Original Article

SAGE Open Medicine

SAGE Open Medicine
Volume 8: 1–9

DOI: 10.1177/2050312119900870
journals.sagepub.com/home/smo
SAGE

Seroepidemiological patterns and predictors of hepatitis B, C and HIV viruses among pregnant women attending antenatal care clinic of Atat Hospital, Southern Ethiopia

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Abstract

Introduction: Viral hepatitis is a serious blood-borne and sexually transmitted systemic communicable disease affecting the liver. Commonly, it is caused by hepatitis B and C viruses. HIV infection has been one of the largest public health challenges that can also be transmitted vertically.

Objective: To determine seroepidemiological patterns and predictors of hepatitis B, C and HIV viruses among pregnant women attending antenatal care clinic at Atat Hospital, Southern Ethiopia.

Methods: Hospital-based cross-sectional study was conducted among 222 pregnant women from May to July, 2017. A structured questionnaire was used to collect socio-demographic characteristics and predicators of hepatitis B, C and HIV infections through face-to-face interview. Venous blood sample of 5 mL was collected from study participants, and serum was tested for HBsAg, anti-HCV and anti-HIV using rapid test kits and further confirmed by enzyme-linked immunosorbent assay. Logistic regression analysis was used to identify predictors of hepatitis and HIV infections. A p-value less than 0.05 was considered statistically significant.

Results: The overall seroprevalence of hepatitis B, C and HIV infections were 4.5%, 1.8% and 2.7%, respectively. In multivariate analysis, the prevalence of hepatitis B virus infections was significantly higher among patients having history of poly-sexual practices (adjusted odds ratio = 11.31; 95% confidence interval = 1.24–28.69, p = 0.003), history of abortion (adjusted odds ratio = 8.64; 95% confidence interval = 5.5–30.36, p = 0.034), home delivery by traditional birth attendants (adjusted odds ratio = 9.06; 95% confidence interval = 2.01–13.36, p = 0.005) and blood transfusion (adjusted odds ratio = 18.1; 95% confidence interval = 2.63–114.24, p = 0.001). HIV co-infection was present in 40% and 100% of hepatitis B virus and hepatitis C virus positive pregnant women, respectively. All hepatitis C virus positive women had a history of ear piercing, abortion and home delivery.

Conclusion: Hepatitis B, C and HIV were all uncommon infections in this population, with hepatitis B virus the most common. All hepatitis C virus positive pregnant women were co-infected with HIV. Significant association was found between hepatitis B virus infection and predictors. Therefore, continuous screening of pregnant women for hepatitis B and C infections should be performed.

Keywords

Hepatitis B virus, hepatitis C virus, HIV, prevalence

Date received: 5 March 2019; accepted: 23 December 2019

Introduction

Viral hepatitis is caused by five hepatotrophic viruses (A through E), and it commonly affects the liver.[1] It is a serious blood borne, sexually, vertically and feco-orally transmitted systemic communicable disease of which hepatitis B virus (HBV) and hepatitis C virus (HCV) are the most common types.[2] HBV is a member of the *Hepadnaviridae* family that contains a unique partially double stranded deoxyribonucleic

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acid (dsDNA)[2–4] genome, while HCV is a small single-stranded ribonucleic acid (ssRNA) virus that belongs to the family of Flaviviridae.[4,5]

HBV can be transmitted horizontally by direct contact with infected blood products and body secretions or vertically from infected mothers to their neonates during pregnancy or delivery process.[6–8] It has been reported that 10%–20% of women seropositive for HBsAg transmit the virus to their neonates.[9] Neonates born of chronically infected mothers have a 70%–90% risk of the infection progressing to a chronic phase.[9,10] In highly endemic areas, up to 75% of chronic carriers acquire the infection through mother to child transmission.[11,12] HBV is the world's most common etiologic agent of life-threatening liver disease and liver-related deaths, a major public health problem, particularly in developing countries.[13,14]

