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Determinants of Syphilis Infection among Women Seeking Antenatal Care and Delivery Services in Olenchity Primary Hospital: A Case-Control Study

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Abstract: The magnitude of syphilis infection among pregnant women is increasing worldwide. Syphilis infection during pregnancy is a risk of congenital syphilis for the fetus, might result in intrauterine death. The objective this study was to identify the predictors of syphilis infection among pregnant and delivering mother in Olenchity primary hospital from October 2017 to January 2018 G. C. Unmatched case-control study design (61 cases and 244 controls) was conducted among women seeking Antenatal care and delivery services. Cases and controls were selected based according to their of the serology result. Data was collected using pre-tested and structured questionnaire. The collected data were entered into EPI-info version 7 and analyzed using SPSS version 20. Principally binary logistic regression model was used to estimate the odds ratio at 95% confidence intervals. Education (AOR, 0.381; 95% CI: 0.169, 0.857), knowledge about Sexually transmitted Infections (AOR, 0.244 95% CI: 0.114, 0.522), loss of baby during pregnancy (AOR, 2.275; 95% CI: 1.022, 5.065), multiple sexual partner (AOR, 3.071; 95% CI: 1.220, 7.730), Cigarette smoking (AOR 7.628; 95% CI: 1.714,33.946), Human immune deficiency virus Positives (AOR, 41.145; 95% CI: 2.250, 752.362) were factors significantly associated with syphilis. Factors like having primary and secondary education and knowledgeable about sexually transmitted infections were less likely to have syphilis. However, having the history of multiple sexual partner, cigarette smoking, lose baby during pregnancy, HIV positive were more likely to associate with syphilis infection. These factors should be taken into consideration to prevent or curb the problems syphilis infection.

Keywords: Syphilis Infection, Hospital, Olenchity

1. Introduction

The magnitude of sexually transmitted infections (STIs) is increasing worldwide and recognized to affect the quality of life [1, 2]. STIs causes morbidity and mortality because of its direct and indirect impact on maternal and child health [1, 2]. The direct impacts include infertility, pregnancy complications and reproductive tract cancer and indirectly its impact on national and individual economies due to human immunodeficiency virus (HIV) [1, 2].

Syphilis is a STIs caused by the spirochete, Treponema palladium subspecies palladium [2-4]. Worldwide the implication of syphilis infection in pregnancy is the severe impact on pregnancy outcome [2]. Studies showed that maternal syphilis is associated with 26% stillbirths, 29% prenatal deaths, 11% neonatal deaths, globally. It can also result in causing spontaneous abortion, premature delivery and low birth weight [2, 5]. In sub-Saharan Africa, about 50-80% poor or adverse pregnancy outcomes are attributed to active syphilis infection [6].

Usually, Treponema palladium crosses the placenta after the first trimester and if the pregnant women have seen in Antenatal care early and treated with penicillin after

screening the prognosis for the fetus might be better [7]. However, many of adults from Africa are continuously dying from problems associated with congenital syphilis acquiring from their mothers [7-9].

Basically, Syphilis infection might present in primary, secondary, latent, and/or tertiary stages [2, 3]. Also, Congenital Syphilis (CS) can be classified into early and late, and its manifestations are influenced by different factors like stage of syphilis, treatment, gestational age, and immunological response of the fetus [2, 3]. In early CS, the signs and symptoms of Hepatomegaly, splenomegaly, hemolytic anemia, Osteochondritis, nephrotic syndrome and hydrops fetalis might be seen, while in late CS it is characterized by Hutchinson's triad, which is a collection of teeth defect, interstitial keratitis and nerve deafness [2, 3, 10].

Syphilis infection primarily transmitted from person to person through sexual contact. In can also be transmitted from mother to the fetus during pregnancy or at birth, resulting in congenital syphilis [11, 12]. Even though there was a decline in the rates of syphilis infection after the availability of penicillin in the 1940s, the infection rate is increasing in many countries because of the rampant widespread of HIV infection [11, 12].

