

Screening for Syphilis among Third Trimester Pregnant Women in a Low Resource Setting: A Missed Opportunity?

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Original Research Article

ABSTRACT

Syphilis accounts for a significant morbidity and mortality especially in the sub-Saharan Africa, where it remains a public health problem. Studies have demonstrated its deleterious effects on pregnancy and its association with HIV/AIDS. The aim of this study was to determine the prevalence of syphilis, its associated factors, and its relationship with HIV, among third trimester pregnant women in the Buea Health District (BHD), Cameroon. This was a cross-sectional study involving

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250 third trimester pregnant women. Serum obtained from 5 ml of venous blood from each participant was tested for syphilis using VDRL antigen and *Treponema pallidum* hemagglutination assay (TPHA). The data on some socio-demographic, clinical characteristics and the results of tests were collected using a pretest questionnaire and analysed using the statistical software Epi-info version 7. P-values less than 0.05 were considered statistically significant. The mean age of the participants was 26.9 (SD 5.2) years. There was a high prevalence of syphilis of 6.4% in Buea Health District. No risk factor was identified to have a significant association with syphilis but there was a significant difference between the prevalence of syphilis among HIV positive and the negative groups ($p < 0.001$). Apart from screening for syphilis during the first trimester; sensitisation, screening, treatment and proper follow-up should also be encouraged in the third semester to prevent adverse foetal outcomes.

Keywords: Prevalence; syphilis; third trimester; associated factors; HIV; Buea.

1. INTRODUCTION

There are estimated twelve million new cases of syphilis infection each year, quite an alarming number for a curable disease. A quarter of these occurs in the sub-Saharan Africa (SSA) [1,2].

Though syphilis was thought to be under control in many parts of the world, there has been a rising incidence in recent years, with a greater proportion in low and middle income countries (LMICs), where it is a major cause for unfavourable pregnancy outcomes [3]. In SSA, studies have demonstrated very high prevalence of syphilis in pregnancy and congenital/neonatal syphilis ranging from 3-20%, and 1-3% respectively [4-6]. Buve et al. found that there were about 30,000 syphilis related deaths in the year 2004 [7,8].

Amidst these high prevalence, it is worth noting that only less than 30% of pregnant women in SSA are screened for syphilis despite the high recommendation [3]. This has resulted in poor perinatal outcomes like: spontaneous abortions, still births, congenital syphilis, intrauterine growth restriction, serious neonatal infections or perinatal death [1,2,4,9]. Furthermore, some studies have brought forth evidence of increase prevalence of syphilis among those infected with HIV [10], with the prevalence of co-infection varying between 2.1-3.3% in Nigeria. This has thus complicated the management of these conditions [11,12].

In Cameroon, there is a paucity of data on the epidemiology of syphilis, especially at regional levels. In a bid to reduce the prevalence of the disease, screening for syphilis is recommended at the first ANC (antenatal care) visit by the Ministry of Public Health and those who test positive for syphilis are treated. The

implementation of this policy still raises concern because third trimester screening for syphilis is not done to diagnose cases of reinfection or those who were not screened during early pregnancy. The aim of the study was to determine the prevalence of syphilis, its associated factors, and its relationship with HIV, among third trimester pregnant women with the goal of reducing morbidity and mortality associated with this infection in Buea Health District (BHD), Cameroon.

2. MATERIALS AND METHODS

2.1 Study Design

This was a hospital-based cross-sectional analytic study.

2.1.1 Study setting

The study was carried out in three antenatal care centres: Buea Regional Hospital, Muea Integrated Health Centre and Prevention Maternelle Infantile (PMI) Centre. These centres provide more than 80 % of ANC coverage in the BHD. Buea is the capital of the South West region of Cameroon. Participants were enrolled over a period of 12 weeks, from December 15th, 2014 to March 15th, 2015.

Buea was chosen because it is rapidly becoming an urban setting, with a fast-growing population and increasing number of learning institutions which attract people across the nation. Furthermore studies on the prevalence of syphilis and HIV co-infection in pregnancy, to the best of our knowledge, have not been done in this region, though the regional HIV prevalence (5.7%) was higher than the national prevalence of 4.3% [13].

2.1.2 Sample size calculation

The minimum sample size (n), was obtained from the formula that calculates the sample size needed when estimating the proportion of a study population with a particular attribute, which in this case, is the prevalence of syphilis among pregnant women in the third trimester as shown: $n = z^2(p)(q)/d^2$

[14]. $z = 1.96$ is the standard normal variate for 95% confidence; $p = 0.15$ pre-study estimate for the prevalence of syphilis in the study population; $q = 1 - p$; $d = 0.05$ which is the tolerated sampling error. Using the prevalence of 15% [15], the minimum sample size was calculated to be 195 participants; however, 250 participants were enrolled to increase the validity of the study.

