women aged 24-34 (50.0%). There were significant relationships between syphilis infection and education ($p < 0.000$), occupation ($p < 0.000$), and residence ($p = 0.002$). Furthermore, a significant majority of pregnant women (78%) were unaware of syphilis transmission routes and its correlation to HIV risk (81.7%). Stillbirths constituted 23.3% of pregnancy-related problems, whereas 17% of pregnant women had a prior record of blood transfusions.

Conclusions: The study found an alarming syphilis seroprevalence in pregnant women, especially in certain demographic groups. The lack of knowledge of syphilis transmission and its effects highlights the necessity for targeted education. Improved prenatal care, health awareness, and effective prevention should lessen the effects of syphilis on mother and newborn health.

Keywords: syphilis, pregnant women, seroprevalence, demographic characteristics, knowledge gap.

Introduction

Syphilis is still the most common congenital infection in the world, and if left untreated, it can have serious effects on both the mother and her growing fetus (Rac et al., 2017). Congenital syphilis, a disorder in which a fetus becomes infected during pregnancy, can result in stillbirth, miscarriage, premature birth, birth abnormalities, and long-lasting physical or neurological alterations. ("Syphilis in Pregnancy," 2022). The spirochete *Treponema palladium* causes the widespread sexually transmitted illness known as syphilis (Lendado et al., 2022). Although this illness is typically thought to be sexually

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transmitted, it can also infrequently spread through blood transfusions, non-sexual contact, and even in utero (Wubete et al., 2019).

The World Health Organization (WHO) reported approximately 200,000 stillbirths and infant deaths due to congenital syphilis in 2019, making it the second leading cause of preventable stillbirths worldwide (Hoque et al., 2021). According to the WHO, 10–12 million new cases of syphilis are reported annually. Infection rates vary greatly among nations in the same area as well as among different groups investigated for syphilis. In developed countries, the seroprevalence during pregnancy is typically low, ranging from 0.02% in Europe to 4.5% in parts of the United States. In contrast, the prevalence of congenital syphilis has increased dramatically in the rural areas of Eastern Europe and Central Asia. In Africa, high rates of syphilis seropositivity (3-18%) have frequently been recorded in prenatal clinics

Approximately 2.7% (ranging from 0.1% to 10.3%) of pregnant women in Sub-Saharan Africa (SSA) are affected with syphilis, which amounts to over 900,000 pregnancies that are at risk annually. Research conducted in East African nations revealed an adjusted mean prevalence rate of syphilis at 4.6%, which is the second highest prevalence rate after Southern Africa (Befekadu et al., 2022a). In Somalia, the prevalence of syphilis among women receiving prenatal care in Somalia was reported to be 4.07% in 2019, according to data provided by the World Bank from officially recognized sources (*Somalia - Prevalence Of Syphilis (% Of Women Attending Antenatal Care) - 2024 Data 2025 Forecast 2010-2019 Historical*, n.d.). Another study conducted Jama reported prevalence of syphilis among pregnant women that is 3% in Mogadishu, Somalia (Jama et al., 1987a).

Risk factors for syphilis transmission during pregnancy include young age, African-American and Hispanic ethnicity, low socioeconomic level, less education, inadequate prenatal care, prostitution, and substance misuse. (Tsimis & Sheffield, 2017). Obstetric consequences associated with syphilis encompass spontaneous miscarriage, non-immune hydrops, stillbirth, preterm labor, low birth weight, heightened neonatal mortality, and congenital syphilis in newborns. (Uku et al., 2021). A study conducted in Sub-Saharan Africa revealed that untreated maternal syphilis resulted in an estimated 205,901 poor pregnancy outcomes, including spontaneous abortion, stillbirth, low birth weight, neonatal death, and congenital syphilis (Befekadu et al., 2022a). Syphilis continue to be a significant contributor to reproductive morbidity and adverse pregnancy outcomes in underdeveloped nations (Geremew & Geremew, 2021).

