

# Sero-Prevalence of Hepatitis B Virus Infection and Associated Factors Among Pregnant Women Attending Antenatal Care Services in Gedeo Zone, Southern Ethiopia

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## Abstract

**Background:** Hepatitis B virus infection is a major public health problem worldwide and is a major cause of morbidity and mortality. This study aimed to assess the prevalence of hepatitis B virus infection and associated factors among pregnant mothers in the Gedeo Zone, southern Ethiopia. **Methods:** An institution-based cross-sectional study was conducted among 479 pregnant women visiting governmental and private health facilities in the Gedeo zone from January to April 2019. We selected study participants using systematic random sampling techniques. The Eugene strip test was used to determine hepatitis B virus infection among pregnant mothers. We collected the status of HIV of the pregnant women from the records. Other variables were collected from the mothers using interviewer-administered questionnaires. We used binary and multivariable logistic regression for the analysis. An adjusted odds ratios and their 95% confidence intervals (CIs) were calculated to determine the association between HBsAg sero-positivity and various factors. A *P*-value of less than .05 was considered significant. **Results:** This study revealed that the prevalence of hepatitis B virus infection among pregnant mothers was 9.2% in Gedeo Zone. A previous history of blood transfusion [AOR=5.2, 95% CI: 2.1, 12.5], a previous history of hospital admission [AOR=3, 95% CI: 1.4, 6.6], a history of having an abortion [AOR=4.1, 95% CI: 1.5, 11.7], the age of the pregnant women [AOR=5.1, 95% CI: 1.5, 18.0], and their HIV status [AOR=8.1, 95% CI: 1.9, 36.0] had a statistically significant association with HBsAg sero-positivity. **Conclusion:** Hepatitis B virus infection was found to have higher endemicity (9.2%) in Gedeo Zone which is higher than the national pooled prevalence which was 4.75%. The health facilities must implement early initiation of antenatal care services which incorporate the prevention and control of HBV in the Gedeo Zone.

## Keywords

hepatitis B virus, pregnancy, sero-prevalence, Gedeo Zone, Ethiopia

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## Introduction

Hepatitis B virus (HBV) is a hepatotropic deoxyribonucleic acid (DNA) virus that occurs because of the immune-mediated killing of infected liver cells.<sup>1</sup> It is a major blood-borne and sexually transmitted infectious agent and poses a serious global public health problem, which is approximately 100 times more contagious than human immunodeficiency virus (HIV) and is found in diverse populations and sub-populations.<sup>2,3</sup> The transmission routes for HBV are mainly

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linked with parenteral or mucosal exposure to infected blood and body fluids, such as secretions or saliva, unsafe sexual intercourse, and transfusion of HBV-infected blood and blood products through vertical (to their own offspring) or horizontal (within the society) transmission routes. The transmission of HBV in highly endemic areas mostly results in a high rate of chronic infections.<sup>4-6</sup>

Globally, mother-to-child transmission (MTCT) is associated with a high risk of maternal complications and affects both the mother (leads to conditions such as preeclampsia, placenta previa, preterm delivery, placental separation, antepartum hemorrhage, preterm labor, increased incidence of intraventricular hemorrhage, gestational diabetes mellitus) and the child (leads to fetal and neonatal hepatitis and a higher risk of developing chronic liver disease and cancer).<sup>7-9</sup>

Infants born to HBV-positive pregnant mothers (having both hepatitis B surface antigen [HBsAg] and hepatitis B e antigen [HBeAg]), have a higher (70-90%) risk of acquiring the infection from their mothers and they are about 10-40% at risk if the mother tested positive for only HBsAg. In endemic areas, where carrier rates are greater than 5%, perinatal transmission is common, especially when HBV-infected mothers are also HBeAg positive.<sup>10-12</sup>

Africa is considered a region of high endemicity ( $\geq 8\%$ ) for HBV. Although, it is difficult to assess the exact burden of HBV in Africa, the sero-prevalence of hepatitis B surface antigen (HBsAg) has been estimated to be in the range of 6 to 20%.<sup>13,14</sup> A higher prevalence of 9.7% to 16.6% was observed in other developing countries.<sup>15-18</sup> The prevalence of HBV in Ethiopia among pregnant women has shown moderate endemicity, with the prevalence of HBsAg positivity ranging from 2.3 to 7.9%.<sup>19-24,27</sup>