In Ethiopia, there is National direction on antenatal screening of syphilis and consensus among obstetricians in Ethiopia. However, different hospitals have decided on their own by different approaches for screening procedures. There is no uniform screening test across all health institutions in Ethiopia [2, 6, 13]. Therefore, this study was conducted for better understanding of predictors for syphilis infections among women seeking ANC and delivery services in Olenchity primary hospital.

2. Methods and Materials

2.1. Study Area

This study was conducted at the Olenchity primary Hospital of East Shoa Zone of Oromia region. The East Shoa Zone is one of the 20 zones in the Regional State located at the eastern part of the country 100 kms from Addis Ababa (the capital of Ethiopia). Olenchity Hospital is found in the town and is a capital of Boset district located at 25 kms away from the capital of Shoa Zone (Adama). The population of the town is increasing (un-guided) owing to the influx of the people to urban area in search of favorable climatic conditions and the relative suitability of the area for the life and work. Presently, the Olenchity total population is approximated to 28,560 (2017 GC) which is projected from CSA. An estimated 28,560 people were living in Olenchity who have got direct ANC and delivery services from the Hospital and health centers in the town. Indeed, the annual number of deliveries/ANC service in the Olenchity Hospital was 1400 during 2009 EC. This study was conducted between from October 2017 to January 2018 G. C [14].

2.2. Study Design

Unmatched case-control study was carried out using quantitative data collection method.

2.3. Population

All women of reproductive age group in the study area where the source population, while all ANC and delivering mother, attending Olenchity primary hospital, between Octobers to January, 2018 GC where the study population. All pregnant women attending antenatal clinics and Delivery Service in Olenchity primary hospital who were residents of the catchment area for six and above months were included and those pregnant and delivering mothers in syphilis treatment were excluded.

2.3.1. Sample Size Determination

Double population proportion formula was employed to calculate the sample size using the Statcalc of the EpiInfo version 7. The final sample size was calculated based on the assumptions of 95% Confidence level, 80% power and the Odds Ratio (OR) of approximately 2.7, 15.2% exposure for controls, a 32.6% exposure to cases and the ratio of one case to four controls based on the study conducted in Brazil [15]. Moreover, the possibility of 10% of losses or refusals was considered. Accordingly, 61 cases and 244 controls and a total of 305 women were estimated.

2.3.2. Sampling Procedure

Eligible women were recruited after having Rapid Plasma Reagin/Treponema Palladium Hemaglutination Assay (RPR/TPHA) test at ANC services and during labor. The cases and controls came from any of the above services to Olenchity primary hospital were recruited.

2.4. Data Collection

Information was collected by face to face interview during ANC service attendance and labour/delivery services using pre-tested structured questionnaires by trained Midwives. About 5ml of blood were collected for syphilis serology test using the RPR kit as a screening to detect the non Treponemal antibodies. The Treponema Palladium Hemaglutination Assay (TPHA) is a specific antibody test used for either confirmation of syphilis or as a routine second test. The reagent system consists of red blood cells coated with antigens of T. Pallidum. The Avian cells were used as they are nucleated and therefore heavier, producing a faster reaction time. In this test the samples are incubated following the kit manufacturer’s instructions at room temperature. Samples are diluted 1:20, and 10µl from the diluted sample is added in 96 well microtitre plates and then 100µl test reagent (avian cells) is added to the sample. Finally, it was incubated for 45-60 min at room temperature. A positive result is indicated by a ‘carpet’ of red cells across the well. A negative reaction is indicated by a button or ring of red cells across the bottom of the well. We have done also positive and negative controls for both HIV and Syphilis test.

2.5. Operational Definitions

Cases: women tested and found positive for syphilis infection.

Controls: women tested and found negative for syphilis infection.

Knowledgeable about STIs: those women who answered the average/mean and above on knowledge related questions were considered to be knowledgeable and otherwise.

