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Research Article

Seroprevalence of Syphilis and Associated Factors Among Pregnant Women Attending Antenatal Care at Hawassa Zuria Woreda Public Health Facilities, Sidama, Ethiopia, 2024

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Abstract

Introduction: Syphilis is a sexually transmitted infection caused by the bacterium Treponema pallidum, and it continues to be a major public health problem worldwide. It can spread through various means, such as unprotected sex, mother to fetus, and blood transfusion. This study aimed to assess the seroprevalence of syphilis and associated factors among pregnant women attending antenatal care at public health facilities in Hawassa zuria woreda, Sidama, Ethiopia. *Methods:* A facility-based cross-sectional study design was conducted in Hawassa Zuria public health facilities from November 1-30, 2024. A total of 482 study participants were selected using systematic sampling techniques. Data were collected through structured interviews using a pretested questionnaire and reviewing records. Epi-data version 4.4 was used to code and enter the data, and SPSS version 26 was used for analysis. Bivariable logistic regression was employed to identify candidate variables for multivariable logistic regression with a significance level of ≤ 0.25. A multivariate logistic regression model was used to investigate factors associated with syphilis infection, p-value of <0.05 was considered statistically significant. *Result:* The seroprevalence of syphilis among pregnant women attending ANC clinics was 3.8% (95% CI: 3.61-3.99). Having multiple sexual partners (AOR = 3.68; 95% CI: 1.22 - 11.11), alcohol use (AOR =7.34; 95% CI: 2.31 - 23.36), and HIV positive women (AOR =10.22; 95% CI: 2.03 - 51.53) were significantly associated with syphilis infection. *Conclusion and recommendation:* Seroprevalence of syphilis was high. Having multiple sexual partners, HIV-positive women, and alcohol drinking were factors significantly associated with syphilis. Therefore, substantial efforts have to be made to provide regular health education for pregnant women at the antenatal clinic on the avoidance of risky behaviors, raise awareness on the transmission and prevention mechanisms of syphilis, promote safe sexual practices, and strengthen partner testing and treatment.

Keywords

Syphilis, Associated Factors, Pregnant Women, Antenatal Care

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1. Introduction

Syphilis is a sexually transmitted infection (STI) caused by the bacterium Treponema pallidum, and it continues to be a major public health problem worldwide. It can spread through various means, such as unprotected sex, mother to fetus, and blood transfusion [1-3]. During pregnancy, there is a specific concern regarding about the potential transmission of infection to the fetus through hematogenous spread [4]. Mother-to-child transmission of syphilis during pregnancy can result in adverse pregnancy outcomes such as early fetal death, stillbirth, premature birth, and low birth weight [5].

Despite widely available and affordable screening methods and treatment, Syphilis infection is a public health problem in pregnant women in Sub-Saharan Africa [4, 6]. Most pregnant women with syphilis are not identified and treated promptly to prevent adverse effects on pregnancy. There is also discrepancies in antenatal care (ANC) availability and syphilis testing rates [1, 7].

Worldwide, around 357 million new cases of STIs were reported in 2015, syphilis accounting for an estimated 12 million cases, including 2 million in pregnant women. Sub-Saharan Africa accounting for 57% of all cases worldwide [8, 9]. Approximately 200,000 stillbirths and infant deaths due to congenital syphilis in 2019, making it the second leading cause of preventable stillbirths worldwide [10]. More than half of untreated maternal syphilis cases lead to adverse pregnancy outcomes such as spontaneous abortion, stillbirth, preterm birth, low birth weight, and neonatal death and congenital syphilis [5, 11, 12].

World Health Organization (WHO) surveillance report shown that the global seroprevalence of syphilis among pregnant women attending ANC was 0.8%. The prevalence of syphilis in African region was 2% [13]. Also, the overall syphilis seroprevalence was 1.9% in Nigeria [14], 3% in Khartoum [15], and 0.9% in Rwanda [16] among pregnant women attending ANC. Ethiopia is a sub-Saharan African nation that experiences high levels of maternal syphilis and adverse pregnancy outcomes [17]. Studies conducted in Debre Berhan 5.1% [18], Asella 2.4% [19], Jinka 4.8% [20] and South Gonder 3.7% [21], revealed that the prevalence of syphilis.

There is complex relationship between HIV and syphilis. The ulcers associated with clinical syphilis increase the risk of HIV infection [22], whereas the progression of HIV into AIDS has a significant outcome on the prognosis of syphilis management resulting mainly from immunosuppression [23]. Management of STIs resulted in 38% reduction in HIV infection rate [24].