HCV can also be transmitted both vertically and horizontally. Its infection is another major worldwide public health concern.[15] The World Health Organization (WHO) estimates that around 3% of the world's population have chronic HCV infection of whom around 3–4 million peoples were infected each year, the majority of which occurring in Africa where Ethiopia is inclusive.[16,17] Almost 50% of all cases become chronic carriers and are at risk of liver cirrhosis and cancer.[6,18]

Human immunodeficiency virus (HIV) infection has been one of the largest public health challenges especially in low- and middle-income countries (LMICs) over the last decades. It affects millions of people worldwide, especially in sub-Saharan Africa.[19] Transmission occurs by several means including the transmission from mother to child.[20] There are about 40 million people worldwide infected with HIV, of which 68% reside in sub-Saharan Africa.[21] HIV in pregnancy has adverse outcome to maternal and fetal and also to health workers at times of delivery.[14,22]

HBV and HIV have similarities by exposure to infectious blood and body fluids, but not all the same modes of transmission.[19] Unlike HIV, HBV is not transmitted by breast feeding; furthermore, child to child transmission is common for HBV but not for HIV and there is evidence suggesting that HBV is more infectious than HIV.[23] Moreover, HBV is 50–100 times and 10 times more contagious than HIV and HCV, respectively.[24,25] Thus, HIV and HBV co-infection has emerged as a significant cause of morbidity and mortality. It alters the natural history of HBV infection promoting HBV replication and progression of hepatic damage associated with anti-retroviral therapy.[21,26] HBV-related liver diseases are more progressive in HIV co-infected patients than in patients with HBV infection alone.[27] Even though WHO recommended screening of all pregnant mothers, this practice is poor currently in Ethiopia especially in the locality where the research is conducted. Hence, this study aimed to assess the prevalence of hepatitis B, C and HIV infections and associated factors among pregnant women attending antenatal care (ANC) clinic at Atat Hospital, Southern Ethiopia.

Materials and methods

Study setting and design

Hospital-based cross-sectional study was conducted at Atat Hospital, Southern Ethiopia, from May to July, 2017.

Study population and sampling techniques

Systematic random sampling method was used to recruit the study participants among ANC attendants. Every fourth woman attending the clinic was enrolled in the study until the calculated sample size (222) was achieved within 3 months of data collection.[13,14] The sample size (N) was determined using single population proportion formula based on the following assumptions: prevalence of HBV[12] infection as 8.1%, 95% confidence level and 5% margin of error. Finally, 5% of non-response rate was added to the calculated sample size. Accordingly, the minimum calculated sample size for HBV infections was 222.

Data collection procedures

Information concerning socio-demographic and possible risk factors was collected from all participants using semi-structured questionnaire through face-to-face interview that was pretested on the 5% of the sample size (out of the study area). The questions were modified by incorporating some relevant variables and rejecting some other unnecessary variables. Moreover, the orders of the questions were rearranged accordingly. The venous blood sample of 5 mL was collected from the study participants by well-trained laboratory technologist. Then, the serum was separated by centrifugation at 5000 r/min for 15 min, transferred into nunc-tube and stored in a freezer at –20°C. Thereafter, the serum was brought out of the refrigerator and allowed to clot at room temperature for about 30 min as recommended by the manufacturer. All collected serum specimens were tested for HBsAg, anti-HCV and HIV antibodies using rapid diagnostic test kits. Finally, the samples were transported to the Blood Bank Laboratory, Hossaena Branch, Ethiopia, in a cold box for further confirmatory processing by enzyme-linked immunosorbent assay (ELISA) machine.[12] Routine HIV testing in Ethiopia is performed uniformly on the basis of the established national rapid testing algorithm: Shenghai Kehua Bioengineering (KHB) test kit as a screening test, followed by the HIV1/2 STAT-PAK assay if positive and finally confirmed by Vikia. During testing, the serum sample reacts with the conjugated dye was coated in the test strip. The mixture then by capillary action reacts with anti-HBsAg antibodies and HCV antigen on the membrane and generates a red band. In general, each woman's serum was tested twice, that is, using rapid diagnostic test kits and later all the reactive and non-reactive samples (222) by the rapid diagnostic test kits were further confirmed by ELISA machine as stated above.