2.6. Data Analysis

The collected data were coded and double entered in to EPI-Info version 7. Later on it was exported to SPSS version 20 for cleaning and analysis. The associations between the study variables were modeled using binary logistic regression. Variables having a P-value < 0.25 at the bivariate level were selected as a candidate to enter into a multivariable analysis to control for the possible confounders. Odds ratio at 95% confidence intervals were used to calculate the risk syphilis infection. Finally, P-value of less or equal to 0.05 was used as a cutoff point to declare the significant associations between the study variables. The assumptions of normality, multi-collinearity and goodness of fit of the model were checked to be satisfied using the appropriate methods.

2.7. Ethical Consideration

The Ethics Committee of Adama Hospital Medical College (AHMC) has approved the study. Moreover, an official letter was given and submitted to the local administrators by the student research program of the College. Anonymous records and coding of the questionnaire were done to assure the confidentiality. Also, the participants were informed to have a full right in participating or withdrawing at any step of the study. Written and verbal consents were obtained from the study participants after reading the informed consent form. The Regional and Hospital administration officials were formally communicated to obtain permission.

3. Result

3.1. Socio-Demographic Characteristics of Study Participants

About 305 (61 cases and 244 controls) were participating in the study. The higher proportion of syphilis infection was seen among the cases of between 35-49 years accounted for 8.20% compared to 4.1% among controls. The lower proportion of syphilis infection was seen among cases having the primary and secondary level of education and married women as well. Accordingly, the proportion of women having primary education is 23% among cases compared to 30.71% of controls and for secondary education and above the proportion is 6.5% among cases and 37.25% among controls. Moreover, the proportion of married women among cases is 80.3% compared to 91.4% of controls (see Table 1).

Table 1. *Socio-demographic characteristics of the study participants, Olenchity primary hospital, October 1 to January 30, 2018.*

Variables	Case	Control	Total
	Number (%)	Number (%)	Number (%)
Residence			
Urban	45 (73.8)	162 (66.4)	207 (67.9)
Rural	16 (26.2)	82 (33.6)	98 (32.1)
Age in years			
Under 18	4 (6.6)	21 (8.60)	25 (8.2)
19-24	22 (36.06)	76 (31.14)	98 (32.1)
25-34	30 (49.18)	137 (56.15)	167 (54.8)
35-49	5 (8.20)	10 (4.10)	15 (4.9)
Level of Education			
Illiterate	43 (70.5)	78 (32)	121 (39.7)
Primary	14 (23)	75 (30.71)	89 (29.2)
Secondary and above	4 (6.5)	91 (37.29)	95 (31.1)
Occupation			
Non-employed	37 (60.6)	152 (62.3)	189 (62)
Employed	24 (39.4)	92 (37.7)	116 (38)
Marital status			
Unmarried	12 (19.7)	21 (8.6)	33 (10.8)
Married	49 (80.3)	223 (91.4)	272 (89.2)
Average monthly income			
<100	11 (18.03)	50 (20.5)	61 (20)
1000-1500	20 (32.78)	73 (29.91)	93 (30.5)
1501-2800	12 (19.7)	56 (22.95)	68 (22.3)
>2800	18 (29.5)	65 (26.63)	83 (27.2)

3.2. Reproductive Health Characteristics of the Study Participants

In general, about 71.47% of the study participants had a history of ANC follow up. However, no significant differences were observed on ANC follow up among cases (73.77%) and controls (70.9%). The highest proportions of women having a history of lost a baby during pregnancy were reported among cases (47.54%) compared to 16.4% among controls. Also, the proportion of women having a history of live born baby and died later was 27.9% of cases and 9.1% of controls. Moreover, a higher proportion (19.7%) of HIV positive mothers among cases was observed compared to 0.4% controls. About 32.79% of cases were considered to be knowledgeable about sexually transmitted infections compared to 70.09% of controls (see Table 2).