Although the proper medical care for pregnant women usually prevents these issues, the main obstacle has been the inability to detect the infected women and ensure that they receive treatment. Utilizing non-treponemal tests like rapid plasma reagin (RPR) or venereal disease research laboratory (VDRL) test, along with confirming positive results using treponemal tests like the fluorescent treponemal antibody absorption (FTA-ABS) assay, is a cost-effective approach for screening in the first trimester. It remains a substantial cause of avoidable child mortality in developing countries, notably in Sub-Saharan Africa, (Genç & Ledger, 2000), (Hamid, n.d.) and (Befekadu et al., 2022a).

Programs that involve syphilis testing combined with adequate, rapid penicillin therapy for pregnant women who test positive for *Treponema pallidum* infection have been found to be effective in lowering unfavorable pregnancy outcomes. (Gomez et al., 2013). Patients who are allergic to penicillin should be desensitized before treatment. (Genç & Ledger, 2000). The actual risk factors for treatment failure, which affect both the expectant mother and her fetus, are complex and include severe congenital syphilis as shown by sonographic fetal anomalies, delayed or insufficient treatment (less than 30 days before delivery), and delayed diagnosis. (Stafford et al., 2019).

Despite the severe impact of syphilis on the health of mothers and babies, there is a lack of research on the prevalence of syphilis among pregnant women in Somalia. This leaves a serious knowledge gap regarding the country's current syphilis infection rate in pregnant women. Consequently, this study aimed to determine the prevalence of syphilis in pregnant women and the association between syphilis and demographics and knowledge gaps using primary screening tests.

Materials and methods

Study subjects, population and criteria

This study employed a cross-sectional methodology to determine the prevalence of syphilis among pregnant women residing in Yaqshid District, Mogadishu, Somalia.

Sample size calculation

The sampling technique was a non-probability sampling technique, and the sample size was calculated using Slovin's formula ($n = N/(1 + Ne^2)$) with a confidence interval (CI) of 95% and an e of 5% marginal error.

$$n = 1200/(1 + 1200 \times 0.05^2) = 300 \text{ participants}$$

Inclusion

This study included all pregnant women attending antenatal care (ANC) at Yaqshiid Maternal and child health Center who agreed to participate.

Exclusion criteria

Pregnant women who were incapacitated to provide consent, those who showed documented hypersensitivity, and those who had received a previous diagnosis and treatment for syphilis were excluded from the study.

Data Collection

Trained nurses collected relevant data including demographic information, medical history, risk factors associated with syphilis, and blood samples from each participant. There was strict confidentiality regarding the information provided in the questionnaires, and the data were double-checked daily to ensure accuracy. The Venereal Disease Research Laboratory (VDRL), a one-step quick diagnostic test cassette, was originally used to analyze blood samples (serum).

Laboratory investigations

The VDRL rapid test can be employed with either blood, serum, or plasma samples. However, serum samples were used in the present study. The VDRL rapid test kit comprises an instructional manual, buffer solution bottle, and single-use cassette test. Showing in **Figure 1.** (*Monlab - Material Para Laboratorio de Diagnóstico Clínico - Syphilis, n.d.*)

