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Original Article

Seroprevalence and Co-infection Pattern of Hepatitis B Virus, Hepatitis C Virus, and Human Immunodeficiency Virus among Antenatal Women in a Tertiary Care Hospital in Western Uttar Pradesh, India

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ABSTRACT

Background: Maternal infection with hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV) continues to pose a risk of chronic infection and vertical transmission despite expanding national prevention programs. Surveillance among antenatal women provides critical insight into the community burden of these infections.

Objectives: To determine the seroprevalence and co-infection patterns of HBV, HCV, and HIV among antenatal women attending a tertiary care hospital in Western Uttar Pradesh, India.

Materials and Methods: A hospital-based cross-sectional study was conducted from January 2023 to December 2025 at the Government Institute of Medical Sciences. A total of 14,185 antenatal women were screened as part of routine antenatal investigations. Serum samples were tested for hepatitis B surface antigen (HBsAg), anti-HCV antibodies, and HIV-1/2 antibodies using standardized serological assays following national guidelines. Associations with demographic and trimester-related variables were analyzed using the Chi-square test, with $p < 0.05$ considered statistically significant.

Results: The seroprevalence of HBV, HCV, and HIV was 1.17%, 1.32%, and 0.16%, respectively. Co-infections were rare, observed in 0.06% of participants. An increasing but statistically non-significant trend in HBV and HCV positivity was noted over the three-year period, whereas HIV prevalence remained consistently low. Age group 21–29 years showed a significant association with HBV and HCV seropositivity ($p < 0.05$). No significant variation was observed across trimesters.

Conclusion: The relatively low prevalence of HBV, HCV, and HIV among antenatal women reflects progress in public health interventions; however, the persistent detection of infections highlights the continued need for universal antenatal screening and strengthened prevention of vertical transmission strategies. Ongoing surveillance in pregnant populations remains essential to sustain gains toward viral elimination goals.

Keywords*: Hepatitis B virus, Hepatitis C virus, HIV, Seroprevalence, Co-infection, Antenatal women.*

INTRODUCTION

Among blood-borne viruses transmissible through parenteral exposure, blood transfusion, and sexual contact, human immunodeficiency virus (HIV-1/2), hepatitis B virus (HBV), and hepatitis C virus (HCV) are of significant clinical and public health importance. [1] These viruses frequently establish asymptomatic chronic infections with the potential for

long-term complications. Their significance increases during pregnancy due to the potential for vertical transmission, which may lead to chronic infection, neonatal morbidity, and long-term complications.[2]

India is considered an intermediate endemic region for hepatitis B, and perinatal transmission contributes substantially to the chronic carrier state. High Endemicity Regions HBsAg prevalence: ≥ 8%, Intermediate Endemicity Regions HBsAg prevalence: 2–7**%** Low Endemicity Regions, HBsAg prevalence: < 2% [3] Although the prevalence of HCV in the general population is relatively low, data among pregnant women are limited. HIV transmission from mother to child is a continuing challenge despite extensive implementation of prevention of parent-to-child transmission (PPTCT) programs. The estimated number of pregnant women requiring Elimination of Vertical Transmission of HIV and Syphilis (EVTH) services declined from 29.50 thousand in 2010 to 18.47 thousand in 2024, a 40% reduction reflecting substantial progress from the scale-up of Prevention of Parent-to-Child Transmission (PPTCT) programmers. [5]

Antenatal women represent a relatively unselected population and serve as a reliable indicator of infection prevalence within the community. This study aimed to determine the seroprevalence of HBV, HCV, and HIV among antenatal women attending a tertiary care hospital and to highlight the importance of routine antenatal screening.

MATERIALS AND METHODS

Study Design and Setting: This hospital-based cross-sectional observational study was conducted in the Department of Microbiology in association with the Department of Obstetrics and Gynecology at the Government Institute of Medical Sciences (GIMS), Greater Noida, Western Uttar Pradesh, India. The study was carried out over a period of three years from January 2023 to December 2025. The study aimed to determine the seroprevalence and co-infection pattern of Hepatitis B virus (HBV), Hepatitis C virus (HCV), and Human Immunodeficiency Virus (HIV) among antenatal women attending the Antenatal Clinic (ANC) during the study period.

All pregnant women attending and registered at the ANC clinic during the study period were screened for HBV, HCV, and HIV infection as part of routine antenatal investigations.

Inclusion Criteria: All pregnant women attending the ANC clinic during the study period. Those who provided written informed consent.

Exclusion Criteria: Pregnant women previously diagnosed and documented as positive for HBV, HCV, or HIV prior to the current pregnancy. Those unwilling to provide informed consent.

