

Syphilis and HIV Infection among Pregnant Women Previously Screened Negative during Their First Antenatal Care Visit (ANC) at Some Selected Health Facilities in the Buea Health District, Cameroon

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Abstract

Syphilis and HIV are amongst the world's most widespread diseases, particularly in low-income countries. Syphilis and HIV infections during pregnancy have been associated with numerous adverse pregnancy outcomes. Of concern now are the rising rates of congenital syphilis and HIV in Cameroon. Cameroon only mandates testing pregnant women for syphilis and HIV during their first ANC visit. This study was aimed at determining the incidence of new syphilis and HIV infections and factors associated with pregnant women who previously tested negative during their first ANC visit. A cohort design was used, where 335 pregnant women were followed up for a period from December 2019 to August 2020. A blood sample was drawn and the serum was analyzed using the WANTAI ELISA and AIDTM HIV 1 + 2 Ag/Ab ELISAPlus test methods for syphilis and HIV respectively at three intervals. A questionnaire was used to identify risk factors. Data was analyzed using SPSS 23.0. Out of the 335 pregnant women who were followed up during this study, 49 (14.6%) were later diagnosed with syphilis (32 in 2nd trimester and 17 in 3rd trimester). 54 (16.1%) were diagnosed with HIV infection (13 at two months post-1st-trimester visit, 23 in the 2nd trimester and 18 in the 3rd tri-

mester). Lastly, 10 (2%) were co-infected with syphilis and HIV of which 8 occurred during 2nd trimester and 2 in the 3rd trimester. The factors associated with contracting new syphilis infections include; younger age group aOR (1.302, 95% CI), leaving in an urban area aOR (3.158, 95% CI), lower level of education (Primary and no formal) with aOR of (9.055, 95% CI) ($P = 0.001$) and (6.764, 95% CI) ($P = 0.006$) respectively, inadequate knowledge on the diseases aOR (2.176, 95% CI), women unaware of their partner status aOR (3.190, 95% CI). Most factors associated with contracting new HIV infections were similar to the factors associated with contracting new syphilis infections post 1st ANC visit aOR (1.174, 95% CI) and pregnant women with more than one sexual partner aOR (7.342, 95% CI) were observed for HIV infection.. There is an increased incidence of new infection of syphilis and HIV post first ANC screening in the Buea Health District, Cameroon. The need for constant education on the identifiable factors and these diseases, and screening during every ANC visit irrespective of their previous laboratory results is warranted.

Keywords

Syphilis, HIV, STI, Pregnant Women, Post First-Antenatal Care, Screening, ELISA, Buea

1. Introduction

Sexually transmitted infections (STIs) are an emerging public health concern and are amongst the world's most widespread diseases, particularly in low-income countries [1]. The bacteria *Treponema pallidum* is the organism that causes the systemic disease syphilis. The infection can be classified as congenital or acquired, transmitted through unsafe sexual intercourse or blood transfusion [2]. The last estimation of WHO showed that approximately, 18 million women worldwide are infected with syphilis and those with pregnancy have approximately 305,000 fetal and neonatal deaths every year and leaving 215,000 infants at increased risk of dying from prematurity, low-birth-weight or congenital disease [3] [4]. Infection with the Human Immunodeficiency Virus (HIV) is also an important public health problem that affects many people around the world. The Global HIV/AIDS statistics estimated 37.9 million, people living with HIV in 2018 [5]. Sub-Saharan Africa remains the most affected area with 70% of all cases [6]. Studies have shown that syphilis infection causes genital ulcers, creating a site for HIV entry due to disruption of the natural mucosal and epithelial barrier integrity [5] [6]. In Africa, it was observed that the overall syphilis prevalence in pregnant women ranges from 4% to 15%, and early untreated syphilis will result in a stillbirth in 25% of pregnancies and death in 14% of newborns [7]. A study across 43 sub-Saharan African countries has shown that adverse outcomes such as stillbirth, neonatal death, low birth weight, and congenital syphilis occur in an estimated 206,000 pregnancies each year [8]. Pregnant women infected with HIV have a higher risk of adverse pregnancy outcomes [9]. An estimated 24% of