Studies indicate that factors such as maternal age, residence, socioeconomic status, education level, prenatal care, prostitution, multiple sexual partners, substance use, knowledge about STIs, partners' educational status, partner occupation, number of pregnancies, history of abortions, history of STIs, HIV/AIDS status, and access to STI treatment were factors associated syphilis infection [25-27].

WHO set an ambitious plan to reduce syphilis by 90% by 2030 [28]. This target should be supported by regular epidemiological surveillance in high-burden areas to guide intervention [29]. Early diagnosis and treatment of syphilis during pregnancy are widely acknowledged as successful approaches to reduce syphilis transmission and adverse pregnancy outcomes [30, 31]. In endemic countries, conducting ANC screening to detect and treat syphilis can result in 82% decrease in stillbirths, 64% decrease in preterm births, and 80% decrease in neonatal deaths [32].

According to Ethiopia Demographic and Health Survey, ANC visit was 62%, and syphilis screening was 44.6% [33]. However, there is wide variation from the WHO target of less than 50 congenital syphilis cases per 100,000 live births, at least 95% coverage in the first ANC visit, 95% syphilis testing, and 95% case treatment [5, 11]. Therefore, the objective of this study was to assess the seroprevalence of syphilis and its associated factors among pregnant women at public health facilities in Hawassa Zuria, Sidama, Ethiopia.

2. Method and Materials

2.1. Study Area and Period

A facility-based cross sectional study was conducted in Hawassa Zuria woreda, Sidama, Ethiopia. It is located 295 kilometers away from the capital, Addis Ababa, and 23 kilometers from Hawassa city. According to the 2024 woreda health office's report, the total population is projected to be 182,215, and about 42,456 fall within the reproductive age (15-49) years. There are five public health facilities in the woreda: Dore Bafano Primary Hospital, Dado Health Center, Mekibesa Health Center, Tenkaka Health Center, and Shamena Health Center. The study was conducted from November 1-30, 2024, in those public health facilities.

2.2. Study Design

Facility based cross-sectional study

2.3. Source and Study Population

2.3.1. Source Population

All pregnant women are attending public health facilities for ANC in Hawassa zuria woreda during the study period.

2.3.2. Study Population

Randomly selected pregnant women attending public health facilities for ANC during the study period.

2.4. Eligibility Criteria

2.4.1. Inclusion Criteria

All selected pregnant women who attended public health facilities for ANC service in Hawassa zuria woreda during the data collection period.

2.4.2. Exclusion Criteria

Pregnant women with mental impairment and critical illness at data collection time were excluded from this study.

2.5. Sample Size Determination

The sample size was calculated by using a single population proportion formula, assuming a 95% confidence level, 4.8% of the seroprevalence of syphilis from a study conducted at Jinka Town [20], Margin of error 2%, and 10% non-response rate.

$$n = \frac{(Z1-\alpha/2)^2 P(1-P)}{d^2}$$

$$n= \frac{(1.96)^2 0.048(0.052)}{(0.02)^2}$$

n= 438

By adding a 10% non-response rate, the final sample size was 482.

2.6. Sampling Methods

The study included the five public health facilities that offer ANC services in Hawassa zuria woreda. By using the previous months ANC flow of pregnant women as a baseline, there were a total of 975 pregnant women visited those public health facilities (Dore Bafano primary hospital 284, Shamena Health Center 215, Dado Health Center 133, Tenkaka Health Center 156, and Mekibesa Health Center 187) that fulfilled the eligibility criteria of the study. The number of pregnant women interviewed at each health facility was determined based on proportional allocation to size. The interval (K) was calculated by dividing 975 by the sample size of 482, resulting in 2 intervals. The lottery method was employed to select the first participant for the study at each health facility. Then, every other pregnant woman was interviewed, and a file checkup was conducted.

2.7. Data Collection and Quality Control

Data were collected using structured questionnaires which are prepared by reviewing different literatures relevant to address the study objectives. Relevant experts reviewed the data collection tool to ensure it aligned with the study objective. The data was collected through exit interviews, and document reviewing. The data collection tool was pre-tested on 5% of the sample at the Yirba primary hospital one week prior to the data collection. Five BSc midwives were appointed as data collectors, along with one health officer serving as the supervisor. One-day training was given to the data collectors and supervisor on study purpose, data collection tool, data handling and maintaining respondent's confidentiality. The syphilis and HIV serostatus results from the medical records were examined. Pregnant women whose medical records were unavailable were not included in the analysis.