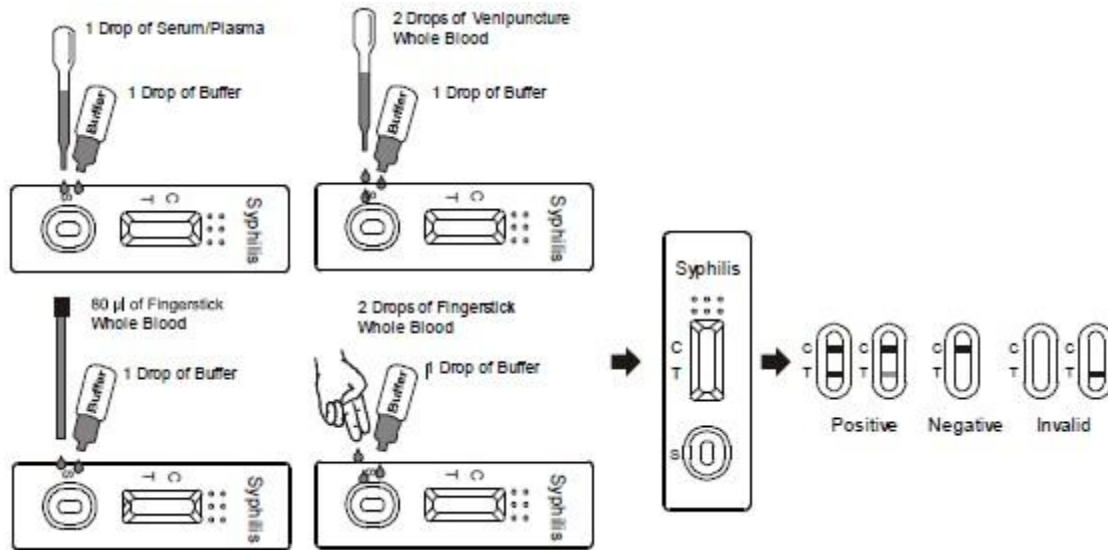


Figure 1: Rapid test cassette for syphilis test (VDRL)

Interpretation of results

The test results show the presence of two separate lines, one in the control line region, referred to as C, and the other in the test line zone, marked as T. A positive result was indicated by the presence of any color in the test line region (T), which was dependent on the concentration of TP antibodies present in the samples. A negative single-colored line is observed in the control line region (C). The absence of a line in the test line region (T) was indicative of a negative result.

MAGLUMI® Syphilis (CLIA) Enzyme-Linked Immunosorbent Assay (ELISA)

SPECIMEN COLLECTION AND PREPARATION

Serum samples were collected using standard sampling tubes and centrifuged at $\geq 10,000$ RCF (Relative Centrifugal Force) for 15 minutes. Collected blood aseptically following the universal precautions for venipuncture.

TEST PROCEDURE

Preparation of the Reagent

Resuspension of the magnetic microbeads took place automatically when the kit is loaded successfully, ensuring the magnetic microbeads are totally resuspended homogeneously prior to use.

Calculation of Results

The analyzer automatically calculated the concentration in each sample by means of a calibration curve which is generated by a 2-point calibration master curve procedure. The results are expressed in mIU/mL (Snibe Co., Ltd., n.d.).

Interpretation of Results

Results obtained with the Syphilis assay can be interpreted as follows:

- Non-reactive: A result less than 1.0 mIU/mL (<1.0 mIU/mL) is negative.
- Reactive: A result greater than or equal to 1.0 mIU/mL (≥ 1.0 mIU/mL) is positive.

Data Analysis

Data analysis was performed using SPSS Version 27.0. Descriptive analyses were conducted in this study. A statistically significant result was defined as having a p -value of less than 0.05.

Results

This study included 300 pregnant women, and the overall seroprevalence of syphilis among the pregnant women was 16/300 (5.3%).

Demographic characteristics of the pregnant women who underwent screening. With regard to age, the highest seroprevalence of syphilis was reported in women aged 24-34 (50.0%). Of the total pregnant women, 97.7% (n = 293) were married and 69% (n = 207) were unemployed. Of the pregnant women who underwent syphilis screening, 192 (64%) resided in urban areas. The educational attainment of the pregnant women in question was notably insufficient, with 219 pregnant women, or 73% of the total number of pregnant women, lacking any formal education. The prevalence of syphilis infection was significantly associated with education (p <0.000), occupation (p <0.000), and residence (p = 0.002). **Table 1** is provided.