Approximately 5 mL of venous blood was collected aseptically using sterile vacutainers. Serum was separated by centrifugation and transferred into sterile storage vials for analysis. All biomedical waste was managed according to standard infection control practices. Used needles were destroyed and discarded in puncture-proof sharps containers. Other contaminated materials were disinfected using 1% sodium hypochlorite solution prior to disposal.

Serological Testing: Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV) Serum samples were tested for Hepatitis B surface antigen (HBsAg) and anti-HCV antibodies using a fully automated chemiluminescent immunoassay (CLIA) system (ARCHITECT i1000SR, Abbott Laboratories, Texas, USA). The assays were performed according to the manufacturer's instructions.

The ARCHITECT assays used in this study have reported sensitivities and specificities exceeding 99%. HBsAg-positive samples were further subjected to confirmatory testing using a neutralization assay on the same platform. Reactive HCV samples were tested in duplicate to ensure reproducibility and accuracy. Human Immunodeficiency Virus (HIV) Screening for antibodies to HIV-1 and HIV-2 was performed using a rapid dot-immunoassay (Comb AIDS HIV 1+2 Immunodot Test Kit, Span Diagnostics Ltd., Surat, India). Samples found reactive were confirmed as per the National AIDS Control Organization (NACO) guidelines using two additional rapid tests based on different antigenic principles: HIV TRI-DOT test (J. Mitra & Co. Pvt. Ltd., New Delhi, India), a flow-through immunoassay for qualitative detection of HIV-1 and HIV-2 antibodies. A lateral flow immunochromatographic assay for confirmatory testing. HIV positivity was reported only when samples were reactive by the recommended testing algorithm as per national guidelines.

Ethical considerations

Written informed consent was obtained from all participants prior to inclusion in the study. Confidentiality of patient information was strictly maintained. All samples and data were anonymized before analysis. Test results were communicated to the treating clinicians for appropriate counselling and management in accordance with national guidelines.

STATISTICAL ANALYSIS

Data was analyzed using SPSS version 28 (IBM Corp., Armonk, NY). Categorical variables were expressed as proportions and percentages. Associations between seropositivity and demographic variables were assessed using the Chi-square test, and p-values < 0.05 were considered statistically significant.

RESULTS

A total of 14,185 antenatal women were screened for hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV) infection during 2023 to 2025. As Shown in Table 1: The overall seroprevalence was 1.17% (167/14,185; 95% CI: 1.01–1.37) for HBsAg, 1.31% (187/14,185; 95% CI: 1.14–1.52) for anti-HCV, and 0.16% (23/14,185; 95% CI: 0.10–0.24) for HIV. A total of 9 antenatal women were identified with co-infections during the study period, corresponding to an overall prevalence of 0.06% (95% CI: 0.03–0.12). Year-wise distribution showed 2 cases (0.01%) in 2023, 3 cases (0.02%) in 2024, and 4 cases (0.03%) in 2025. The observed increase over the study period was minimal and not statistically significant (p>0.05). Year-wise analysis demonstrated an increasing trend in HBV and HCV seropositivity, with HBsAg rising from 0.27% in 2023 to 0.50% in 2025 and HCV from 0.30% to 0.55% over the same period. HIV prevalence remained low and stable (0.04–0.06%). However, year-wise differences were not statistically significant (p > 0.05).

As Shown in Table 2a: Among the nine co-infected patients, dual viral infections predominated (88.9%), with HBV + HCV and HBV + HIV emerging as the most frequent combinations (33.3% each). HCV + HIV co-infection accounted for 22.2% of cases, while triple infection (HBV + HCV + HIV) was identified in 11.1%, reflecting a predominance of dual infections and a relatively low burden of triple viral co-infection.

As Shown in Table 3: Trimester-wise distribution showed no statistically significant variation. Among HBsAg-positive women (n=167), 35.9% were detected in the first trimester, 31.7% in the second, and 32.3% in the third (p=0.81). For HCV-positive women (n=187), corresponding proportions were 37.4%, 34.8%, and 27.8% (p=0.25). HIV distribution across trimesters was also not significant (p=0.83).

As shown in Table 4: Age-wise analysis revealed a significant association for HBV (p=0.003) and HCV (p=0.002), with the highest proportion of cases in women aged 21–29 years. No significant association was observed for HIV (p=0.28).