2.8. Operational Definitions

1) *Syphilis:-* In this study, a case of syphilis was considered when the Rapid Plasma Reagin (RPR) or Venereal Disease Research Laboratory (VDRL) test was reactive for syphilis infection among pregnant women [34].
2) *Knowledge of STI*: - Nine questions were used for assessing the level of knowledge. The total score of each study participant was converted to a percentage and used to categorize them into those with good knowledge (score>= 50).
3) *Alcohol drinking*: - Consuming alcohol at least once per month in the last twelve months (above the recommended level). This means above 2 bottles for males and 1 bottle for females [33].

2.9. Data Processing and Analysis

Data were coded, entered into Epi-Data version 4.4, and then exported to SPSS version 26 for analysis. Data cleaning was performed by running the frequency of each variable to check the accuracy, inconsistency and missed value of the data. Variables were checked by the chi-square test to identify the association between each categorical variable and dependent variables. Bivariable logistic regression was employed to identify candidate variables for multivariable logistic regression with a significance level of ≤ 0.25. The degree of association between independent and dependent variables was assessed by using an odds ratio with a 95% confidence interval, and variables with a P-value <0.05 in the multivariable logistic regression model were considered statistically significant. Model fitness was checked by Hosmer and Lemeshow Goodness of fit test and Multicollinearity was assessed using the method variance inflation factors. Its value was observed between one and two for all independent variables entered to assess Multicollinearity. Descriptive statistics were done and summarized using texts, tables, and graphs based on the type of variables.

2.10. Ethical Consideration

Ethical clearance was obtained from the Institutional Research Ethical Review Committee (IRERC) at Pharma college school of Graduate studies. Permission letters were

acquired from the Hawassa Zuria Woreda health office and formal letters were written to each health facility from the Woreda health office. Informed verbal consent was obtained from each study participants to confirm their willingness to participate after explaining the objective of the study. To keep their privacy each of the pregnant women was interviewed separately in a quiet room prepared for this purpose. Participants were guaranteed that their responses would remain confidential from both data collectors and supervisor. The data collected was solely used for the study's purposes, and confidentiality was upheld throughout the study.

3. Result

3.1. Socio-demographic Characteristics of Participants

About 479 pregnant women participated in the study, making the response rate of 99.3%. The mean age of respondents was 25.95 (±4.72) years. The majority of 469 (97.9%) of study participants were married and 233 (48.6%) participants attended primary education. More than three-fourths (82.7%) of the pregnant women were rural residents and 288 (60.1%) were housewives. More than one-third (36.1% of participants earned >3000 ETB.

Table 1. *Socio-demographic characteristics of study participants in Hawassa zuria woreda public health facilities, Sidama, Ethiopia, 2024.*

Variables	Category	Frequency	Percent
Age category	18-24	201	42
	25-29	156	32.6
	30-42	122	25.5
Marital status	Married	469	97.9
	Divorced	3	0.6
	Widowed	4	0.8
	Single	3	0.6
Religion	Protestant	439	91.6
	Muslim	23	4.8
	Orthodox	12	2.5
Residence	Rural	398	82.7
	Urban	83	17.3
Education	Non	91	19
	Primary	233	48.6
	Secondary	123	25.7
	Collage and above	32	6.2
Occupation	Housewife	288	60.1
	Merchant	98	20.5
	Private employee	30	6.3
	Government employee	28	5.8
	Other	35	7.3
Partners occupation	Farmer	294	61.4
	Merchant	63	13.2
	Private	48	10
	Government	60	12.5
	Other	14	2.9

Variables	Category	Frequency	Percent
Monthly Income (ETB)	500-1000	47	9.8
	1001-2000	100	20.9
	2001-3000	159	33.2
	Above 3000	173	36.1

3.2. Behavior Related Characteristics

About 397 (82.9%) of the study participants had one sexual partner in lifetime and 82 (17.1%) had multiple sexual partners in lifetime. Fifty-two (10.9%) respondent had history of alcohol drinking and 13 (2.7%) respondents had history of cigarettes smoking.