2.1.3 Study population and sampling

All pregnant women in the third trimester of pregnancy in the aforesaid structures were invited to take part in the study through convenient consecutive sampling. The study was explained to them and written consent sought after which data collection proceeded. Pregnant women on treatment for syphilis or on antibiotics for other diseases were excluded from the study.

Ethical clearance (N^o. 2014-08-0320) was obtained from the Institutional Review Board of the Faculty of Health Sciences, University of Buea and administrative approval from the Regional Delegate of Health, South West Region.

2.2 Data Collection and Procedure

Data was collected using an interviewer-administered pretested questionnaire. Information was obtained on: socio-demographic characteristics and clinical data, risk factors for infection with syphilis (such as level of education, number of sexual partners, marital status) and past medical history. Each participant was privately assisted to complete the questionnaire.

Five milliliters of venous blood was collected from each consenting participant by a trained laboratory technician using the standard procedure. The collected samples were separately transferred into different plain test tubes and the samples were centrifuged where available or allowed to settle for 10 minutes so that the red blood cells could sediment.

Laboratory methods involved two separate analyses per given sample; one with Venereal Disease Research laboratory (VDRL) (Omega Diagnostic laboratories, Hillfoots Business Village, Scotland) and another with *Treponema pallidum* hemagglutination assay (TPHA) (Reckon Diagnostic laboratories, Vadodara, India).

- I. With the VDRL reagent, **50 μ l** of serum was collected from the test tube using a micropipette which was then placed onto a glass slide, against a white background, and **16 μ l** of VDRL antigen (reagent) was added onto the slide sample, stirred for 10 minutes and observed for flocculation. No visible reaction implied a negative result while flocculation implied a positive result.
- II. TPHA strip was then used to conduct another test using the same sample collected from the participant. A dropper was used to collect a sample of serum from the test tube, and placed onto the test strip and a buffer was added. A single red line indicated a functional test strip but a negative result, while a double red line implied a positive result.

2.3 Data Management

All data was entered into Microsoft Excel spread sheet for subsequent analysis. Each participant's data was also entered into an Epi InfoTM version 7 data entry form to crosscheck for any errors. Important variables that were measured were recorded in a tabular form and analysed.

To describe the relationship between the prevalence of syphilis among third trimester pregnant women with some socio-demographic characteristics, the predictor variables; age, marital status, level of education, use of condoms and number of sexual partners were considered and the outcome variable was a positive test for syphilis. These factors were first categorised into groups: age (11-20 years, 21-30 years and above 30 years), marital status (single or married), level of education (less educated i.e no formal education and primary, and educated), use of condoms (used consistently or did not use condoms), number of sexual partners (1 or >1 partners). In each subgroup, the proportion of individuals positive for syphilis were calculated. The statistical significance of the differences in proportions was assessed using the Chi-square test or Fisher's exact test were applicable. The

relationship between HIV and the prevalence of syphilis in pregnancy was assessed as follows; the participants were grouped into those who were HIV negative and those who were HIV positive. The proportion of those positive for syphilis in both groups was calculated. The test for statistical significance was then assessed using the Chi-square or Fisher's exact test. The test for statistical significance was assessed using the Chi-square test. P-values <0.05 were considered statistically significant.

3. RESULTS

The prevalence of syphilis in the third trimester of pregnancy in BHD was 6.4%. The mean age of the participants was 26.9 (SD 5.2) years. There was a 26.3% prevalence of syphilis and HIV co-infection.

3.1 Socio-demographic Characteristics of Study Population

Of the 250 participants, 158 (63.2%) were married, most had secondary education 130 (52.0%) and those who were employed [skilled 95(38.0%) and unskilled 51(20.4%)] made up the majority of these participants. Table 1 summarises other socio-demographic characteristics of the participants.

3.2 Clinical Characteristics of Participants

The gestational age (GA) ranged from 28 to 41 weeks. The mean GA was 32.2 ± 3.8 weeks. Table 2 shows that most, 113 (45.2%) of the participants were in the GA range of 28-30weeks. Also, most 128 (51.2%) had attended ANC more than twice. Knowledge of syphilis was divided into those who had heard about the disease and those who had not, which were 170 (68.0%) and 80(32.0%) respectively. The former was then divided into those who knew how the infection could be acquired and those who did not; we had 142(83.93%) and 28(16.07%) respectively. Of all the participants, 219(87.6%) had one partner, 126 (50.4%) occasionally used condoms during sexual intercourse and 245(98.0%) knew their HIV status of which 19 (7.8%) of them were HIV positive.

3.3 Prevalence of Syphilis

Table 3 below shows the prevalence of syphilis using both VDRL and TPHA was highest at 10.0% (5 of 50) in the age group >30years and least at 4.8% (8 of 165) in the age group 21-30years. It was highest at 8.4% (8 on 95) among those with skilled jobs and greater at 6.7% (14 of 205) among the educated participants. Prevalence was higher at 6.5% (6) among those who were single, 3.4% (3 of 89).