Table 1. Year-wise seropositivity of HBV, HCV and HIV among antenatal women screened during 2023–2025

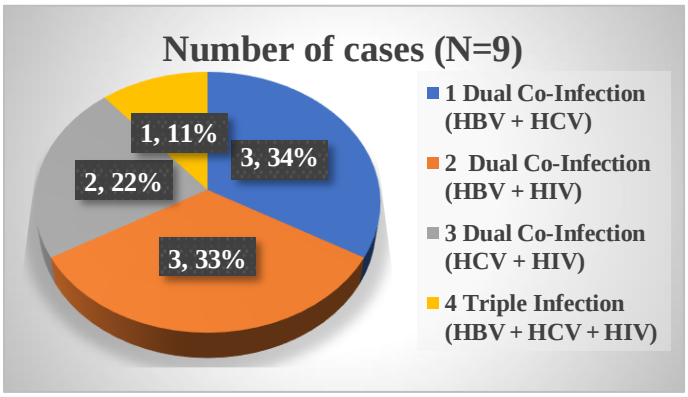
Test	Total patients screened (N)	2023 N= (%)	2024 N= (%)	2025 N= (%)	Total positive (N)	Overall prevalence % (95% CI)	p-value
HBsAg	14,185	38 (0.27)	58 (0.41)	71 (0.50)	167	1.18 (1.01–1.37)	>0.05
Anti-HCV	14,185	43 (0.30)	66 (0.47)	78 (0.55)	187	1.32 (1.14–1.52)	>0.05
HIV	14,185	8 (0.06)	6 (0.04)	9 (0.06)	23	0.16 (0.10–0.24)	>0.05
Co-infections	14,185	2 (0.01)	3 (0.02)	4 (0.03)	9	0.06 (0.03–0.12)	>0.05

Table 2: Total Positive Patients (All Years Combined)

Parameter	Number of Patients	percentage (%)
Total screened	14,185	100.00
Total positive (HBsAg + HCV + HIV + Co-infections)	386	2.72

Total positive includes all seropositive cases for HBsAg, anti-HCV, HIV, and co-infections. Percentages are calculated from the total screened population.

Table 2a: Distribution of co-infection combinations among antenatal women (2023–2025)



The pie chart illustrates the proportional distribution of co-infection combinations: HBV + HCV (33.3%), HBV + HIV (33.3%), HCV + HIV (22.2%), and HBV + HCV + HIV (11.1%) among all detected co-infection cases.

Table 3: Distribution of Hepatitis B, Hepatitis C and HIV among antenatal cases according to trimester

Test	1st Trimester N= (%)	2nd Trimester N= (%)	3rd Trimester N= (%)	Total (N)	χ^2	p-value
HBsAg	60 (35.9%)	53 (31.7%)	54 (32.3%)	167	0.41	0.81
HCV	70 (37.4%)	65 (34.8%)	52 (27.8%)	187	2.75	0.25
HIV	9 (39.1%)	7 (30.4%)	7 (30.4%)	23	0.35	0.83
Total	139 (36.9%)	125 (33.2%)	113 (29.9%)	377	2.69	0.26

Table 4: Distribution of Hepatitis B, Hepatitis C and HIV among Antenatal Cases According to age group

Test	<20 years N= (%)	21–29 years N= (%)	30–44 years N= (%)	Total (n)	χ^2	p-value
HBsAg	34 (20.4%)	71 (42.5%)	62 (37.1%)	167	11.32	0.003*
HCV	38 (20.3%)	77 (41.2%)	72 (38.5%)	187	12.08	0.002*
HIV	4 (17.4%)	11 (47.8%)	8 (34.8%)	23	2.52	0.28

*Statistically significant ($p < 0.05$)

DISCUSSION

The present study demonstrated an HBsAg seroprevalence of 1.17% among antenatal women, consistent with contemporary Indian hospital-based reports ranging from 0.9% to 5.2% [3,6–8]. These findings support India's classification as an intermediate endemic zone for hepatitis B infection and underscore the continued importance of universal antenatal screening. Vertical transmission remains a major contributor to chronic HBV infection; therefore, early identification of infected mothers enables timely neonatal monoprophylaxis and referral for antiviral evaluation when indicated [3,9]. The National Viral Hepatitis Control Programme (NVHCP) recommends universal screening during pregnancy and linkage to care, reinforcing the public health relevance of these findings [9].

Anti-HCV seroprevalence was 1.31%, which is comparable to reported Indian antenatal data [10]. Although prevalence remains relatively low, the absence of an effective vaccine and the potential for asymptomatic infection necessitate sustained surveillance. The higher proportion of cases in women aged 21–29 years reflects patterns observed in previous Indian studies and may relate to exposure dynamics during peak reproductive years [10]. Risk-based screening strategies may miss asymptomatic cases, whereas integration of HCV testing into routine antenatal services may improve case detection in resource-constrained settings.