Table 2. *Behavior related characteristics of study participants in Hawassa zuria woreda public health facilities, Sidama, Ethiopia, 2024.*

Variable	Category	Frequency	Percent
Lifetime sexual partners	Multiple	82	17.1
	One	397	82.9
Last 12 month sexual partners	Multiple	34	7.1
	One	445	92.9
Alcohol drinking	Yes	52	10.9
	No	427	89.1
Cigarette smoking	Yes	13	2.7
	No	466	97.3

3.3. Knowledge Related Characteristics

Among 479 study participants, 261 (54.5%), 252 (52.2%), 156 (32.6%), and 92 (19.2%) of the study participants got information about STIs from School, Health facilities, Media, and peers/families respectively. About 291 (60.7%) of study participants had awareness about the STI transmission and while 362 (75.6%) did not know symptoms of STI. Nearly one-third of 150 (31.3%) study participants knew the common types of STI. Approximately half 239 (49.9%), study participants had awareness about the prevention of mother-to-child transmission. About 334 (69.7%) of the participants know that STIs could be prevented through the use of a condom. About 164 (34.2%) of study participants had good knowledge about STI.

3.4. Obstetric Characteristics of Study Participants

Majority 321 (67%) of the study participants were multigravida and 356 (74.3%) were screened for syphilis in the first trimester. About 265 (55.3%) of the study participants started ANC visit during first trimester and 165 (34.4%) of the study participants had first ANC visit. About 53 (11.1%) of participants reported a history of abortion.

Table 3. *Obstetric characteristics of study participants in Hawassa zuria woreda public health facilities, Sidama, Ethiopia, 2024.*

Variable	Category	Frequency	Percent
Pregnancy	Nulliparous	158	33
	Multigravida	321	67

Variable	Category	Frequency	Percent
Syphilis test time	First trimester	356	74.3
	Second trimester	81	17
	Third trimester	42	8.7
First ANC visit	First trimester	265	55.3
	Second trimester	159	33.2
	Third trimester	55	11.5
Number of ANC visit	First	165	34.4
	Second	134	27.9
	Third	104	21.7
	Fourth and above	76	15.8
History of Abortion	Yes	53	11.1
	No	426	88.9

3.5. Medical Characteristics of Study Participants

About 19 (4%) of the study participants had history previously and 11 (2.3%) of the study participants were reactive for HIV. About 16 (84.2%) of the study participants diagnosed for STI before one year.

3.6. Factors Associated with Syphilis Infection

The seroprevalence of syphilis determined using the VDRL test was 3.8% (95% CI: 3.61 - 3.99%). In the binary logistic regression analysis, variables such as; Age, HIV positive, multiple sexual partners and drinking alcohol were candidate variables for multivariable logistic regression analysis. In the multivariate logistic regression analysis, after controlling for possible cofounders, pregnant mothers who had multiple sexual partners, alcohol consumption and HIV positive were significantly associated with syphilis infection.

This study indicated that pregnant mothers with multiple sexual partners were almost four times more likely to have syphilis infection than their counterparts (AOR=3.68, 95%CI: 1.22 - 11.11). Pregnant women who were HIV positive were ten times more likely to have syphilis infection than those who were HIV negative (AOR =10.22, 95%CI: 2.03 - 51.53). The finding also showed that pregnant women who were alcohol users had significantly higher odds of being seropositive for syphilis than women those who were not alcohol drinking (AOR= 7.34, 95%CI: 2.31 - 23.36).

Table 4. *Medical history related characteristics of study participants in Hawassa zuria woreda public health facilities, Sidama, Ethiopia, 2024.*

Variable	Category	Frequency	Percent
History of STI	Yes	19	4
	No	460	96
Year of diagnosis	Last 12 months	3	15.8
	Before one year	16	84.2
Treatment	Oral	7	36.8
	Injection	12	63.2
HIV Sero-status	Reactive	11	2.3
	Non-reactive	468	97.7
Syphilis	Reactive	18	3.8

Variable	Category	Frequency	Percent
	Non-reactive	461	96.2

Table 5. *Factors associated with seroprevalence of syphilis among of study participants in Hawassa zuria woreda public health facilities, Sidama, Ethiopia, 2024.*

Variables	Category	Syphilis		COR (95%CI)	AOR (95%CI)
		R	NR		
Age	<25	4	197	1	1
	25-29	5	151	1.63 (0.43 - 6.18)	2.00 (0.49 - 8.13)
	30-42	9	113	3.92 (1.18 - 13.03)	3.03 (0.82 - 11.17)
Alcohol drinking	Yes	7	45	5.88 (2.17 - 15.93)	7.34 (2.31 - 23.36) *
	No	11	416	1	1
Number of sexual partner	One	9	388	1	1
	Multiple	9	73	5.32 (2.04 - 13.84)	3.68 (1.22 - 11.11) *
HIV Status	Reactive	4	7	18.53 (4.86 - 70.67)	10.22 (2.03 - 51.53)*
	Non-reactive	14	454	1	1

NB: (* Statistically significant variable at p-value < 0.05 in multivariable analysis).