postpartum deaths are due to HIV infections [10]. Reports from CDC have recommended testing for syphilis and HIV during pregnancy at the first prenatal visit, and to repeat the testing for mothers at risk during the third trimester (preferably 28 - 32 weeks). Increased testing for HIV during pregnancy has helped in drastically reducing vertical, or mother-to-child, transmission of HIV. Many health facilities [11] require testing pregnant women for HIV during their first and third trimesters, leading to a public health victory in preventing perinatal cases of HIV. However, in most low-income countries most of these recommendations for routine screening for syphilis and HIV infection are usually not adhered to, because of limited finance, poor infrastructure, low-quality and inadequate test kits and methods, late ANC visit and low educational background. There is a paucity of data on the prevalence of Syphilis and HIV infections among pregnant women who previously tested negative but during their subsequent ANC visits became positive. The prevalence of syphilis in pregnant women in the Buea Health District was high (6.8%) as of 2018 [12]. HIV in pregnant women in the Buea Health District also had a high prevalence of 8.37% as of 2016 [13]. Limited data has been available since then. Most clinical studies with their reported prevalence were recorded during the first ANC screening and this data might underestimate the prevalence of syphilis and HIV infection during pregnancy. Continuous screening for HIV and syphilis in most of the health facilities are not usually done after the first ANC visit. Early diagnosis might provide better care and management of the HIV infection during pregnancy, as well as enable effective timely treatment for syphilis. This study thus seeks to determine the incidence and factors associated with acquiring new HIV and syphilis infection at any point in time post-first ANC visit. Enforcing and harmonizing screening of syphilis and HIV testing in different health facilities for pregnant women in all ANC visits could play a significant role in reducing congenital syphilis in the Buea Health District, Cameroon.

2. Materials and Methods

2.1. Study Area and Population

This study was carried out among pregnant women who were diagnosed negative for syphilis and or HIV infection during their first antenatal visit at some stratified selected health facilities. We targeted settings in Buea Health District (Rural and Urban) where the potential for benefit would be the greatest and the study would be the most feasible. The three participating ANC clinics are Regional Hospital Buea, CMA Muea, and St Veronica Polyclinic (Biaka). These sites were selected because they are found around the epicentres of high venereal diseases as they are surrounded by many Universities and higher institutions. The selected clinics comprise a Unit specialized in HIV counselling.

2.2. Study Design

A hospital-based cohort study was carried out among 335 pregnant women who

were previously tested negative for syphilis and HIV. They were followed up during their subsequent ANC visit using WANTAI ELISA test methods for syphilis and the AIDTM HIV 1 + 2 Ag/Ab ELISAPlus test methods for HIV for a duration of nine months, from December 2019 to August 2020. Also, factors including age, living in an urban area, level of education, knowledge on the diseases, and the women's awareness of their partner's status were assessed to determine if they affect their health outcomes. The individuals in the cohort were all resident in the Buea health district for at least 2 years.

2.3. Sampling Technique

A consecutive sampling technique and review of medical records were used to recruit 335 pregnant women who tested negative for syphilis and HIV during their first ANC visit. Participants were recruited over two weeks through a two-stage process. First, the service providers sensitized women coming for the first ANC visits at their respective centres about the study, giving only basic information about the study. This was to give all clients undergoing the screening test for HIV and syphilis an opportunity to choose to participate while avoiding a potentially biased approach by study staff. Subsequently, those who were willing to participate in the study were referred (using a study referral notepad) to the researcher sitting in another room closely. It was considered that those who presented to the researcher were truly willing to participate in the study.

2.4. Ethical Consideration

The researcher conducted consenting to every pregnant woman individually by providing in-depth information about the study and answering questions they posed.

Those willing to participate in the study provided written consent. Only pregnant women who had previously tested negative for Syphilis and HIV consented and enrolled. During consenting, everyone was assured of confidentiality and privacy; informed that their information will be kept confidential and that they should not use their names when filling out the forms. Each was assigned a unique number code.

Participation in this study had a risk of mild discomfort, bruising, bleeding, and blood clot at the needle puncture site during the collection of blood. However, in case of a blood clot (hematoma), the needle was removed and pressure applied at the site for two minutes. For discomfort, the patients were talked to and given assurance. In case of excessive bleeding, dry cotton was applied at the site until there is a complete stoppage. Participants that tested positive in the course of the follow-up, were referred to see the counsellor, who disclosed their results and were further sent to see the physician for management. The study was conducted after obtaining clearance from the Institutional Review Board (IRB) of the Faculty of Health Science, University of Buea and also an administrative authorization was obtained from the delegation of public health in Buea.