Table 1. Socio-demographic and associated factors with HBV infection among pregnant mothers attending ANC clinic of Atat Hospital, South Ethiopia, 2017 (N = 222).

Variables		HBsAg status		COR (95% CI)	P-value	AOR (95% CI)	P-value
		Positive, n (%)	Negative, n (%)				
Age (years)	20–29	9 (4.1)	189 (85.1)	1.173 (0.348–3.948)	0.797		
	⩾30	1 (0.4)	23 (10.4)	1			
Residency	Urban	7 (3.2)	121 (54.5)	1.755 (0.442–6.972)	0.424		
	Rural	3 (1.3)	91 (41.0)	1			
Educational status	No formal education	1 (0.4)	56 (25.2)	1			
	Formal education	9 (4.1)	156 (70.3)	0.9189 (0.376–2.242)	0.852		
Gestation period (trimesters) (weeks)	1st (<14)	1 (0.4)	14 (6.3)				
	2nd (14–28)	5 (2.3)	54 (24.3)	1.976 (0.828–4.713)	0.125		
	3rd (>28)	4 (1.8)	144 (64.9)				
Occupation	Employed	2 (0.9)	44 (19.8)	1.048 (0.215–5.110)	0.954		
	Housewife	8 (3.6)	168 (75.7)	1			
Gravidity	Primigravida	1 (0.4)	3 (1.3)	7.741 (0.731–81.939)	0.089		
	Multi-gravida	9 (4.1)	209 (94.1)	1			
Parity	Nulli-para	1 (0.4)	2 (0.9)	11.667 (0.966–140.919)	0.053		
	Multi-para	9 (4.1)	210 (94.6)	1			
Poly-sexual partner history	Yes	7 (3.1)	31 (14.0)	7.502 (0.603–15.331)	0.000	11.314 (1.243–28.688)	0.003
	No	3 (1.4)	181 (81.5)	1			
Cesarean section history	Yes	8 (3.6)	24 (10.8)	7.833 (1.770–33.114)	0.002	9.353 (1.354–16.227)	0.004
	No	2 (0.9)	188 (84.7)	1		1	
Abortion history	Yes	8 (3.6)	78 (35.1)	4.872 (1.423–33.177)	0.000	8.643 (0.502–30.361)	0.034
	No	2 (0.9)	134 (60.4)	1		1	
Home delivery history by TBA	Yes	9 (4.1)	61 (27.5)	6.095 (2.432–34.011)	0.000	9.059 (2.01–13.361)	0.005
	No	1 (0.4)	151 (68.0)	1		1	
Tooth extraction	Yes	1 (0.4)	5 (2.3)	4.600 (0.486–43.572)	0.183		
	No	9 (4.1)	207 (93.2)	1			
Blood transfusion history	Yes	5 (2.3)	9 (4.1)	22.556 (5.518–92.198)	0.000	18.1 (2.629–114.241)	0.001
	No	5 (2.3)	203 (91.4)	1		1	
Previous hospitalization	Yes	6 (2.7)	39 (17.6)	12.388 (2.244–50.987)	0.003	0.356 (0.007–16.963)	0.600
	No	4 (1.8)	173 (77.9)	1		1	
Contact with liver diseased patient	Yes	4 (1.8)	4 (1.8)	34.667 (6.957–172.749)	0.072	15.325 (4.761–79.579)	0.506
	No	6 (2.7)	208 (93.7)	1		1	
Alcohol taking history	Yes	8 (3.6)	54 (24.3)	1.531 (0.743–11.132)	0.002	4.179 (0.439–7.566)	0.004
	No	2 (0.9)	158 (71.2)	1		1	
HIV status	Positive	3 (1.3)	1 (0.5)	15.662 (6.957–121.749)	0.199		
	Negative	7 (3.2)	211 (95.0)	1			

HBV: hepatitis B virus; ANC: antenatal care; AOR: adjusted odds ratio; CI: confidence interval; TBA: traditional birth attendant; HIV: human immunodeficiency virus; COR: crude odds ratio.