Table 2. *Reproductive Health characteristics of the study participants, Olenchity primary hospital, October 1 to January 30, 2018.*

Variables	Case	Control	Total
	Number (%)	Number (%)	Number (%)
ANC follow-up			
Yes	45 (73.77)	173 (70.9)	218 (71.47)
No	16 (26.23)	71 (29.1)	87 (28.53)
Gravidity			
1-2	43 (70.5)	195 (79.92)	238 (78.03)

Variables	Case	Control	Total
	Number (%)	Number (%)	Number (%)
3-5	17 (27.87)	46 (18.9)	63 (20.66)
>=6	1 (1.639)	3 (1.23)	4 (1.311)
Lost baby during pregnancy			
Yes	29 (47.54)	40 (16.4)	69 (22.62)
No	32 (52.46)	204 (83.6)	236 (77.38)
Baby born alive and died later			
Yes	17 (27.9)	22 (9.1)	39 (12.79)
No	44 (72.1)	222 (90.9)	266 (87.21)
Level of Knowledge about STIs			
Knowledgeable	20 (32.79)	171 (70.09)	191 (62.62)
Non-knowledgeable	41 (67.21)	73 (29.91)	114 (37.38)
HIV test result			
Positive	12 (19.7)	1 (0.4)	13 (4.26)
Negative	49 (80.3)	243 (99.6)	292 (95.74)

3.3. Behavioral Characteristics of the Study Participants

A significantly higher proportion of cases were seen among women who stayed with their partner for one year and above, history of partner travel, having history of two or more sexual partners and smokers compared to controls (p-value<0.02) (Table 3). About 16.4% of cases and 13.51% of controls, 73.8% of cases and 84.4% of controls were staying with their husband/partner for one year and two or above years, respectively. Moreover, 42.62% of cases had history of partner travel compared to 14.34% of controls. The proportion of having two sexual partners was 21.3% among cases compared to 13.9% among controls. The same pattern showed the proportion of women having three or more sexual partners were 26.2% among cases compared to 2.5% among controls. The proportions of women having a history of cigarette smoking were 19.67% among cases and 1.64% among controls. In addition, the higher proportion (39.34%) of women among cases was Khat chewers compared to 6.6% among controls (Table 3).

Table 3. *Behavioral characteristics of the study participants, Olenchity primary hospital, October 1 to January 30, 2018.*

Variables	Case	Control	Total
	Number (%)	Number (%)	Number (%)
Duration of staying with a partner			
6 Months	6 (9.8)	10 (4.09)	15 (4.92)
One year	10 (16.4)	33 (13.51)	44 (14.43)
>=2years	45 (73.8)	201 (84.4)	246 (80.66)
Partner Travel			
Yes	26 (42.62)	35 (14.34)	61 (20)
No	35 (57.38)	209 (85.66)	244 (80)
No of ever Sexual Partners			
One	32 (52.5)	204 (83.6)	236 (77.38)
Two	13 (21.3)	34 (13.9)	47 (15.41)
Three or more	16 (26.2)	6 (2.5)	22 (7.21)
Cigarette Smoking			
Non Smoker	49 (80.33)	240 (98.36)	289 (94.75)
Smoker	12 (19.67)	4 (1.64)	16 (5.25)
Khat Chewing			
Yes	24 (39.34)	16 (6.6)	40 (13.11)
No	37 (60.66)	228 (93.4)	265 (86.89)

3.4. Factors Associated with Syphilis Infection

Women's level of education, number of ever having sexual partners, history of having lost a baby during pregnancy, history of cigarette smoking, knowledge about STIs and HIV positivity were significantly associated with the odds of having a syphilis infection ($P < 0.05$). Accordingly, the odds of having a syphilis infection were less (AOR, 0.38; 95% CI: 0.169-0.857) likely for women of having primary and secondary and above (AOR, 0.05; 95% CI 0.010-0.259) level of education compared to illiterate women. Having Knowledge about STIs was less (AOR= 0.24; 95% CI: 0.11, 0.52) likely to have syphilis infection compared to their counterparts. However, the odds of syphilis infection were more (AOR, 3.07, 95% CI 1.220-7.730) and (AOR, 5.81, 95% CI 1.579-21.274) among women having two and three or more sexual partners compared to women having one sexual partner. The chance of having a syphilis infection among mothers who had a history of losing a baby during pregnancy was more than two times (AOR, 2.28; 95% CI: 1.02, 5.07) higher compared to their counterparts. The odds of having a syphilis infection among women with a history of cigarette smoking was nearly eight times (AOR, 7.63; 95% CI: 1.71, 33.95) higher compared to non-smoking women. Similarly, being HIV positive women was associated with higher