During data collection, all pregnant women eligible for the study was asked to sign the informed consent form before blood collection. For pregnant women aged less than 21 years, assent was obtained from parents, guardians or husbands.

2.5. Data Collection

Data was collected using a pretested questionnaire. This questionnaire was used to explore information on socio-demographic characteristics and clinical data, risk factors for infection with syphilis (such as level of education, number of sexual partners, marital status, partner's status) and past medical history. Blood samples were collected into dry tubes, centrifuged and the serum was preserved.

2.6. Laboratory Analysis

5 mL of Blood samples were collected through the venous puncture into dry tubes. These blood samples were centrifuged and the serum was obtained and transferred to cryo tubes which were frozen at -40 c. These samples were later used to test for syphilis using the WANTAI anti-TP ELISA test methods meanwhile the HIV was analyzed using the AIDTM HIV 1 + 2 Ag/Ab ELISAPlus test methods.

2.7. Data Analysis

Data was input into a Microsoft Excel sheet for easy access while the questionnaire was properly preserved. All source documents and laboratory reports were reviewed and ensured that they are accurate and complete. Data were analyzed using the SPSS version 23.0 software for statistical analysis. The Chi-square test was used to access association and the multinomial logistic regression was used to access risk factors at a 95% confidence interval (95% CI). A P-value < 0.05 was considered significant.

3. Results

3.1. Socio-Demographic Characteristics of Pregnant Women in the Buea Health District

Out of the 335 pregnant women who were enrolled in this study, the majority originating from the North West region was 203 (60.6%). Most of the study participants were within the age group of 16 - 29 years 222 (66.3%), followed by the age group 30 - 40 years 113 (33.7%). Most of the participants were residents of Muea 141 (42.1%) and the least came from Buea station 47 (14.0%), meanwhile, Great Soppo and Molyko/Mile 17 had a frequency of 78 (23.3%) and 69 (20.6%) respectively. The majority of these participants were unemployed 130 (38.8%) and also had a Secondary level of education 137 (40.9%). Almost all participants were Christians 331 (98.8%). Married women were greater in number 232 (69.3%) than single women 103 (30.7%) (See **Table 1**).

Table 1. Demographic data of study participants.

Variables	Parameters	Frequency (n = 335)	Percentage (%)
Age	16 - 29 years	222	66.3
	30 - 42 years	113	33.7
Region of Origin	Center	1	0.3
	North	2	0.6
	North. W	203	60.6
	South. W	115	34.3
	West	14	4.2
Area of Residence	Buea Station	47	14.0
	Great Soppo	78	23.3
	Molyko/Mile 17	69	20.6
	Muea	141	42.1
Level of Education	No formal Ed.	2	0.6
	Primary	49	14.6
	Secondary	177	52.8
	Tertiary	107	31.9
Occupation	White-collar	44	13.1
	Blue-collar	41	12.2
	Green collar	120	35.8
	Unemployed	130	38.8
Religion	Christian	331	98.8
	Moslem	3	0.9
	Unbeliever	1	0.3
Marital status	Married	232	69.3
	Single	103	30.7

3.2. Prevalence of Syphilis and HIV Infections Post First ANC Visit in the Buea Health District, Cameroon

Out of the 335 pregnant women who previously tested negative for syphilis and HIV during their first ANC visit who participated in this study, the majority 49 (14.6%) were later diagnosed positive for syphilis, followed by 54 (16.1%) positive for HIV and 10 (3%) co-infected with Syphilis and HIV (as shown in **Figure 1**).

3.3. Prevalence of Syphilis and HIV Infections among Pregnant Women Follow-Up at Two Months Post 1st ANC, 2nd and 3rd Trimester Visit at the Buea Health District Cameroon

Concerning trimester distribution with regard to the incidence of new cases of HIV and syphilis within the 9-month follow-up, it was observed that the majority of the pregnant women became diagnosed positive for syphilis in the second trimester 32 (9.4%) as compared to the third trimester 17 (5.1%) as seen in **Figure 2**.