Data analysis method

Data were cleaned, coded and entered into Epi-info version-7 and exported to SPSS version 20 for analysis. Descriptive statistical tests, proportion and mean were used to compute the socio-demographic and other characteristics. Binary logistic regression analysis was used to determine the association between explanatory variables and the outcome variable. All explanatory variables with p-value less than 0.25 in the bivariate analysis were subjected to run in multivariate logistic regression model, where p-value less than 0.05 was considered as statistically significant.

Results

Socio-demographic characteristics

A total of 222 pregnant women with mean age of 29 years were enrolled in the study. Majority of the study subjects (72.5%) were in the age range of 21–30 years. A total of 127 (57.2%) of the pregnant women were urban dwellers, while 100% of them were married. Gravidity and parity status of the participants showed that 98.2% of the women were multi-gravidae and 98.6% of them were multi-parous (Table 1). Regarding occupation, majority of the study participants were housewives (79.5%) and 74.3% of them had formal education (Table 1).

Table 2. Distribution of HCV and HIV prevalence by socio-demographic and obstetric characteristics among pregnant women attending ANC clinic of Atat Hospital, Southern Ethiopia, 2017 (N = 222).

Variables	N = 222	HCV+ve, n, 4 (1.8%)	HCV–ve, n, 218 (98.2%)	HIV+ve, n, 6 (2.7%)	HIV–ve, n, 216 (97.3%)
Age (years)					
20–29	198	3	195	5	193
>30	24	1	23	1	23
Occupation					
Employed	46	1	45	1	45
Housewife	176	3	173	5	171
Residency					
Urban	128	3	125	3	125
Rural	94	1	93	3	91
Educational status					
No formal education	57	0	57	0	57
Formal education	165	4	161	6	159
Gestational period (trimesters) (weeks)					
1st (<14)	15	0	15	0	15
2nd (14–28)	59	2	57	3	56
3rd (>28)	148	2	146	3	145
Gravidity					
Primigravida	4	0	4	0	4
Multi-gravida	218	4	212	6	212
Parity					
Nulli-para	3	0	3	0	3
Multi-para	219	4	215	6	213

HCV: hepatitis C virus; HIV: human immunodeficiency virus; ANC: antenatal care.

Seroprevalence of HBV, HCV and HIV infections (rapid test kits vs ELISA machine)

After collecting the specimen, the isolated pregnant mothers' serum was first subjected to be checked by rapid test kits to detect HBsAg, anti-HCV and anti-HIV antibodies. From the rapid test kits, we investigated 6 (2.7%) and 2 (0.9%) of the specimen were found to be reactive for HBV and HIV viral infections, respectively. Even if all of the attendants were screened for HIV during their ANC visit via rapid HIV test kits, only two of them were found to be reactive for HIV while the rest reported as if they were non-reactive. However, when all the identified samples were subjected to ELISA machine, additional four samples were found to be reactive for the three viral infections which is very critical issue. The overall recorded HIV seroprevalence was 6 (2.7%) of which 4 (66.7%) of them were also positive to HBsAg. Similar percentage of HIV/HBV co-infection rate, HIV, HCV and HCV/HBV were observed. Finally, the total number of samples that were found to be reactive for HBV, HCV, HIV, HIV/HBV, HIV/HCV, HBV/HCV and HIV/HBV/HCV via ELISA machine is depicted, respectively, in Table 2. Accordingly, the total seroprevalence of the HBV, HCV and HIV infections obtained from our study result were 4.5%, 1.8% and 2.7%, respectively.