The pooled prevalence for HBV among pregnant mothers in Ethiopia was 4.75%.<sup>25</sup> Different factors, such as having a history of blood transfusion, history of use of sharp materials, having multiple sexual partners, ear piercing, history of abortion, place of delivery, the practice of female genital mutilation, history of tooth extraction, cesarean section, and tattooing, were some major risk factors associated with HBV Ag sero-positivity in previous studies in similar settings.<sup>19-30</sup>

In Ethiopia package of services provided within the ante natal care include but not limited to iron folic acid supplementation, deworming, HIV testing, nutrition counseling and intermittent preventive treatment for malaria. Every mother is expected to have a minimum of 4 visits through the course of her pregnancy.<sup>31</sup> Because HBV-infected pregnant women are at risk of infecting their babies, knowing the magnitude of HBV status and its risk factors in the area is highly important in preventing mother-to-child transmission and reducing the disease burden. However, in resource-constrained settings such as

Ethiopia, laboratory diagnosis of HBV infection is not part of routine care in ANC of all health facilities, which makes the detection of pregnant mothers with HBV difficult, which also makes the intervention very difficult.<sup>32</sup> Observational community studies of serological markers of HBV infection have an important role in identifying population endemicity and routes of transmission that could help in the development of control measures. Therefore, this study intends to fill the limited information gap regarding the prevalence and associated factors of HBV among pregnant women in the southern part of Ethiopia specifically in the Gedeo Zone.

## Methods

### Design and Study Sites

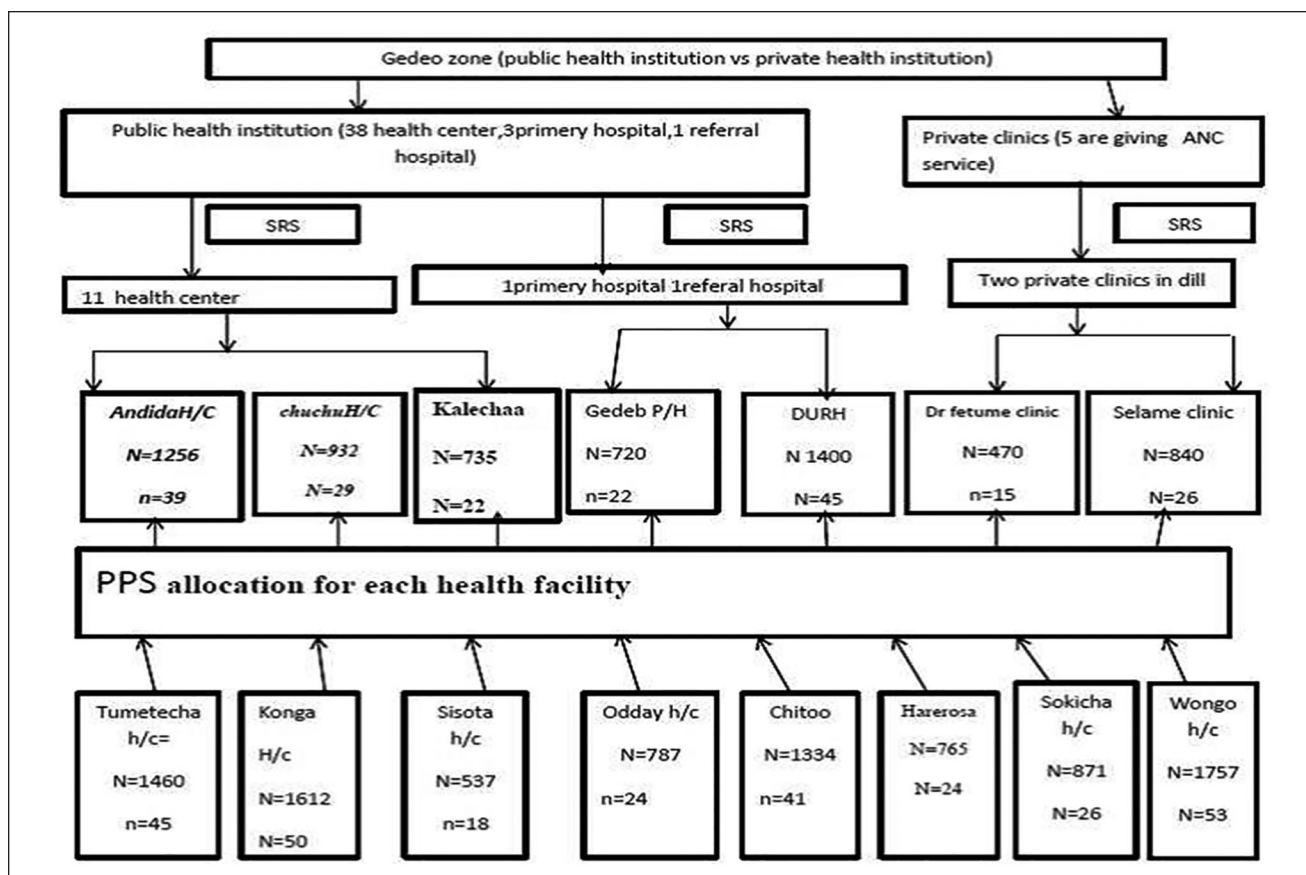
An institution-based cross-sectional study conducted in selected health facilities in Gedeo Zone Southern Ethiopia. The Zone has 1 referral hospital, 3 primary hospitals (Bule, Gedeb and YergaChefe), 38 health centers, 146 health posts, 4 NGO clinics, and 17 reported private health facilities.