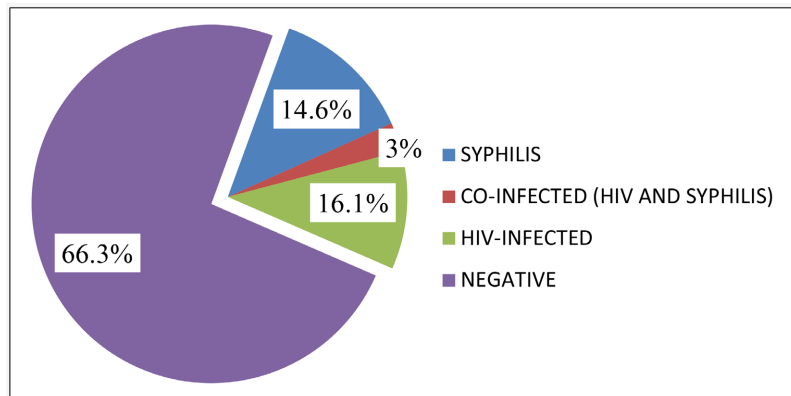


Figure 1. Prevalence of HIV and Syphilis among pregnant women previously tested negative during their first ANC visit at the Buea Health District, Cameroon.

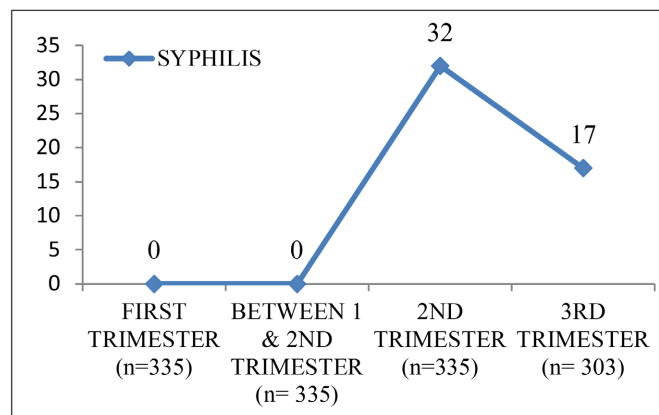


Figure 2. Incidence of syphilis at the 2nd and 3rd trimester during pregnancy among participants previously tested negative at first semester at the Buea Health District, Cameroon.

The incidence of new HIV infection among the pregnant women follow-up for 9 months, had an increasing pattern of new HIV infection starting from the time frame of two months after the first-trimester visit 13 (4%), followed by a near double infection rate of 23 (7%) in the 2nd trimester. 18 (6%) infection rate was recorded in the 3rd trimester as seen in **Figure 3**.

3.4. Co-Infection of Syphilis and HIV among Pregnant Women Occurring at the 2nd and 3rd Trimester of Previously Tested Negative Participants

It was observed that new cases of syphilis and HIV co-infections occurred mostly in the second trimester 8 (2.3%) and a few 2 (0.5%) occurred in the 3rd trimester as seen in **Figure 4**.

3.5. Incidence of Syphilis and HIV Infections with Respect to Age among Pregnant Women Previously Tested Negative during Their First-Trimester Visit at the Buea Health District, Cameroon

The incident of syphilis during pregnancy was higher at 8% in the older age

group 30 - 42 years when compared with the younger aged group 16 - 29 years 5.9%. Syphilis and HIV co-infections were mostly recorded among the older pregnant women at 1.8% as compared to the younger age group at 0.9%. The distribution of new cases of HIV and syphilis can be seen in **Figure 5**.

3.6. Prevalence of Syphilis and HIV Infections with Respect to Educational Level among Pregnant Women Previously Tested Negative during Their First-Trimester Visit at the Buea Health District, Cameroon

The prevalence of syphilis was higher in pregnant women who ended at the

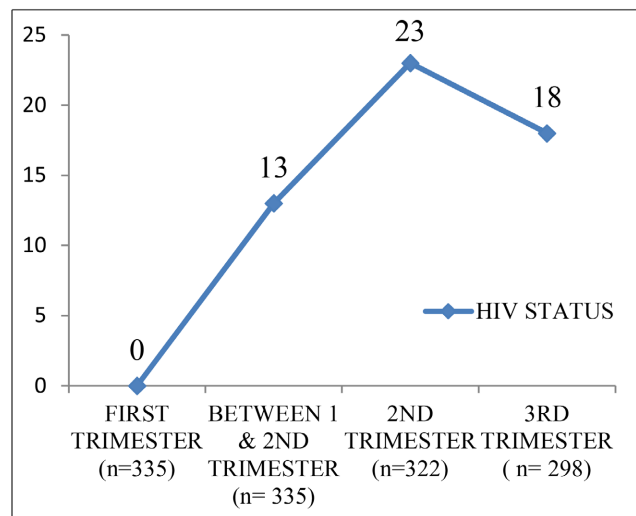


Figure 3. Increased Incidence of HIV among pregnant women at two months post 1st ANC, 2nd and 3rd trimester visit at the Buea Health district, Cameroon.