Table 1: The social demographics and characteristics factors associated with the prevalence of syphilis among pregnant women

Characteristics	Number (300) z	Percent	Syphilis		Chi square Value	* P-value
			Positive No (%)	Negative No (%)		
Age category						
15-24	108	36.0	5 (31.3)	103 (36.3)	0.723	0.697
25-34	120	40.0	8 (50.0)	112 (39.4)		
35-44	72	24.0	3 (18.8)	69 (24.3)		
Marital status						
Married	293	97.7	16 (75.0)	277 (97.5)	0.404	1.000
Divorced	5	1.7	0 (0.0)	5 (1.8)		
Widowed	2	0.7	0 (0.0)	2 (0.7)		
Education						
Formal Education	81	27.0	12 (75.0)	69 (24.3)	19.757	0.000
No Formal Education	219	73.0	4 (25.0)	215 (75.7)		
Occupation						
Employed	93	31.0	12 (75.0)	81 (28.5)	15.297	0.000
Unemployed	207	69.0	4 (25.0)	203 (71.5)		
Residence						
Urban	192	64.0	16 (100.0)	176 (62.0)	9.507	0.002
Rural	108	36.0	0 (0.0)	108 (38.0)		

Additionally, our study reported an association between medical conditions related to pregnancy, obstetric history, and knowledge of syphilis. A total of 264 pregnant women, representing 88% of this study, were identified as being in the multigravida, and a significant proportion of the group, specifically 234 pregnant women, or 78%, demonstrated a lack of awareness regarding syphilis, which is mainly transmitted through sexual contact. Moreover, a significant proportion of pregnant women, specifically 245 (81.7%), lacked awareness regarding syphilis infection, which can increase the risk of HIV transmission or acquisition. Approximately 79.3% of the surveyed pregnant women lacked knowledge regarding the potential transmission of syphilis from infected women to their newborns. Among the various categories of pregnancy-related complications, 70 (23.3%) were identified as stillbirths. Pregnant women who had previously received blood transfusions accounted for 17% of patients. **Table 2.**

Table 2: Medical conditions related to pregnancy, obstetric history, and knowledge of syphilis among pregnant women

Characteristics	Number (300)	Percent	Syphilis		Chi square Value	* P-value
			Positive No (%)	Negative No (%)		
Do you know Syphilis is mainly transmitted through sexual contact						
Yes	66	22.0	12 (75.0)	54 (19.0)	27.667	0.000
No	234	78.0	4 (25.0)	230 (81.0)		
Do you know A man or woman who looks healthy may have syphilis						
Yes	60	20.0	8 (50.0)	52 (18.3)	9.507	0.002
No	240	80.0	8 (50.0)	232 (81.7)		
Do you know Syphilis infection can increase the risk of HIV transmission or acquisition						
Yes	55	18.3	11 (68.8)	44 (15.5)	28.694	0.000
No	245	81.7	5 (31.3)	240 (84.5)		
Do you know Syphilis-infected woman can transmit the infection to their newborn						
Yes	62	20.7	12 (75.0)	50 (17.6)	30.432	0.000
No	238	79.3	4 (25.0)	234 (82.4)		
Have you had a history of blood transfusion						
Yes	51	17.0	12 (75.0)	39 (13.7)	40.295	0.000
No	249	83.0	4 (25.0)	245 (86.3)		
How many times do you get pregnant						
Primigravida	36	12.0	8 (50.0)	28 (9.9)	23.111	0.000
Multigravida	264	88.0	8 (50.0)	256 (90.1)		
Do you have pregnancy-related problems						
Yes	180	60.0	10 (62.5)	170 (59.9)	0.044	0.834
No	120	40.0	6 (37.5)	114 (40.1)		
What Types of pregnancy-related problems						
Abortion	60	20.0	2 (12.5)	58 (20.4)	2.297	0.522
Stillbirth	70	23.3	6 (37.5)	64 (22.5)		
Caesarean section	50	16.7	3 (18.8)	47 (16.5)		
No	120	40.0	5 (31.3)	115 (40.5)		

Discussion

Our findings shed light on the seroprevalence of syphilis in pregnant women, as well as the complex relationships between socio-demographic characteristics, obstetric history, and awareness levels. The overall seroprevalence of syphilis in our study was 5.3%, which is comparable to studies in Somalia (3%) ((Jama et al., 1987b), Ethiopia (1.9%, 2.9%, and 0.44%) (Yitbarek & Ayele, 2019) (Kebede & Chamiso, 2000) and (Tridapalli et al., 2007), South Sudan (22.1%) (Emmanuel et al., 2010), Zambia (12.5%) (Ratnam et al., 1982) and Sub-Saharan Africa (2.9%) (Hussen & Tadesse, 2019). This study's syphilis seroprevalence is similarly comparable to previous studies conducted in Italy (0.49%) (Marangoni et al., 2008), Mexico (0.27%) (Noyola et al., 2006), Bulgaria (0.56%) (Tsankova et al., 2016), and Brazil (1.02%) (Domingues et al., 2014). Possible explanations for the discrepancies include geographical and temporal variations, socioeconomic and cultural variables, and variations in the availability of syphilis diagnosis and treatment.