Table 1. Socio-demographic characteristics of 250 participants

Factor	Frequency (N=250)	Percentage
Maternal age group (years)		
11-20	35	14.0%
21-30	165	66.0%
30 ⁺	50	20.0%
Occupation		
Skilled	95	38.0%
Unskilled	51	20.4%
Unemployed	104	41.6%
Level of education		
Tertiary	75	30.0%
Secondary	130	52.0%
Primary	42	16.8%
None	3	1.2%
Marital status		
Married	158	63.2%
Single	92	36.8%
Region of Origin		
Southwest	94	37.6%
Northwest	128	51.2%
Others	28	11.2%

Table 2. Clinical characteristics of 250 Participants

Factor	Frequency	Percentage
Gestational age (In weeks)		
28-30	113	45.2%
31-33	40	16.0%
34-36	60	24.0%
37-39	26	10.4%
≥40	11	4.4%
N° of partners		
1	219	87.6%
>1	31	12.4%
ANC attendance		
Once	33	13.2%
Twice-thrice	89	35.6%
Four and above	128	51.2%
Use of condoms		
Used	126	50.4%
Did not use	124	49.6%
HIV status	N=245 in category	
Positive	19	7.8%
Negative	226	92.2%
Knowledge of syphilis		
Have not heard	80	32.0%
Have heard	170	68.0%
Know how it is acquired	142 of 170	83.9%

Table 3. Prevalence of syphilis-based socio-demographic characteristics

Factor	Total(N=250)	Total (%)	VDRL/TPHA Positive	Percentage (%)
Maternal age group (years)				
11-20	35	14.0%	3	8.50%
21-30	165	66.0%	8	4.8%
30 ⁺	50	20.0%	5	10.0%
Occupation				
Skilled	95	38.0%	8	8.4%
Unskilled	51	20.4%	2	4.4%
Unemployed	104	41.6%	6	5.7%
Marital Status				
Married	92	36.8%	6	6.5%
Single	158	63.2%	10	6.3%
Level of education				
Educated	205	82.0%	14	6.8%
Less educated	45	18.0%	2	4.4%

3.4 Prevalence of Syphilis Based on Clinical Characteristics

The prevalence of syphilis was 8.75% (7 of 80) among those who had never heard of syphilis and 5.3% (9 on 170) among their counterparts. The prevalence of syphilis was highest at 9.1% (3 of 33) among those who attended ANC only once and least among those who had attended twice or thrice. The prevalence was highest at 8.3 (5 of 63) in GA group of 34-36 years.

Using VDRL and TPHA combined, 14 of 219 (6.3%) and 2 of 31 (6.4%) tested positive among those with one partner and among those with more than one partner in the past year respectively. For those who used condoms, 4.8%(6) and those who did not use condoms, 8.9%(10) tested positive for syphilis. As much as 26.3%(5) of the HIV positive participants and 4.8%(11) of those who were HIV negative tested positive for syphilis. For those with one sexual partner versus more than one sexual partner in the last one year, 6.4% (14/219) and 6.5% (2/31) respectively tested positive for syphilis.

Table 4. Prevalence of syphilis based on clinical characteristics

Factor	Total N=250	Total (%)	VDRL/TPHA Positive	VDRL/TPHA +VE (%)
Gestational age (weeks)				
28-30	113	45.2%	7	6.1%
31-33	40	16.0%	3	7.5%
34-36	60	24.0%	5	8.3%
37-39	26	10.4%	1	3.8%
N^o of partners				
1	219	87.6%	14	6.4%
>1	31	12.4%	2	6.5%
ANC attendance				
Once	33	13.2%	3	9.1%
Twice-thrice	89	34.4%	3	3.4%
≥ Fourth times	128	51.2%	10	7.8%
Use of condoms				
Use	126	50.4%	6	4.8%
Do not use	124	49.6%	10	8.9%
HIV status N ^x =245				
Positive	19	7.8%	5	26.3%
Negative	226	92.2%	11	4.9%
Knowledge of syphilis				
Had knowledge	170	68.0%	9	5.3%
No knowledge	80	32.0%	7	8.8%

N^x=245 (Number of participants who consented to disclose their HIV status)

3.5 Factors Associated with Syphilis

Maternal age was divided into two categories: 11-25, and 26-40 years. The prevalence of syphilis using VDRL and TPHA tests were 6.9% and 5.9% respectively. The difference, however, was not statistically significant with $p=0.70$.

The number of sexual partners within the last one year was grouped into those who had one and those who had more than one. A majority of participants (87.5%) had one partner, amongst which 6.5% tested positive. There was no statistically significant difference between a number of sexual partners and testing positive for syphilis as shown on Table 4 above ($X^2=0.14$; $p=0.695$).