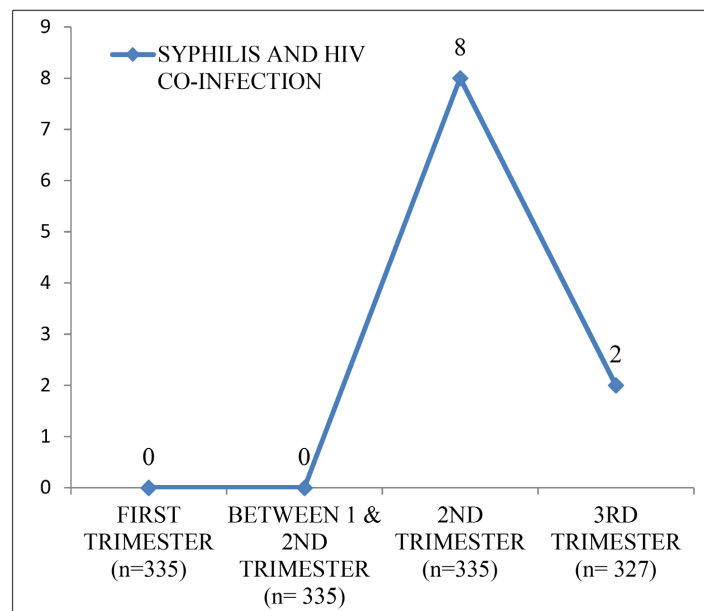


Figure 4. Co-infection of Syphilis and HIV among pregnant women occurring at the 2nd and 3rd trimester of previously tested negative participants.

primary level 16.3% followed by those who ended at the Secondary level 6.2% and tertiary level 2.8%. The prevalence of HIV was higher in pregnant women who ended at the Primary level 18.4% followed by those who ended at the Secondary level 5.6% and the least being those who ended at the tertiary level 1.9%. Co-infections were higher in those who ended at the primary and secondary levels with a prevalence rate of 4.1% and 1.5% respectively. There was no co-infection prevalence at the tertiary level likewise those with no formal education. Those with no formal education also had no Syphilis or HIV prevalence. The distribution of new cases of HIV and syphilis during pregnancy as per educational level can be seen in **Figure 6**.

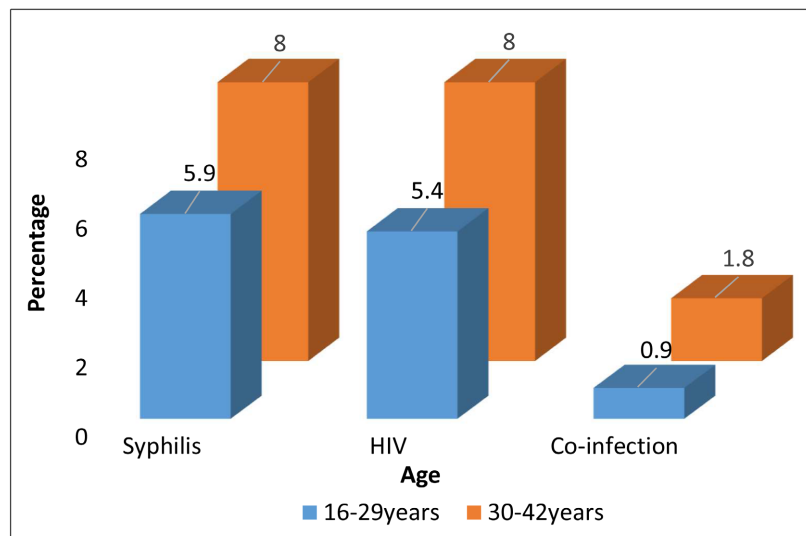


Figure 5. Prevalence of Syphilis and HIV infections with respect to age among pregnant women previously tested negative during their first trimester visit at the Buea Health District, Cameroon.