The correlation between the prevalence of syphilis and socio-demographic parameters exhibited noteworthy patterns. The seroprevalence was highest among women aged 24-34, highlighting the importance of targeting this age group in preventive measures. A recent study conducted in Ethiopia

reported a high prevalence of syphilis in young individuals, with an adjusted odds ratio (AOR=4.3, 95% CI: 2.2 to 7.9, $p=0.045$) (Befekadu et al., 2022b).

This could be attributed to the higher prevalence of sexual activity within this age group, which increases the likelihood of encountering a spouse with syphilis. The educational level of the pregnant women in the present was noticeably low, with 73% of them lacking any formal education. The increased risk among people with low education demonstrates the importance of health literacy on preventative practices. Our findings are consistent with those of (Befekadu et al., 2022b) who observed that a woman's lack of knowledge of syphilis (AOR=3.3, 95% CI: 1.04 to 10.4, $p=0.042$) was substantially linked with syphilis. A similar study conducted in Tanzania found no statistically significant link between education and syphilis (Manyahi et al., 2015).

Disparities between urban and rural areas were noticeable, with rural residents being more likely to contract syphilis. In contrast, Ethiopia reported a 3.2% prevalence of syphilis in urban and 2.2% in rural pregnant women (Assefa, 2014). Our result is consistent with another study conducted in Ethiopia, which found a higher frequency of syphilis in rural areas compared to urban areas (COR = 3.48, $p = 0.079$), (Tareke et al., 2019). The increased prevalence of syphilis among rural inhabitants can be defined to inadequate healthcare access, lower education levels, socioeconomic constraints, cultural norms affecting sexual habits, and a paucity of sexual health education resources in these places.

The significant deficiency (81.7%) in knowledge about syphilis and its correlation with heightened HIV transmission risk underscores the pressing requirement for comprehensive sexual health education initiatives. A study conducted in southern China found that the awareness of syphilis knowledge ranged from 51.7% to 81.1%, (Wu et al., 2016). The discovered deficiency in knowledge on mother-to-child transmission (79.3%) highlights the significance of antenatal education to decrease the risk of vertical transmission. Study done in Uganda reported poor knowledge of syphilis mode of transmission 52.4% (Hakizimana et al., 2023). The high prevalence of stillbirths (23.3%) necessitates additional research into the possible impact of syphilis on negative pregnancy outcomes and emphasizes the need for timely identification and care. This result is consistent with a study conducted in China, which revealed 21.3% stillbirth or fetal death among pregnant women (Qin et al., 2014).

Lack of knowledge on the correlation between syphilis and HIV, as well as limited comprehension of mother-to-child transmission, is sometimes attributed to inadequate sexual health education. Insufficient access to reliable information can make individuals more susceptible to these illnesses. Implementing comprehensive educational programs is essential in order to close this knowledge gap, enabling individuals to acquire the necessary skills to successfully prevent and manage these health risks.

A limitation of our study is cross-sectional study design, small sample size collected because of the relatively short duration of the data collection. The generalizability of the findings may be limited due to the geographical restriction of the sample to Mogadishu and its surrounding rural areas, which may not fully represent the entire pregnant population in Somalia. Future study should use longitudinal studies to investigate the causal links between sociodemographic characteristics, knowledge levels, and syphilis prevalence. Furthermore, interventions addressing identified knowledge gaps should be developed and evaluated to inform public health initiatives.