### Sample Size Determination and Procedure

The sample size was determined using a single population proportion formula. We calculated the sample size based on the following assumptions: 95% confidence interval (CI), hepatitis B virus prevalence rate 3.5%,<sup>24</sup> and nonresponse rate of 10%. Finally, the calculated sample size was 479. Out of 42 the public health facilities found in Gedeo Zone, one referral hospital, eleven health centers and 1 primary hospital are selected using lottery method and from 17 private clinic only 5 were giving ANC service at the time of the study and from these 5 private clinic 2 was private clinics were included in the study using lottery method. Then the total sample size allocated for each facilities proportional to their population size. A list of pregnant mothers from ANC registration in the selected health facilities was used as a sampling frame. We selected finally the study subjects attending ANC clinic at the time of data collection using systematic random sampling technique as indicated in (Figure 1).

### Data Collection

Data was collected from January to March in 2019. Socio-demographic characteristics, such as age, residence, employment status, level of education, and marital status, were collected using a structured questionnaire administered by trained health professionals. The status of HIV of the pregnant women was collected from the records and HBV infection status was determined using the Eugene



**Figure 1.** Procedure for selecting study participants from health institutions.

strip test. Eugene rapid test is a qualitative, solid phase, two-site sandwich immunoassay for the detection of HBsAg in serum HBV infection status. It was defined by a positive or negative result for HBsAg using HBsAg test strip.

### Laboratory Analysis

3 ml of venous blood drawn under aseptic conditions has transferred to an EDTA (Ethylene diamine tetra acetic acid) tube by trained laboratory personnel. These tubes were labelled and processed at the time of collection. The blood samples taken from the participants were centrifuged at 3000 revolution per minute (RPM) for at least 10 min at room temperature. Each serum sample was subjected to the HBsAg antibody rapid test using the test kit (Manufacturer: Shangai Eugene Biotech Co., Ltd. Shangai. China.)

### Data Quality Assurance

To ensure the quality of data, the questionnaire was prepared in the English language, translated to Amharic and Gedeofa, and translated back to English by another person who can speak all 3 languages to ensure consistency. Furthermore, the questionnaire was pretested, and field

editing was performed to ensure the completeness and correctness of the data. A pretest was conducted on 5% of the total sample size in Bule Primary Hospital, which was not included in this study. We checked the collected data daily for consistency and accuracy. Standardized procedures were strictly followed during blood sample collection and storage. We run a known positive and negative samples to control the quality of the HBsAg kit as external quality assurance.

### Data Processing and Analysis

Data were entered into Epi-Data version 3.1 and exported to SPSS version 25 for data cleaning and analysis. Bivariate and multivariable binary logistic regression analyses were used to determine the association between explanatory variables and the outcome variable. Crude and adjusted odds ratios with 95% CI were used to see the strength of association. Predictor variables with a  $P$ -value  $< .25$  in the bivariate analysis were candidates for the multivariable logistic regression model. A  $P$ -value of less than .05 was considered to declare statistical significance. The Hosmer-Lemeshow test was used to check the overall model fitness.

## Results

### Socio-Demographic and Obstetric Characteristics

A total of 479 mothers have taken part in this study with a mean age 25.9 (SD  $\pm$  5.01). The majority of the mothers interviewed 411(85.8%) were married, and over two-thirds of the respondents 185(38.6%) had primary education. More than half of the participants (245, 51.1%) were housewives, while 265(55.3%) of the mothers were rural residents. Age between 26 and 30 years was the dominant maternal age group with 151(31.5%) mothers, while mothers older than 35 were only 23(4.8%).