(AOR, 41.15; 95% CI: 2.25-752.36) chance to have syphilis infection compared to HIV negative women (Table 4).

However, factors like mothers with history of partner travel, chat chewing, age of mothers, marital status, women with baby born alive and died later were not significantly associated with syphilis in the study area.

Table 4. *Factors associated with Syphilis Infection among study participants, Olenchity primary hospital, October 1 to January 30, 2018.*

Variables	Case	Control	COR (95% CI)	AOR (95% CI)
	Number (%)	Number (%)		
Level of education				
None	43 (70.5)	78 (32)	1:00 (Ref)	1:00 (Ref)
Primary	14 (23)	74 (30.71)	0.34 (0.17, 0.67)*	0.381 (0.17, 0.86)*
Secondary and above	4 (6.5)	91 (37.29)	0.08 (0.23, 0.18)*	0.052 (0.01, 0.26)***
Sexual Partners				
One	32 (52.5)	204 (83.6)	1:00 (Ref.)	1:00 (Ref.)
Two	13 (21.3)	34 (13.9)	2.44 (1.16, 5.1)*	3.07 (1.22, 7.73)*
Three and more	16 (26.2)	6 (2.5)	17 (6.20, 46.66)*	5.81 (1.58, 21.4)**
Lost baby during pregnancy				
Yes	29 (47.54)	40 (16.4)	4.62 (2.52, 8.47)*	2.28 (1.02, 5.07)*
No	32 (52.46)	204 (83.6)	1:00 (Ref.)	1:00 (Ref.)
Cigarette smoking				
Yes	49 (80.33)	240 (98.36)	14.69 (4.55, 47.47)*	7.63 (1.71, 33.95)**
No	12 (19.67)	4 (1.64)	1:00 (Ref.)	1:00 (Ref.)
Level of Knowledge				
Knowledgeable	20 (32.79)	171 (70.09)	0.208 (0.11, 3.8)*	0.24 (0.11, 0.52)***
Non-Knowledgably	41 (67.21)	73 (29.91)	1:00 (Ref.)	1:00 (Ref.)
HIV test result				
Positive	12 (19.7)	1 (0.4)	59.5 (7.6, 468.3)*	41.15 (2.25, 752.36)*
Negative	49 (80.3)	243 (99.6)	1:00 (Ref.)	1:00 (Ref.)

NB: * P < 0.05; ** P < 0.01; *** P < 0.001.

4. Discussions

To the best knowledge of our knowledge this is the first case control study to elicit factors associated with syphilis infection among pregnant women who seek ANC and delivery services in Ethiopia. The chance of having a syphilis infection was associated with the level of knowledge about STIs, increase in level of education, having multiple sexual partners, having a history of lost a baby during pregnancy, being HIV positive and having a history of cigarette smoking.

This study shows that the chance of having syphilis is lower for a woman with the educational level of primary education and above compared to non-educated women corroborating previous studies in China [9], Brazil [15] and South Africa [16]. This is attributed for education is considered to be a tool for prevention of communicable diseases including STIs. Also in the present study, the chance of having syphilis was decreased in women who have knowledge about STIs. This is supported by a study conducted in South Sudan [2]. These could explain the earlier association between syphilis and education as knowledge is the result of awareness coming after education. Moreover, this might be attributed to women who are less educated are more likely to be dependent and they don't have knowledge about STIs and ways of prevention. As education is the key factors that is mandatory to get jobs in Ethiopia, un-educated women are exposed to have sex for business purpose and they are informally employed as a sex worker and it was also a risk factor identified in this study.