The observed HIV seroprevalence (0.16%) was comparable to national antenatal sentinel surveillance estimates [4]. The low prevalence likely reflects the impact of the National AIDS Control Programme and Prevention of Parent-to-Child Transmission (PPTCT) initiatives [4,11]. Routine antenatal testing and early antiretroviral therapy have substantially reduced vertical transmission risk. Nevertheless, continued detection of infection in asymptomatic women highlights the necessity of universal screening.

The observed co-infection rate in the present study was exceedingly low (0.06%), indicating limited overlap of HBV, HCV, and HIV infections among the antenatal population. The small year-wise increase from 2023 to 2025 was not statistically significant, suggesting stable epidemiological trends rather than a true rising burden. This low prevalence may reflect effective public health interventions, vaccination coverage, and risk-reduction strategies. However, the rarity of co-infections could also be influenced by the overall low seroprevalence and sample size limitations, warranting larger multicentric studies for more precise estimates. [12]

This study is limited by its single-centre cross-sectional design and lack of molecular confirmation or viral load assessment. Findings may not be generalizable to broader populations. Despite these limitations, the study provides important regional baseline data supporting strengthened integrated antenatal surveillance. [13]

CONCLUSION

This study demonstrates a low but clinically meaningful seroprevalence of hepatitis B virus, hepatitis C virus, and human immunodeficiency virus among antenatal women, with rare co-infections and a predominance of dual viral infections. Although the observed increase in HBV and HCV seropositivity over the study period was not statistically significant, it emphasizes the need for continued epidemiological surveillance. The significant age association for HBV and HCV identifies reproductive-age women as a key population for targeted preventive interventions. Importantly, the continued detection of these infections among largely asymptomatic antenatal women reinforces the necessity of universal antenatal screening, early diagnosis, and timely clinical management to prevent vertical transmission. Integration of routine viral screening into national maternal and reproductive health programs is essential to reduce maternal morbidity, protect neonatal health, and sustain progress toward long-term elimination goals for viral hepatitis and HIV.

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Conflict of Interest
The authors declare no conflict of interest.

REFERENCES

1. Leoni MC, Ustianowski A, Farooq H, Arends JE. HIV, HCV and HBV: A review of parallels and differences. **Infect Dis Ther.** 2018;7:407-419.
2. Wu S, Wang J, Guo Q, Lan H, Sun Y, Ren M, et al. Prevalence of HIV, syphilis, and hepatitis B and C infections in pregnant women: systematic review and meta-analysis. **Clin Microbiol Infect.** 2023;29:1000-1007.
3. Premkumar M, Chawla YK. Chronic hepatitis B: Challenges and successes in India. **Clin Liver Dis (Hoboken).** 2021;18:111-116.
4. National AIDS Control Organisation; ICMR-NIRDHDS. *India HIV estimations 2025: Technical report.* New Delhi: Ministry of Health and Family Welfare; 2025.
5. Government of India. *India Against AIDS: Aspiring for AIDS-free India.* New Delhi: Ministry of Health and Family Welfare; 2024.
6. Maheshwari K, Kansal S. Knowledge and prevention of vertical transmission of hepatitis B infection: a cross-sectional study among pregnant females in Varanasi, India. **Indian J Community Med.** 2023;48(4):612-614.
7. Giri S, Sahoo S, Angadi S, Afzalpurkar S, Sundaram S, Bhrugumalla S. Seroprevalence of hepatitis B virus among pregnant women in India: a systematic review and meta-analysis. **J Clin Exp Hepatol.** 2022;12(6):1408-1419.
8. Yadav A, Agarwal M, Agarwal V, et al. Seroprevalence and determinants of hepatitis B virus and hepatitis C virus infection among pregnant women in North India: a cross-sectional study. **Cureus.** 2026;18(1):e101805.
9. Ministry of Health and Family Welfare. *Operational guidelines: National Viral Hepatitis Control Programme.* New Delhi: Government of India; 2019.
10. Singh MP, Arora D. Hepatitis C prevalence among antenatal women in India. **Indian J Med Microbiol.** 2022;40:xxx-xxx.
11. National AIDS Control Organisation. *National HIV counselling and testing guidelines 2024.* New Delhi: Ministry of Health and Family Welfare; 2023.
12. Sabin L, Haghparast-Bidgoli H, Miller F, Saville N. A systematic review of barriers and facilitators to antenatal screening for HIV, syphilis or hepatitis B in Asia: perspectives of pregnant women, their relatives and health care providers. **PLoS One.** 2024;19(5):e0300581.
13. Bhatta M, Dutta N, Nandi S, Dutta S, Saha MK. Mother-to-child HIV transmission and its correlates in India: systematic review and meta-analysis. **BMC Pregnancy Childbirth.** 2020;20(1):509.