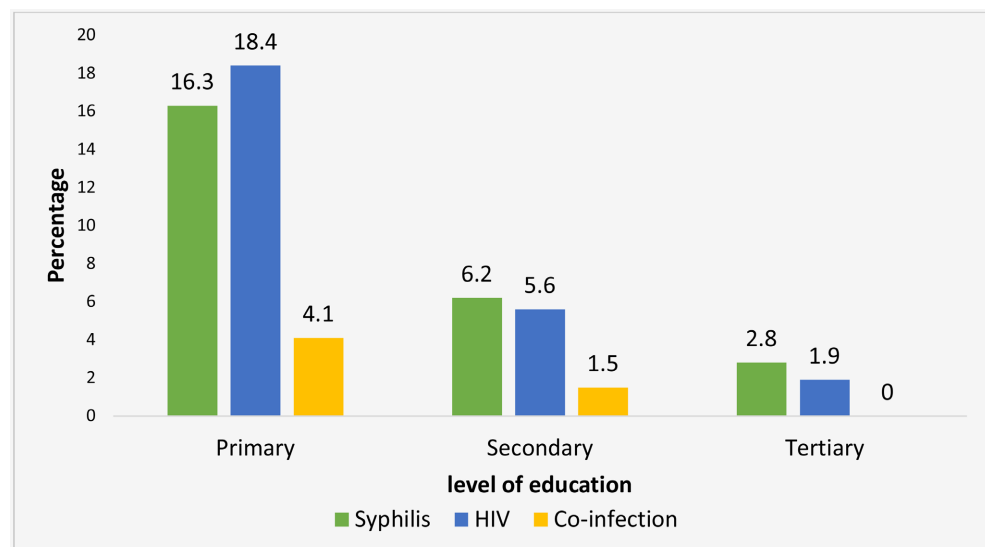


Figure 6. Prevalence of Syphilis and HIV infections concerning educational level among pregnant women previously tested negative during their first-trimester visit at the Buea Health District, Cameroon.

3.7. Risk Factors Associated with Contracting New Syphilis Infections among Pregnant Women Previously Tested Negative during Their First ANC Visit at the Buea Health District, Cameroon

The findings of this study revealed that pregnant women between the age group of 16 - 29 years had a higher risk aOR (1.302, 95% CI) of contracting syphilis infection after their first semester ANC screening negative test results. It was also observed that pregnant women resident in Buea station were three times more likely to contract a new infection of syphilis aOR (3.158, 95% CI). Pregnant women with no formal education and primary education levels were more likely to contract the new infection and were statistically significant with aOR of (9.055, 95% CI) ($P = 0.001$) and (6.764, 95% CI) ($P = 0.006$) respectively. Pregnant women in the second trimester also showed a high risk of acquiring new infections of syphilis aOR (2.018, 95% CI). Pregnant women who had inadequate knowledge of syphilis were 2 times more likely to acquire a new infection of syphilis during pregnancy aOR (2.176, 95% CI) and those who were not aware of their partner's syphilis status also had a high risk at 3 times more likely of acquiring new syphilis infection aOR (3.190, 95% CI) as seen in **Table 2**.

3.8. Risk Factors Associated with Contracting New HIV Infections among Pregnant Women Previously Tested Negative during Their First ANC Visit at the Buea Health District, Cameroon

The findings of this study showed that pregnant women between the age group of 16 - 29 years had a higher risk aOR (1.302, 95% CI) of contracting HIV infection. Those who had primary and secondary level of education was eleven and three times more likely to contract new HIV infection which was statistically significant with aOR of (11.912, 95% CI) ($P = 0.001$) and (3.144, 95% CI) ($P = 0.002$) respectively. Pregnant women two months post 1st ANC and second trimester also showed a high risk with aOR (1.174, 95% CI) and (1.081, 95% CI) respectively of contracting new HIV infection. Pregnant women who had more than one sexual partner were seven times at risk of contracting the new HIV infection aOR (7.342, 95% CI) while those who had inadequate knowledge were two times at risk of acquiring this infection aOR (2.866, 95% CI) as shown in **Table 3**.

4. Discussion

A total of 335 pregnant women participated in this study and were categorized into two sets of age groups (16 - 29 years) and (30 - 42 years). 16 - 29 years had the highest frequency of 222 (66.3%) which indicate the increased tendency of the young adult population in the Fako health district engagement unprotected sexual activity. Participants from the Northwest region had the highest participation rate of 203 (60.3%) which may be due to the fact Buea is inhabited by a lot of North Westerners probably due to migration as a result of conflicts. Muea a rural setting had the highest number of participants with a frequency of 141 (42.1%). A

Table 2. Risk factors associated with contracting new Syphilis infections among pregnant women previously tested negative during their first ANC visit at the Buea Health District, Cameroon.