In this study, syphilis infection was higher among pregnant and delivering women with a history of having multiple sexual partners. This was also observed in the study done in China [9], Brazil [15] and Kenya [16]. Obviously, sexually active pregnant women are susceptible to contract STIs. On pregnant women, many STIs including Syphilis do not show symptoms early making screening and testing difficult to treat or prevent serious health complications as the earlier treatment might result in better health outcomes [3]. These might be explained by a desire in having multiple sexual partners of cultural origin and lack of awareness of preventive methods like the use of condom.

This study also revealed that mothers having a history of adverse birth outcome were more likely to have syphilis infection. Basically, syphilis can cause many negative outcomes during pregnancy, including spontaneous abortion. This might explain the fact that spontaneous abortion could have happened due to infection with syphilis. Similar findings were observed in a study done in Gondar University [17] and Wolmera district [8] showed a history of abortion was associated with having syphilis during pregnancy. Moreover, pregnant women without previous history of neonatal loss had lower odds of having a syphilis infection compared to their counterparts. This is supporting the study conducted in South Africa by Hlabisa hospital that showed about 11% of mothers reported a previous perinatal death. A similar study from South Sudan showed having a history of abortion or prenatal death was associated with syphilis infection [2, 16].

However, in this study, having a history of antenatal care service during the previous pregnancy was not significantly associated with syphilis infection in pregnant women. This finding couldn't be explained from the point that pregnant women who utilized the antenatal services received some basic education from the health professionals [18]. As it is a

normal practice in the ANC, whereby staff does encourage pregnant women to have syphilis test, obtain treatment in case they are positive to avoid maternal negative outcomes associated with syphilis infections.

Cigarette smoking was significantly associated with having syphilis as smoking might be related to other drugs and risky sexual behaviors. However, no study was undertaken concerning smoking status of women and its association with syphilis infection to justify or nullify it.

In this study, women's whom their partner had a history of frequent travel to other places were more likely to be positive for syphilis infection at bivariate analysis even though it was failed to be significant in multivariate analysis. This shows that there is a high trend for their partners to travel to other places as the study area is in the corridor of the main road to Ethio-Djibouti and they might be more likely to be a driver and driver supporters. This practice might lead both partners to be involved in risky sexually behavior. This has also been reported in China in which history of frequent partner travelling was associated with syphilis infection among pregnant women [9].

This study also showed, being not married is associated with syphilis infection among pregnant women even though it is not significant in the final model. This could be explained because in Olenchity town is found on the main Ethio-Djibouti road and commercial sex workers are living in favors of long vehicle drivers. This association might be due to the fact that women are paying less attention to syphilis as the infection is asymptomatic for many years. Study in south Sudan, Juba found that women whom their partner involved in jobs like track drivers was associated with syphilis infection among pregnant women. This could explain the aforementioned association between syphilis infection and education. Less educated women are more likely to be dependent and exposed to have sex for business purpose [2].

The proportion of syphilis infection among HIV negative pregnant women is lower compared to their counterparts. This might be related to HIV infection that facilitates the transmission of syphilis infection and both have the same ways of transmissions [8].

As to the limitation of this study, classification errors might be possible as the data were collected by a face to face interview. Social desirability bias might be inevitable as the study is sensitive in nature.

5. Conclusion and Recommendation

Several factors; having education and knowledge about STIs reduces the odds of syphilis infection among pregnant women. While, having a history of a lost baby during pregnancy, having a history of multiple sexual partners, Cigarette smoking and HIV positive were factors significantly associated with higher chances of syphilis infection among pregnant women.

Continuous and proper health education should be provided for mothers about STIs as early as possible before they had got pregnant. Interventions targeting, behavioral factors like Cigarette smoking, having multiple sexual partners should be instituted to curb the problems. It is also recommended to test for syphilis infections among all women with a history of adverse pregnancy outcomes and provide treatment as early as possible.

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