Regarding the obstetric history of the mothers, 121(25.3%) had no previous birth history, while the remaining 358(74.7%) reported that they had experienced multiple pregnancies. Out of 479 pregnant women, 99(20.7%) were in the first trimester, 245(50.5%) were in the second trimester, and the rest were in the third trimester. It was assessed that 32(6.7%) of the pregnant women had a history of abortion in the past. Among 479 respondents, 103 mothers had a history of home delivery (21.5%), and 255 mothers had a history of institutional delivery (52.2%).

### Prevalence of Hepatitis B Virus Among ANC's Following Pregnancy

The prevalence of HBV among pregnant mothers who were on ANC follow-up in the Gedeo Zone was 9.2% during the study period.

### Bivariate and Multivariable Analysis

During the bivariate analysis, a history of blood transfusion, previous history of hospital admission, previous history of abortion, gestational age, previous place of birth, age of the pregnant women, and HIV status of the pregnant women were significant variables associated with HBV status of the pregnant women.

As stated in (Table 1), candidates in the bivariate analysis were analyzed in the multivariate logistic regression analysis and women with a previous history of blood transfusion, previous history of hospital admission, previous place of birth, ear-piercing practice, current gestational age, and HIV status of the pregnant women were significant factors that determined the sero-prevalence of the hepatitis B virus among pregnant women in the Gedeo zone.

In the multivariable logistic analysis after controlling for the cofounders, a previous history of blood transfusion [AOR=5.2, 95 % CI: 2.1, 12.5], previous history of hospital admission [AOR=3, 95% CI: 1.4, 6.6], history of having an abortion [AOR=4.1, 95 % CI: 1.5, 11.7], age of the pregnant women [AOR=5.1, 95 % CI: 1.5, 18.0], and their HIV status [AOR=8.1, 95 % CI: 1.9, 36.0] were significant

factors associated with HBV infection among pregnant women in the Gedeo Zone.

## Discussion

Surface antigen (HBsAg) can be used as a key marker to indicate the prevalence and endemicity of HBV active infection in the general population in a particular geographical area.<sup>32</sup> In this study area, the overall sero-prevalence of HBsAg among pregnant women was 9.2%, which could be considered as a high endemicity area (with sero-positivity  $\geq$ 8% seropositive), based on WHO classification criteria of endemicity of HBV infection.<sup>13</sup>

The prevalence was the highest across the country compared to the pooled prevalence as showed by<sup>26</sup> recently. Previous studies in different regions of Ethiopia reported lower proportions, from the lowest prevalence (3.7%) in Jimma town to the highest (8.4%) in Dire Dawa.<sup>19-24,27</sup> However, the finding was lower than findings reported by other developing countries, with (8%) in Mali,<sup>15</sup> (9.7%) in Cameroon,<sup>16</sup> (10.8%) in Yemen,<sup>17</sup> (11.8%) in Uganda,<sup>18</sup> and (16.6%) in Nigeria.<sup>27</sup> The observed discrepancies in the magnitude of HBV prevalence across different geographical locations and regions might be because of variations in socio-demographic characteristics of the study population, such as socio-cultural, and tribal practices. The variation in diagnosis methodologies, level of awareness, and the quality and access to antenatal care service provision might add to the difference.

In this study, except for the age of the pregnant women all the other socio-demographic variables such as marital status, residence, educational status and occupation of the pregnant women did not significantly associate with the risk of acquiring HBV infection ( $P > .05$ ).

Blood transfusion as an identified well-established risk factor for HBsAg,<sup>33</sup> was significantly associated with seropositivity of HBsAg among Pregnant women in the Gedeo Zone. Pregnant women with a previous history of blood transfusion were 5 times more likely to be infected with HBV than women who had no history of blood transfusion. This result is in line with previous similar studies.<sup>23,25,29</sup>

In this study, a previous history of hospital admission was associated with HBV among pregnant women. This might be because of poor infection prevention practices among the health facilities during hospital admission and delivery. Previous hospital admissions were one of the predictors in other previous findings.<sup>30,34</sup>

Pregnant women with a history of abortion had 4 times increased risk of having HBV infection when compared with those who without previous history abortion practice. These could be justified by either the abortion resulted from unsafe sexual encounter which is considered as the predominant mode of transmission path way for Hepatitis B infection among pregnant women or the poor quality of the

**Table 1.** Bivariate and Multivariable Logistic Analysis of HBV among Pregnant Women in the Gedeo Zone, Southern Ethiopia.