Risk factors for HBV infections

The highest prevalence of HBsAg, 8 (3.6%), was observed in the age group of 21–30 years. Most of the HBsAg positive pregnant women (3.2%) observed were urban dwellers. In our study, an inverse relationship between the educational level of the pregnant women and the seroprevalence of HBsAg, HCV and HIV was observed. Out of 10 HBsAg reactive study subjects, almost all, that is, 9/222 (4.1%) or 9/10 (90%) had formal education level while the remaining were without formal education. Only one pregnant woman without formal education was found to be seropositive for HBsAg while most 6 (3.9%) had formal education (COR = 0.92; 95% confidence interval (CI) = 0.38–2.24, p = 0.852) (Table 1). Moreover, the prevalence of HBV infection was higher (3.6%; 8/222 or 80%; 8/10) among housewives. Though the difference was not statistically significant, HIV positive women have higher odds of HBV infection (crude odds ratio [COR] = 15.66; 95% CI = 6.96–121.75, p = 0.199) than their correspondents.

Concerning exposure to potential risk factors for HBV infection, 12 (5.4%) had been hospitalized at sometime during their lives, 86 (38.7%) had a past history of abortion, 70 (31.5%) had home delivery history by traditional birth attendants (TBAs), 62 (27.9%) had alcohol taking history, 38 (17.1%) had poly-sexual partners, 32 (14.4%) had undergone surgical procedures (CS), 14 (6.3%) had blood transfusion history and 4 (13.1%) had HIV history. Among pregnant women that had a history of abortion, 8 (3.6%) were positive for HBsAg and was significantly associated with infection caused by the HBV (COR = 4.87; 95% CI = 1.42–33.18, p = 0.000). A total of 18.4% of pregnant women with history of multiple sexual practices were found to be positive for HBsAg (Table 1).

Table 3. Seroprevalence of HCV and HIV infections, and their risk factors among pregnant women attending ANC clinic of Atat Hospital, Southern Ethiopia, 2017 (N = 222).

Variables	N = 222	HCV +ve, n, 4 (1.8%)	HCV –ve, n, 218 (98.2%)	HIV +ve, n, 6 (2.7%)	HIV –ve, n, 216 (97.3%)
History of poly-sexual partner					
Yes	38	4	34	5	33
No	184	0	184	1	183
Cesarean section history					
Yes	32	3	29	5	27
No	190	1	189	1	189
Abortion history					
Yes	86	4	82	5	81
No	136	0	136	1	135
Home delivery history by TBA					
Yes	70	4	66	3	67
No	152	0	152	3	149
Tooth Extraction					
Yes	6	0	6	0	6
No	216	4	212	6	216
Blood transfusion history					
Yes	14	2	12	4	10
No	208	2	206	2	206
Ear Piercing					
Yes	220	4	216	6	214
No	2	0	2	0	2
Tattooing					
Yes	8	3	5	4	4
No	214	1	213	2	212
Previous hospitalization					
Yes	45	1	44	2	43
No	177	3	174	4	173
Alcohol taking history					
Yes	62	4	58	4	58
No	160	0	160	2	158

HCV: hepatitis C virus; HIV: human immunodeficiency virus; ANC: antenatal care; TBA: traditional birth attendant.

Having history of poly-sexual partners ((COR = 7.502; 95% CI = 0.60–15.33, $p < 0.001$) and (adjusted odds ratio (AOR) = 1.31; 95% CI = 1.24–28.69, $p = 0.003$)); abortion ((COR = 4.87; 95% CI = 1.42–33.18, $p < 0.001$) and (AOR = 8.64; 95% CI = 0.50–30.36, $p = 0.034$)); TBA ((COR = 6.10; 95% CI = 2.43–34.01, $p < 0.001$) and (AOR = 9.06; 95% CI = 2.01–13.36, $p = 0.005$)); and blood transfusion ((COR = 22.56; 95% CI = 5.52–92.20, $p < 0.001$) and (AOR = 18.1; 95% CI = 2.63–114.24, $p = 0.001$)) were significantly associated with HBV infection (Table 1). Moreover, the aforementioned associated factors pregnant women had a higher risk for seroprevalence of HBV, that is, 11, 9, 9 and 18 times more risky than their counterparts consecutively (Table 1). Nonetheless, none of the socio-demographic factors were found to be statistically significantly associated with HBV infection (Table 1). The study result has also revealed that none of the pregnant mothers participated in the current study responded as they were vaccinated for HBV.