In conclusion, our findings highlight the multifaceted nature of syphilis prevalence among pregnant women and emphasize the urgency of tailored interventions targeting sociodemographic disparities and knowledge deficits to enhance maternal and neonatal health outcomes.

Ethics Approval and Informed Consent

The Research Ethics Committee of the University of SIMAD School of Medicine and Health Sciences approved this study, and all participants were enrolled voluntarily after receiving the necessary information. The authors followed the EQUATOR Network (<https://www.equator-network.org/>) guidelines during this study.

Abbreviations

VDRL: Venereal Disease Research Laboratory, HIV: Human Immunodeficiency Virus, WHO: World Health Organization. CLIA: chemiluminescence immunoassay.

Competing interests

The authors have no conflicts of interest to disclose.

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Data Availability

The data are available from the authors upon request.

Consent for publication

Not applicable.

Reference

- Assefa, A. (2014). A Three Year Retrospective Study on Seroprevalence of Syphilis among Pregnant Women at Gondar University Teaching Hospital, Ethiopia. *African Health Sciences*, 14(1), Article 1. <https://doi.org/10.4314/ahs.v14i1.18>
- Befekadu, B., Shuremu, M., & Zewdie, A. (2022a). Seroprevalence of syphilis and its predictors among pregnant women in Buno Bedele zone, southwest Ethiopia: A community-based cross-sectional study. *BMJ Open*, 12(8), e063745. <https://doi.org/10.1136/bmjopen-2022-063745>
- Befekadu, B., Shuremu, M., & Zewdie, A. (2022b). Seroprevalence of syphilis and its predictors among pregnant women in Buno Bedele zone, southwest Ethiopia: A community-based cross-sectional study. *BMJ Open*, 12(8), e063745. <https://doi.org/10.1136/bmjopen-2022-063745>
- Domingues, R. M. S. M., Szwarcwald, C. L., Souza Junior, P. R. B., & Leal, M. do C. (2014). Prevalence of syphilis in pregnancy and prenatal syphilis testing in Brazil: Birth in Brazil study. *Revista De Saude Publica*, 48(5), 766–774. <https://doi.org/10.1590/s0034-8910.2014048005114>
- Emmanuel, S. K., Lado, M., Amwayi, S., Abade, A. M., Oundo, J. O., & Ongus, J. (2010). Syphilis among pregnant women in Juba, Souther Sudan. *East African Medical Journal*, 87(5), Article 5. <https://doi.org/10.4314/eamj.v87i5.63073>
- Genç, M., & Ledger, W. J. (2000). Syphilis in pregnancy. *Sexually Transmitted Infections*, 76(2), 73–79. <https://doi.org/10.1136/sti.76.2.73>
- Geremew, H., & Geremew, D. (2021). Sero-prevalence of syphilis and associated factors among pregnant women in Ethiopia: A systematic review and meta-analysis. *Systematic Reviews*, 10(1), 223. <https://doi.org/10.1186/s13643-021-01786-3>
- Gomez, G. B., Kamb, M. L., Newman, L. M., Mark, J., Broutet, N., & Hawkes, S. J. (2013). Untreated maternal syphilis and adverse outcomes of pregnancy: A systematic review and meta-analysis. *Bulletin of the World Health Organization*, 91(3), 217–226. <https://doi.org/10.2471/BLT.12.107623>
- Hakizimana, T., Muhumuza, J., Selamo, F. M., Ishimwe, M. P. S., Kajabwangu, R., Jelle, O. M., Muhumuza, J., Kiyaka, S. M., Nyakato, S., & Fajardo, Y. (2023). Prevalence and Factors Associated with Syphilis among Mothers with Missed Opportunities for Antenatal Syphilis