Characteristics	Frequency	OR	AOR	Lower limit	Upper limit	P-value
Age group						
16 - 29 years	222	1.904	1.302			
30 - 42 years	113	0		0.307	5.525	0.721
Area of residence						
Buea station	47	-	3.158	0.466	21.427	0.239
Soppo	78	-	0.678	0.065	7.030	0.745
Molyko/Mile17	69	-	0.845	0.103	6.951	0.875
Muea	141	0				
Level of education						
No formal Ed.	2	16.217	9.055	9.055	9.055	0.001
Primary	49	1.912	6.764	1.710	26.760	0.006
Secondary	177	0.832	2.797	0.626	8.428	0.210
Tertiary	107	0				
Trimester						
Second trimester	335	1.948	2.018	0.562		
Third trimester	335	0			7.246	0.281
Knowledge on syphilis						
Inadequate knowledge	173	3.600	2.176			
Adequate knowledge	162	0		0.690	13.822	0.140
Partners status						
Not aware	276	2.912	3.190			
Aware	59	0		0.482	29.109	0.229

Table 3. Risk factors associated with contracting new HIV infections among pregnant women previously tested negative during their first ANC visit at the Buea Health District, Cameroon.

Characteristics	Frequency	OR	AOR	Lower limit	Upper limit	P-value
Age group						
16 - 29 years	222	1.145	1.080			
30 - 42 years	113	0		0.268	4.347	0.914
Educational status						
No formal Ed.	2	15.847	1.310	1.310	1.310	0.001
Primary	49	2.469	11.912	2.446	57.055	0.002
Secondary	177	1.145	3.144	0.676	14.630	0.144

Continued

Tertiary	107	0				
Trimester						
2 months post First trimester	335	1.416	1.174	0.093	14.909	0.901
Second trimester	335	1.072	1.081			
Third trimester	335	0		0.260	4.492	0.915
No sexual partners						
>1	4	7.342	2.705			
1	331	0		0.153	47.784	0.497
Partners HIV status						
Not aware	204	2.866	2.360			
Aware	131	0		0.356	15.666	0.374

study carried out by Halle-Ekane *et al.*, 2018 [12], had similar demographic characteristics such as age group, occupation, marital status and level of education. With the high rate of pregnancy in the Fako health district, the Cameroon health care system should improve surveillance system for HIV and Syphilis.

The prevalence of syphilis infections in pregnant women post-first ANC visit was high (13%) considering the fact that these women had been screened for this disease during the first-trimester visit and all tested negative. This study corroborate with a study that indicate that syphilis is fast becoming a growing burden in the population, Kengne-Nde *et al.*, 2020 [14]. However, the findings of our study were contrary to the study conducted by Halle-Ekane *et al.*, 2018 [12] in Buea which had a prevalence of 6.3% and far lest obtained by Befekadu B *et al.*, 2022 [15]. The difference might be due to the fact that their study was a cross-sectional study wherein data was collected just at one point in time. Our findings were also higher than the 3.92% gotten by Roch *et al.*, 2017 [16] in a study in the Republic of Congo. The contrary findings might have resulted from the difference in sexual behaviour. Another study conducted by Rosa *et al.*, 2017 [17] in Brazil had a prevalence of 8.7% which was lower than that of this study. This may be due to the fact that Rosa *et al.*, 2017 [17] worked with incarcerated pregnant women and these women usually had lower levels of antenatal care and higher levels of social vulnerability. The high incidence of new cases of syphilis during pregnancy (2nd and 3rd trimester) among women who were previously tested negative during their first ANC visits, indicates that more intensive care and follow-up with advanced laboratory tests for syphilis are warranted to improve the diagnosis of these disease in a timely manner. Sensitization on lifestyle changes post negative results should be carried out with continual test screening. As most women might lower their guard as they feel safe and fine after they test negative. More so screening for syphilis should be encouraged at every ANC visit despite previous negative results reported from their first ANC visit.