Association between risk factors for HCV and HIV infections

Majority of the HCV (75%) and HIV (83.3%) positive pregnant women were found to lie in the age range of 20–29 years and were housewives (Tables 1, 3 and 4). Regarding distribution of HIV seroprevalence based on obstetric characteristics, 100% of the HCV and HIV positive pregnant women were found to be multi-gravida and multi-parous (Table 3).

As very small number of pregnant women were found to be positive (4/222) for anti-HCV antibody and anti-HIV antibody (6/222), the different categories of the variables do have nil cell values. Hence, it was unfeasible to conduct logistic regression analysis. Nevertheless, 100% seropositive pregnant women had history of exposure to risk factors like ear piercing, multiple sexual partners, abortion, alcohol taking and home delivery by TBA while 75% of them had

Table 4. Comparison between specimen results via rapid test kits and ELISA machine among pregnant women attending ANC clinic of Atat Hospital, Southern Ethiopia, 2017 (N = 222).

Type of test kits or machine used	No. of specimen became reactive for, n (%)							Remark
	HBV	HCV	HIV	HIV/HBV	HIV/HCV	HBV/HCV	HBV/HCV/HIV	
Rapid test kits	6 (2.7)	0	2 (0.9)	1 (0.5)	0	0	0	
ELISA machine	10 (4.5)	4 (1.8)	6 (2.7)	4 (1.8)	4 (1.8)	4 (1.8)	4 (1.8)	

ANC: antenatal care; HBV: hepatitis B virus; HCV: hepatitis C virus; HIV: human immunodeficiency virus; ELISA: enzyme-linked immunosorbent assay.

CS and tattooing history (Table 3). All HCV positive pregnant women were co-infected with HIV.

Among the total HIV-positive pregnant women, 5/6 (83.3%) of them had history for poly-sexual practice, CS and abortion, while 4/6 (66.7%) of them had history for blood transfusion, tattooing and alcohol taking. Furthermore, all the HIV positive pregnant women had ear piercing history (Table 3). Regarding gravidity and parity status, all of the four anti-HCV and six anti-HIV antibody positive pregnant women were pregnant for two and more times and have two and above previous delivery, respectively.

Discussion

Different studies conducted around the globe including in Ethiopia recommended that pregnant women should be screened for HBV, HCV and HIV. This is because screening of apparently healthy pregnant women has a significant relevance for identifying the infection status of the mother as well as her baby to prevent the transmission and the complications resulted by the viruses.[28] Infection caused by these viruses has a high rate of vertical transmission and causes adverse effect on both the mother and child. Thus, due attention should be given to pregnant women so as to prevent the transmission of HBV, HCV and HIV to their newborn.[29]

The present study can also be useful for the stakeholders involved in the solutions of those infections such as alleviation of epidemic size and prevention to severe disease status let alone in the study area but at country level at large. Majority of the studies conducted in Ethiopia were either on the prevalence of the HBV and HCV or HBV with HIV co-infection in line with the associated factors. None of them has studied on the Prevalence of HBV, HCV and HIV co-infection and their predictors. So, this is the first work to be published and utilized for intended goals of the local area and country at large. In the province of Wolkite and the adjacent administrative areas, there are no any published data on prevalence of hepatitis B, C and HIV mainly in the group of pregnant women. Using this background information, the epidemiology of viral hepatitis and HIV during pregnancy is essential for health planners, program managers and policy makers. Besides, screening for HBV, HCV and HIV during pregnancy helps to decide on appropriate antiviral therapy and to minimize vertical transmission to the newborn infants.