- Testing in Rural Western Uganda: A Cross-Sectional Study. *International Journal of Reproductive Medicine*, 2023, 2971065. <https://doi.org/10.1155/2023/2971065>
- Hamid, N. A. Y. (n.d.). Sero-Detection of Syphilis Antibodies Among Pregnant Women by Different Serological Tests in Khartoum State, Sudan 2019. 132.
- Hoque, M., Hoque, M. E., van Hal, G., & Buckus, S. (2021). Prevalence, incidence and seroconversion of HIV and Syphilis infections among pregnant women of South Africa. *Southern African Journal of Infectious Diseases*, 36(1), 296. <https://doi.org/10.4102/sajid.v36i1.296>
- Hussen, S., & Tadesse, B. T. (2019). Prevalence of Syphilis among Pregnant Women in Sub-Saharan Africa: A Systematic Review and Meta-Analysis. *BioMed Research International*, 2019, 4562385. <https://doi.org/10.1155/2019/4562385>
- Jama, H., Hederstedt, B., Osman, S., Omar, K., Isse, A., & Bygdeman, S. (1987a). Syphilis in women of reproductive age in Mogadishu, Somalia: Serological survey. *Genitourinary Medicine*, 63(5), 326–328.
- Jama, H., Hederstedt, B., Osman, S., Omar, K., Isse, A., & Bygdeman, S. (1987b). Syphilis in women of reproductive age in Mogadishu, Somalia: Serological survey. *Genitourinary Medicine*, 63(5), 326–328. <https://doi.org/10.1136/sti.63.5.326>
- Kebede, E., & Chamiso, B. (2000). Prevalence of syphilis in pregnancy in Addis Ababa. *East African Medical Journal*, 77(4), 212–216. <https://doi.org/10.4314/eamj.v77i4.46623>
- Lendado, T. A., Tekle, T., Dawit, D., Daga, W. B., Diro, C. W., Arba, M. A., & Tekle, T. (2022). Determinants of syphilis infection among pregnant women attending antenatal care in hospitals of Wolaita zone, Southern Ethiopia, 2020. *PLOS ONE*, 17(6), e0269473. <https://doi.org/10.1371/journal.pone.0269473>
- Manyahi, J., Jullu, B. S., Abuya, M. I., Juma, J., Ndayongeje, J., Kilama, B., Sambu, V., Nondi, J., Rabel, B., Somi, G., & Matee, M. I. (2015). Prevalence of HIV and syphilis infections among pregnant women attending antenatal clinics in Tanzania, 2011. *BMC Public Health*, 15(1), 501. <https://doi.org/10.1186/s12889-015-1848-5>
- Marangoni, A., Moroni, A., Tridapalli, E., Capretti, M. G., Farneti, G., Faldella, G., Antuono, A. D., & Cevenini, R. (2008). Antenatal syphilis serology in pregnant women and follow-up of their infants in northern Italy. *Clinical Microbiology and Infection*, 14(11), 1065–1068. <https://doi.org/10.1111/j.1469-0691.2008.02066.x>
- Monlab—Material para laboratorio de diagnóstico clínico—Syphilis. (n.d.). Retrieved May 20, 2023, from <https://monlab.com/index.php/en/products-monlab/rapid-tests/serum-plasma-samples/syphilis.html>
- Noyola, D. E., Malacara-Alfaro, O., Lima-Rogel, V., & Torres-Montes, A. (2006). [Seroprevalence of syphilis in pregnant women in San Luis Potosí]. *Salud Publica De Mexico*, 48(2), 151–154. <https://doi.org/10.1590/s0036-36342006000200008>
- Qin, J., Yang, T., Xiao, S., Tan, H., Feng, T., & Fu, H. (2014). Reported Estimates of Adverse Pregnancy Outcomes among Women with and without Syphilis: A Systematic Review and Meta-Analysis. *PLOS ONE*, 9(7), e102203. <https://doi.org/10.1371/journal.pone.0102203>
- Rac, M. W. F., Revell, P. A., & Eppes, C. S. (2017). Syphilis during pregnancy: A preventable threat to maternal-fetal health. *American Journal of Obstetrics and Gynecology*, 216(4), 352–363. <https://doi.org/10.1016/j.ajog.2016.11.1052>
- Ratnam, A. V., Din, S. N., Hira, S. K., Bhat, G. J., Wacha, D. S., Rukmini, A., & Mulenga, R. C. (1982). Syphilis in pregnant women in Zambia. *British Journal of Venereal Diseases*, 58(6), 355–358.
- Snibe Co., Ltd. (n.d.). Retrieved October 16, 2023, from https://www.snibe.com/zh_en/en_productArtical.aspx?id=32
- Somalia—Prevalence Of Syphilis (% Of Women Attending Antenatal Care)—2024 Data 2025 Forecast 2010-2019 Historical. (n.d.). Retrieved January 23, 2024, from