The prevalence of HIV infections in pregnant women post-first ANC was 11% which was also high considering the fact that these women tested negative during their first ANC visit. A similar finding was obtained by Mengistu *et al.*, 2015 [18] on pregnant women in a teaching hospital in Northwest Ethiopia had a prevalence of 11.2%. A study conducted by Jodie-Dione *et al.*, 2016 [19] in pregnant women and blood donors in Cameroon had a lower prevalence of 6.0% which could be due to the small sample size for pregnant women used and two different study participants. Also another study carried out in Cameroon reported a decreasing prevalence of HIV, Billong C *et al.*, 2020 [20]. Another study conducted by Roch *et al.*, 2017 [16] in the Republic of Congo had a lower prevalence of 3.6% which could be due to increased awareness in the study population. The increased incidence of HIV among pregnant women at two months post 1st ANC, 2nd and 3rd-trimester visit at the Buea Health District, Cameroon indicates a call for continual screening of pregnant women by health facilities for HIV infection despite previous HIV-negative test reports done during the first trimester. Buea Health District is a cosmopolitan centre surrounded with several universities. Activities here usually influence women to engage in risky behaviours. This might account for an increase in HIV incidence among these women.

This study also recorded a 2% rate of co-infection which is also high compared to other studies such as Roch *et al.*, 2017 [16] who had a co-infection prevalence rate of 0.73% and Belete *et al.*, 2019 [21] who had a co-infection rate of 0.66%. This could be due to poor responses to sexual awareness and prevention strategies. Also, Mengistu *et al.*, 2015 [18] had a co-infection prevalence lower than that of this study with a prevalence rate of 1.2% in one of its sentinel study sites of Impfondo. The differences recorded in most of these studies might be related to their studies using cross-sectional studies. Using a cross sectional study design might lead to under reporting of most cases. Since new cases are not easily captured.

Risk factors associated with contracting new HIV and Syphilis infections among pregnant women who previously tested negative during their first ANC visit at the Buea Health District, Cameroon associated with the younger age group, leaving in an urban area, having lower level and having no formal education, inadequate knowledge on the diseases, many sexual partners and pregnant women unaware of their partner status.

Following this study, the age group 16 - 29 years which is the younger age group were at increased risk of contracting both syphilis and HIV. Another study carried out by Roch *et al.*, 2017 [16] in Congo showed that younger pregnant women had a low risk of contracting Syphilis and HIV but rather older pregnant women were at increased risk of contracting these diseases. This could be due to the fact that the older pregnant women in that study area were more exposed to these infections. This study also showed that participants living in Buea station were at increased risk of contracting both syphilis and HIV. Other studies such as Jodie *et al.*, 2016 [19] rather compared their study areas in terms of rural and urban settings and the urban areas showed significant risks. Preg-

nant women with no formal education, primary and secondary levels of education showed high risks of contracting syphilis and HIV infections. Pregnant women with no formal education and those with primary levels of education showed significant risk with P values of 0.001 and 0.006 for syphilis respectively and a P value of 0.001 and 0.002 for HIV respectively. Roch *et al.*, 2017 [16] showed no relationship between educational status and syphilis or HIV. This could be due to an increased awareness in the study population. There are several risk factors that were shown to be associated with contracting new HIV and Syphilis infections among pregnant women who previously tested negative during their first ANC visit at the Buea Health District, Cameroon, There is a need for constant education on these diseases during every visit. Persons in charge of carrying out the education session should highlight these identifiable factors when talking to pregnant women during their ANC visits despite the outcome of their previous or current test results.

5. Conclusions

There are increased new cases of syphilis and HIV infection during pregnancy among women who previously tested negative at their first ANC visit.

Risk factors associated with contracting new HIV and syphilis infections among pregnant women who previously tested negative during their first ANC visit at the Buea Health District, Cameroon, were associated with a younger age group, residents of an urban area, lower level and no formal education, inadequate knowledge on the diseases, many sexual partners and pregnant women unaware of their partner status.

Consent

Participants were issued consent/assent forms to seek for their/guardian's approval. Participants were recruited only after they or their guardians signed the consent/assent forms indicating their acceptance to participate in this study.

Ethical Approval

The study was conducted after obtaining clearance from the Institutional Review Board (IRB) of the Faculty of Health Science, University Of Buea and also an administrative authorization was obtained from the delegation of public health in Buea. An additional clearance was obtained from the Regional Hospital Buea, Muea Integrated Health Center and St Veronica Polyclinic where study participants were recruited.

Data Availability Statement

Data is available at the University of Buea library.

Author's Contribution

This work was carried out in collaboration among all authors. Authors MGM

and SEA managed the conceptualization and design of the study. Authors NAL and NH supervised the study. Author MGM, NAL, HN and SEA edited and reviewed the manuscript. Authors MGM managed data curation and manuscript. All authors validate and approved the manuscript.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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