Variable	HBV		COR	AOR	P-value
	Positive	Negative			
Blood transfusion					
No	31	398	1	1	
Yes	13	37	4.5 (2.2-9.4)	5.2 (2.1-12.5)**	<.001
Hospital admission					
No	27	373	1	1	
Yes	17	62	3.8(2.0-7.4)***	3.0 (1.4-6.6)**	.006
Body tattooing					
No	37	332	1	1	
yes	7	103	0.6 (0.3-1.4)	0.8 (0.3-2.1)	.719
History of ear piercing					
No	2	60	1	1	
Yes	42	375	3.4 (0.8-14.2)	4.4 (0.9-21.2)	.067
History of abortion					
No	37	410	1	1	
Yes	7	25	3.1 (1.3-7.7)	4.1 (1.5-11.7)**	.008
Residence					
Rural	29	236	0.6 (0.3-1.2)	1.6 (0.8-3.3)	.220
Urban	15	199	1	1	
Gestational age					
First trimester	15	84	3.3 (1.3-8.5)*	2.7 (0.9-8.1)	.073
Second trimester	22	220	1.9 (0.8-4.5)	2.1 (0.8-5.7)	.151
Third trimester	7	131	1	1	
Age of the pregnant women					
<20	16	77	2.8 (0.98-8.1)	5.1 (1.5-18.0)*	.011
20-29	14	148	1.3 (0.4-3.7)	2.0 (0.6-6.6)	.275
30-39	9	142	0.9 (0.3-2.7)	0.98 (0.3-3.5)	.979
40-49	5	68	1	1	
HIV status					
Negative	39	427	1	1	
Positive	5	8	6.8 (2.1-21.9)	8.3 (1.9-36.0)**	.005

\* $P < .05$ . \*\* $P < .01$ . \*\*\* $P < .001$ .

abortion practices might be the reason for the exposure. This finding was in line with previous findings in different parts in Ethiopia.<sup>25,30</sup> Pregnant women with age less than 20 were more at risk of having unsafe sexual encounters than the other age groups. This could be one prominent reason history of abortion and being in the age under 20 has a similar effect on pregnant mothers' sero-positivity for HBsAg. This was similar to the finding reported by,<sup>35</sup> where the proportion of HBV infection was significantly higher in the age group between 15 and 17 years old<sup>30</sup> and, <25-year-old pregnant women.

The HIV status of the pregnant women was another determinant of HBV infection in this study as in findings in other studies.<sup>17,23,29</sup> Since Ethiopia is categorized as a country with a high HIV burden<sup>33</sup> and in a region with a high HBV endemic area,<sup>36</sup> the possibility of HBV/HIV co-infection is a more expected precedent. Moreover, it was reported that the co-infection of HIV/HBV could greatly facilitate

HBV replication and reactivation, leading to higher HBV-DNA levels and reduced spontaneous clearance of the virus.<sup>33</sup>

## Conclusion

A higher prevalence (9.2%) of HBV infection was detected in the study area which is higher than the national pooled prevalence which was 4.75%. This study illustrated that the sero-prevalence of HBV infection has significant association with having a history of blood transfusion, hospital admission, HIV positive status, having history of abortion and pregnant women's age in Gedeo zone southern Ethiopia.

To reduce the sero-prevalence of HBV infection in the Gedeo Zone, health education on the risk of HIV, abortion and unsafe sex at early age and safety issues during admission to hospitals is needed at the Zonal level and health facility level. They must integrate the screening of all

pregnant women for hepatitis B virus in the routine antenatal care services.

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### Authors' Contributions

**Mhired Belay Tadiwos:** conceptualization, investigation, Project administration, methodology, Formal analysis, analysis, writing original draft.

**Girum Gebremeskel Kanno:** methodology, data curation, analysis, editing, supervision, writing review and editing, manuscript preparation.

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### 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.

### Declaration

We declare this article is available online as a preprint on “research square” website.

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### Ethical Approval

Ethical approval of this study was approved after review by the “Dilla University Institutional Research and Ethical Review Board,” and the research was carried out only after an ethical letter was obtained with Protocol Unique number **009/19-01**. A consent form was provided to all participants, and the purpose and importance of the study were explained to each study participant. To ensure the confidentiality of the participant’s information, codes were used instead of the names of the participant. Participants were interviewed alone to maintain privacy. All participants did not pay for the test. Voluntary participation was clearly explained to all the participants that they could choose to participate in before the study.

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### Data Availability

The data sets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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