- <https://tradingeconomics.com/somalia/prevalence-of-syphilis-percent-of-women-attending-antenatal-care-wb-data.html>
- Stafford, I. A., Berra, A., Minard, C. G., Fontenot, V., Kopkin, R. H., Rodrigue, E., Roitsch, C. M., Rac, M. W., & Hill, J. B. (2019). Challenges in the Contemporary Management of Syphilis among Pregnant Women in New Orleans, LA. *Infectious Diseases in Obstetrics and Gynecology*, 2019, 2613962. <https://doi.org/10.1155/2019/2613962>
- Syphilis in pregnancy: An ongoing public health threat. (2022). *American Journal of Obstetrics and Gynecology*, 227(6), 822–838. <https://doi.org/10.1016/j.ajog.2022.07.041>
- Tareke, K., Munshea, A., & Nibret, E. (2019). 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 Research Notes*, 12(1), 69. <https://doi.org/10.1186/s13104-019-4106-6>
- Tridapalli, E., Capretti, M. G., Sambri, V., Marangoni, A., Moroni, A., D'Antuono, A., Bacchi, M. L., & Faldella, G. (2007). Prenatal syphilis infection is a possible cause of preterm delivery among immigrant women from eastern Europe. *Sexually Transmitted Infections*, 83(2), 102–105. <https://doi.org/10.1136/sti.2006.021352>
- Tsankova, G., Todorova, T. T., Kostadinova, T., Ivanova, L., & Ermenlieva, N. (2016). Seroprevalence of Syphilis among Pregnant Women in the Varna Region (Bulgaria). *Acta Dermatovenerologica Croatica: ADC*, 24(4), 288–290.
- Tsimis, M. E., & Sheffield, J. S. (2017). Update on syphilis and pregnancy. *Birth Defects Research*, 109(5), 347–352. <https://doi.org/10.1002/bdra.23562>
- Uku, A., Albuja, Z., Dwivedi, T., Ladipo, Z., & Konje, J. C. (2021). Syphilis in pregnancy: The impact of “the Great Imitator.” *European Journal of Obstetrics & Gynecology and Reproductive Biology*, 259, 207–210. <https://doi.org/10.1016/j.ejogrb.2021.01.010>
- Wu, X., Hong, F., Lan, L., Zhang, C., Feng, T., & Yang, Y. (2016). Poor awareness of syphilis prevention and treatment knowledge among six different populations in south China. *BMC Public Health*, 16(1), 287. <https://doi.org/10.1186/s12889-016-2966-4>
- Wubete, M., Mohammed, M., Mengistu, M., & Mekonnen, R. (2019). PREVALENCE OF SYPHILIS AMONG PREGNANT WOMEN ATTENDING ANTENATAL CLINIC OF BULCHANA HEALTH CENTER, SHASHEMENE, WEST ARSI ZONE, ETHIOPIA. *International Journal of Medical and Biomedical Studies*, 3(2). <https://doi.org/10.32553/ijmbs.v3i2.90>
- Yideg Yitbarek, G., & Ayele, B. A. (2019). Prevalence of Syphilis among Pregnant Women Attending Antenatal Care Clinic, Sede Muja District, South Gondar, Northwest Ethiopia. *Journal of Pregnancy*, 2019, 1584527. <https://doi.org/10.1155/2019/1584527>
- Yitbarek, G. Y., & Ayele, B. A. (2019). Prevalence of Syphilis among Pregnant Women Attending Antenatal Care Clinic, Sede Muja District, South Gondar, Northwest Ethiopia. *Journal of Pregnancy*, 2019. <https://doi.org/10.1155/2019/1584527>