According to the National Center for Disease Control (NDCD) and WHO grouping, the prevalence of HBV and HCV is categorized and graded as low (<2% for HBV and <1.5% for HCV), intermediate (2%–7% for HBV and 1.5%–3.5% for HCV) and high endemicity (⩾8% for HBV and >3.5% for HCV).[25,30,31] In agreement with NDCD and WHO grouping criteria, the prevalence of HBV (2%–7%) and HCV (1.5%–3.5%) infections found in the present study can be categorized as intermediate, 10(4.5%), and low, 4(1.8%), endemicity, respectively. Similar results were reported for HBV from the studies conducted from the country and abroad, namely, in Jimma (3.7%),[32] Arba Minch (4.2%),[33] Felege Hiwot (4.4%),[34] Dessie (4.9%),[2] Lagos Nigeria (4.0%)[35] and Tunisia (4.3%).[36] Variations in seroprevalence in Ethiopia and elsewhere might be due to differences in sampling method, geographical variation, differences in cultural practices, sexual behavior and practices and differences in the test methods employed to detect HBV infection. Unless preventive measures through vaccination are taken to tackle the risk of transmission, the unborn babies are at a higher risk of contracting HBV infection.

Even though the difference was not statistically significant, the prevalence of HBsAg was higher in the age group between 21 and 30 years old, 7 (3.2%), which is in line with Debre-Tabor town of Ethiopia[37] where higher HBsAg prevalence was reported among the age group <30 years old. However, it disagrees with the results reported in Iran[27] and Jimma,[32] Ethiopia where pregnant women with the age group between 30–34 years and greater than 40 years old had higher prevalence of HBV infection. The high prevalence among this age group was consistently reported in several other studies.[38,39] This is partly because HBV infections are mainly acquired following vertical transmission or through sexual contact, and this group is the most sexually active age group. In agreement with other studies,[40,41] HBsAg seropositivity was not significantly different by age.

History of abortion, blood transfusion, home delivery by TBA, alcohol taking, surgical procedure (CS) and poly-sexual partners were significant predictors of HBV infections. Like other studies conducted in Jimma,[32] Arba Minch,[33] Addis Ababa[42] and Dessie,[2] pregnant women with abortion history have increased the risk of having HBV infection more than nearly nine times (AOR = 8.643; 95% CI = 0.502–30.361, p = 0.034) as compared with those who had no such

practices. Deliberate termination of pregnancy is the result of unwanted pregnancy which in turn could be because of unwanted sexual contact. Besides this, instrumentation during abortion procedure could also contribute to HBV transmission. Therefore, abortion significance could be because of sexual transmission of HBV. Similarly, women with a history of multiple sexual partners were 11 times (AOR = 11.314; 95% CI = 1.243–28.688, p = 0.003) more likely to develop HBV infection compared with those having single partner which is consistent with reports from Addis Ababa, Ethiopia[42] and in Nigeria.[35] This reveals that blood, semen and other body fluids are common source of infection that sexual contacts serve as a mode of transmission. Thus, sexually active women have a higher chance of getting the infection especially those who have the history of multiple sexual partners.

The HCV's finding of our study (1.8%) is inconsistent with previous reports among pregnant women in Sudan (0.6%),[43] Benin City, Nigeria (0.8%)[44] and Iran (0.2%).[27] However, it is in line with Egypt (1.75%),[45] Gondar, Ethiopia (1.3%).[39] In contrast, higher prevalence of HCV was reported from Yemen (8.5%).[46] The difference between the present study and the above studies might be due to difference in geographical location, sample size taken, socio-economy and behavioral and cultural practices of age between 15 and 45 years. This might also be as a result of well information dissemination by heath agents concerning HCV transmission routes and their consequences.