4. Discussion

This study aimed to assess the seroprevalence of syphilis and its associated factors among pregnant women attending ANC in Public health facilities in Hawassa Zuria Woreda, Sidama, Ethiopia. The overall seroprevalence of syphilis among pregnant women attending antenatal care was 3.8% (95% CI, 3.61-3.99). This finding was comparable with those of studies conducted in Northwest Gonder 3.7% [21] and South Africa 3.4% [35]. However, the findings of this study were lower than those in Southern Ethiopia 4.8% [20], Zambia 9.3% [36], and Yirgalem-Ethiopia 5.1% [37]. This finding is higher than the study conducted in Sub-Saharan Africa 2.3% [35], Nigeria 1.98% [38], Bahirdar Ethiopia 2.6% [39] and Yaya Gulele, Oromia Ethiopia 2.6% [40], and systemic review and meta-analysis, Ethiopia 2.3% [41]. The difference in the magnitude of syphilis may be due to variations in the laboratory diagnostic techniques used. Moreover, a possible reason for the difference in the seroprevalence of syphilis might be the difference in sociodemographic characteristics, study period, sexual practice, and cultural differences across the study population.

Pregnant women with multiple sexual partners were four times more likely to have syphilis infection than their counterparts. This finding is consistent with studies conducted in Zambia [36], Bahir Dar, Ethiopia [39], Southwest Shoa, Ethiopia [42], and Southern Ethiopia [20], Shashemene town, Southern Ethiopia [43]. A possible reason might be that having multiple sexual partners increases vulnerability to STIs owing to unsafe sexual practices and low level awareness of STI transmission and prevention methods.

This study showed that pregnant women who had a history of alcohol drinking were found to be about seven time's higher likelihood of getting syphilis infection compared to their counterparts. This finding was supported by studies conducted in Southwest Shoa, Ethiopia [42], and Southern Ethiopia [20]. This might be explained by alcohol intake exposing women to unsafe sexual practices, including concomitant multiple sexual partnerships that predispose them to the acquisition of STIs including syphilis.

Furthermore, HIV positive pregnant women were ten times more likely to be infected with syphilis than women who are HIV negative women. This finding is consistent with those of studies conducted in Ethiopia [41], Zambia [36], and Uganda [44].

Limitations of the Study

The use of VDRL tests for syphilis screening may be underestimates the results of the study because it has low sensitivity and specificity. History of sexual habits reported by respondents may have been underestimated or overestimated because of recall bias and cultural taboos. Facility-based design limits the generalizability to the broader community.

5. Conclusion

This study showed that the magnitude of syphilis infection among pregnant mothers attending ANC at the Hawassa Zuria Woreda public health facilities was 3.8%, which is higher than the national prevalence of Syphilis 2.32%. It highlights the importance of routine syphilis screening in ANC to prevent adverse outcomes. This study finding indicates that multiple sexual partners, HIV status, and alcohol consumption were significantly associated with syphilis infection. Healthcare workers should provide regular comprehensive health education for pregnant women at ANC clinics on the avoidance of risky sexual behaviors, the impact of syphilis on the pregnancy and awareness of the transmission and prevention mechanisms of syphilis. Appropriate strategies should be planned for the prevention and control of maternal syphilis.

Abbreviations

ANC	Antenatal Care
CI	Confidence Interval
CS	Congenital Syphilis
DC	Data Collectors
IRERC	Institutional Research Ethical Review Committee
MTCT	Prevention of Mother to Child Transmission
PI	Principal Investigator
RPR	Rapid Plasma Reagin
SPSS	Statistical Package for Social Sciences
SSA	Sub-Saharan Africa
STI	Sexually Transmitted Infection
SDG	Sustainable Development Goal
VDRL	Venereal Disease Research Laboratory
WHO	World Health Organization

Author Contributions

Akililu Aliye: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Visualization, Writing - original draft, Writing - review & editing.

Solomon Tesfaye Doelaso: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Software, Supervision, Validation, Visualization, Writing - original draft, Writing - review & editing.

Amanuel Samuel: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Supervision, Validation, Visualization, Writing - original draft.

Conflicts of Interest

The authors declare no conflicts of interest.

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