Level of education was divided into two categories; the less educated (none and primary education) and the educated (secondary and above). We noted that 18%(45) were less educated (Table 3) of which 4.4% were positive as well as 6.8% of the educated category but the difference was not significant ($X^2=0.35$; $p=0.55$).

Marital status was divided into two groups, married and single with most being in the married category 63.2%(158). Syphilis was diagnosed in 6.5% and 6.3% of married and single women

respectively but this difference was insignificant ($p=0.952$).

Almost half of the participant population (49.6%) were not condom users amongst which 8.9% were positive for syphilis, however, while 4.8% of condom users were positive but the difference was not statistically significant ($X^2=1.14$; $p=0.290$).

Almost all of the participants (98%) knew their HIV status with 7.8% of them being seropositive. Furthermore, those who were seropositive with HIV were 5 times more likely to be coinfectd with syphilis than those who were HIV seronegative ($X^2=13.2$; $p<0.001$).

4. DISCUSSION AND CONCLUSION

4.1 Prevalence of Syphilis

The prevalence of syphilis among third trimester pregnant women at the BHD was high considering that these women screened negative at their first ANC visit. However, 13.2% (33) started their first ANC at the third trimester. This prevalence was higher than 2.9-5.0 % reported by some authors [16-18] and lower than 7.7-17% in other countries, [3,6,15,19-23]. This discrepancy could be due to differences in the geographical location, study population, period or

study setting, bearing in mind that BHD is a cosmopolitan semi-urban town with many young people who generally are more sexually active. Their socio-cultural interaction in this locality is influenced by the university milieu and several other tertiary learning institutions with the majority (66.0%) of the participants being in the age group of 21-30 years. Furthermore, high prevalence recorded in some of these studies was probably attributed to the study population [6] (First trimester pregnant women) and published than 15 years ago [6,15] when this subject had not yet attracted public health attention. Combined with the effective screening methods for syphilis and treatment during pregnancy recommended by WHO to achieve the sustainable development goals, this decrease in the prevalence is understood.

4.2 Socio-demographic Characteristics

Having multiple sexual partners and high level of education were not significantly associated with syphilis in this study. This was different from the findings of Araujo et al. [19] where having multiple partners was associated with syphilis. Shimelis et al. also reported that the level of education was associated with syphilis [24], however in their study this was linked to the low educational level of the participants implying they were probably less aware of preventive measures of sexually transmitted infection. The small sample size and setting of this study might have accounted for the disparity between our findings and those of other authors as regards the role of multiple sexual partners and level of education in the transmission of STI like syphilis.

4.3 Clinical Characteristics

Maternal age, marital status and use of condoms were not statistically significant risk factors for syphilis in this study. The prevalence of HIV and syphilis co-infection in the study population was only 0.02%, although 26.3% of those with HIV had syphilis. The difference in the prevalence of syphilis among participants with HIV infection was quite high compared to those who were HIV negative. This tallies with the findings of Msuya et al. [21]. The prevalence of treponemal antibodies by TPHA test was 11.2%. These results are similar to, but slightly higher than the 10% prevalence Shahrook et al. reported in Mongolia [20], but less than 13% recorded by Msuya et al. [21]. Prevalence of syphilis based

on TPHA antibodies are usually higher because these are not necessarily suggestive of active infections. That notwithstanding, there was a statistically significant association between HIV and syphilis using the TPHA test. This is not an unusual finding as documented by Kwiek et al. [16] because syphilitic lesions increase the risk of HIV infections.

4.4 Conclusions

The study revealed a high prevalence of syphilis in the third trimester, a very disturbing finding for a curable disease, hence not screening for syphilis during this period of gestation can be considered a missed opportunity. Though no risk factors of syphilis were identified, sensitisation, screening, treatment and proper follow-up for syphilis even during third trimester of pregnancy should be encouraged to prevent adverse maternal and foetal outcomes.

5. STUDY STRENGTH AND LIMITATIONS

The study highlighted the importance of screening for syphilis in the third trimester of pregnancy as it permitted the detection of cases of reinfection and those who missed to be screened in early pregnancy. The study however had some limitations. Being a cross-sectional hospital based study, it might not necessarily represent the prevalence of syphilis in the general population. This short coming was reduced by choosing high volume medical facilities that provided ANC to the majority clients in the Buea Health District.

CONSENT

As per international standard, patient's written consent was obtained and preserved by principal investigator.

ETHICAL APPROVAL

Ethical clearance (N^o. 2014-08-0320) was obtained from the Institutional Review Board of the Faculty of Health Sciences, University of Buea and administrative approval from the Regional Delegate of Health, South West Region, Cameroon.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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