Ethiopia is one of the countries with high burden of HIV infection, and it is located in a region classified as high endemic area for HBV. HBV and HIV infections are significant health troubles around the world especially in pregnant women due to vertical transmission.[7] The overall seroprevalence of HIV infection obtained from our study (2.7%) is higher than study among pregnant women from a rural hospital in Southern Ethiopia[47] and Kenya,[48] 1.8% each, and is much higher from 0.4% reported in South Africa.[49]

The HBV and HIV co-infection we obtained from this study (1.8%) is consistent with the HBV and HIV co-infection prevalence among pregnant women in Bamenda Health District of Cameroon (1.7%)[19] and relatively comparable with the 1.5% prevalence registered in North Region of Cameroon[50] and reports from Bahir Dar city, Northwest Ethiopia (1.3%) among pregnant women by Zenebe et al.[51] Our study result revealed that the HBV/HIV co-infection is higher than a study from a rural hospital in Southern Ethiopia, 0.6%[52] and 1.0% registered in Cambodia.[52] In contrast, current HIV/HBV co-infection was lower than the HBV and HIV co-infection found among pregnant women in other sub-Saharan African countries: in Nigeria it was 4.2%,[35] 4.9% in Uganda[53] and 5.3% from one study done in South Africa.[49] The similarity in the HBV and HIV co-infection rate is due to the shared mode of transmission, while the differences are because of the prevalence rates of HBV and HIV co-infection varies worldwide depending on the geographic regions and risk groups.[54]

This study assessed the prevalence of hepatitis B and C as well as HIV infections and associated factors among pregnant women attending ANC clinic of Atat Hospital, Southern Ethiopia. However, this study still had some limitations. The study did not include information on other sexually transmitted bacterial and protozoan infections. Another limitation is that the study did not include non-pregnant mothers who were visiting the ANC clinic for their medical checkup; therefore, the results cannot be generalized from hospital-based data. Furthermore, the sample size was estimated based on the prevalence of HBV infections which gave rise to small sample size. This small sample may limit the generalization of the study. However, efforts were made to ensure the study participants to be representative of the general population. Thus, further large-scale studies using other additional risk factors are required to elucidate the relationship between sexually transmitted viral, bacterial and protozoan infections and reducing methods of vertical transmission. Moreover, the questionnaires were pilot-tested. Despite these limitations, this study provides valuable information about the relationship of screening of pregnant mothers for HBV, HCV and HIV using rapid diagnostic test kits and ELISA machine.

Conclusion and recommendations

This study depicted that a significant number of pregnant women were found to be positive for HBV, HCV and HIV infections. According to the multivariate logistic regression analysis of our study, history of abortion and home delivery by TBA were found to be main predictors of HBV infections whereas history of home delivery by TBA was found to be the common risk factors for HBV and HCV infections. Nevertheless, having multiple sexual partners was considered as the top risk factor for HIV infections. All HCV positive pregnant women were co-infected with HIV, while 40% of HBV infected pregnant women were co-infected with HIV. Thus, pregnant women visiting ANC clinic of Atat Hospital should be screened for HBV and HIV, and treated if necessary to reduce their viral loads and their children vaccinated at birth with the single-dose hepatitis B vaccine to break the cycle of mother-to-child transmission.

Acknowledgements

The authors would like to thank Wolkite University for funding. Thanks are also granted to the pregnant women who participated in the study. They would like to thank the ANC clinic staffs and laboratory technicians at Atat Hospital and Hossaena Blood Bank for their cooperation and help during sample collection and processing.

Author contributions

T.A.B. developed proposal, designed the study, collected and analyzed the data, interpreted the result and prepared the manuscript for publication. A.D.E. participated in designing the study, supervised the data collection, reviewed the draft of the manuscript and

performed data entry and involved in manuscript preparation. Both authors read and approved the final draft of the manuscript.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

The study was conducted after obtaining ethical clearance from Institutional Review Board (IRB) of Wolkite University. The IRB had reviewed the study protocol and approved with ethical approval reference number IRB/123/2009. Then, letter of cooperation to conduct the study was obtained from Atat Hospital clinical director office.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This study was funded by Wolkite University. The funders had no role in study design, data collection and analysis, decision to publish or preparation of the manuscript.

Informed consent

Data were collected after obtaining written informed consent from all study participants. All personal information about the study participants were kept confidential throughout the study.

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Supplemental material

Supplemental material for this article is available online.

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