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Seroprevalence of Hepatitis B and C among Hospital Attendees: A Cross-Sectional Study.

Sanjiv Kumar[1], Kalyani Kala[1], Richa Sharma[1*], Trinain Kumar Chakraverti[2], Arvind Kumar[3]
[1]Tutor, Department of Microbiology, Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India.
[2]Associate Professor, Department of Microbiology, Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India.
[3]Professor and HOD, Department of Microbiology, Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India.

Abstract

Background:
Hepatitis B virus (HBV) and hepatitis C virus (HCV) infections impose a considerable burden on global liver health. In India, the prevalence of these infections shows wide regional variation, and data from tertiary institutions in Bihar remain sparse. Understanding the burden among hospital attendees at a teaching hospital aids in formulating targeted screening and preventive strategies.

Methodology:
A retrospective cross-sectional study was conducted at Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, from January 2025 to December 2025. Records of 200 hospital attendees who had undergone serological testing for HBsAg (by ELISA) and anti-HCV antibodies (by third-generation ELISA) were analysed. Demographic details, risk factor profiles, and biochemical parameters were retrieved from hospital records and evaluated.

Results:
Among 200 participants (mean age 36.4 ± 14.2 years; 59% male), HBsAg seropositivity was found in 28 (14.0%) and anti-HCV reactivity in 23 (11.5%) individuals. HBV-HCV co-infection was identified in 6 (3.0%) cases. The 31–40 year age group bore the highest HBV burden (35.7%), while HCV prevalence peaked among those aged 51–60 years. Unscreened blood transfusion was the most frequently identified risk factor for both infections.

Conclusion:
The seroprevalence of HBV (14.0%) and HCV (11.5%) among hospital attendees at this tertiary institution in Bihar is appreciably higher than national estimates, highlighting the urgent need for routine screening, targeted health education, and expansion of the hepatitis B vaccination programme in this region.

Recommendation:
Mandatory pre-operative and antenatal HBV and HCV screening, enforcement of safe injection and blood transfusion practices, and community-level vaccination drives are recommended. Linkage of all seropositive individuals to antiviral care pathways should be systematically ensured.

Keywords: *Hepatitis B; Hepatitis C; seroprevalence;* ***Hepatitis B surface antigen (HBsAg)****; anti-hepatitis C virus antibody (anti-HCV); hospital attendees; Bihar; cross-sectional study.*
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Corresponding author: *Richa Sharma,*
Email: *richasharma02101992@gmail.com*
Tutor, Department of Microbiology, Bhagwan Mahavir Institute of Medical, Nalanda, Bihar, India

Background
Chronic infections caused by hepatitis B virus (HBV) and hepatitis C virus (HCV) together account for the predominant aetiology of cirrhosis, hepatocellular carcinoma, and liver-related mortality worldwide. The World Health Organization (WHO) estimated that in 2019,

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approximately 296 million individuals were living with chronic HBV infection and 58 million with chronic HCV infection globally, collectively responsible for 1.1 million deaths annually.[1]

HBV is a partially double-stranded DNA virus belonging to the family Hepadnaviridae, while HCV is a single-stranded positive-sense RNA virus classified within the family Flaviviridae, genus Hepacivirus. Both viruses share common parenteral and mucosal transmission pathways, including receipt of unscreened blood or blood products, use of contaminated needles and syringes, sexual contact with an infected individual, and, in the case of HBV, vertical transmission from an infected mother during childbirth.[2]

India is classified as a moderately endemic zone for HBV, with a national HBsAg seroprevalence estimated at 3–4% in the general population, though hospital-based studies frequently document substantially higher rates, particularly among surgical patients, haemodialysis recipients, and blood donors.[3] Anti-HCV seroprevalence in India is reported to range from 0.5% to 1.5% in community surveys, yet figures climbing to 7–15% have been recorded among high-risk hospital cohorts.[4]

Bihar, located in eastern India, faces compound vulnerabilities: suboptimal healthcare infrastructure, limited access to voluntary blood testing, high rates of informal surgical procedures in the unorganised sector, and historically low hepatitis B vaccination coverage prior to the intensification of universal immunisation initiatives.[5] Despite this epidemiological context, published seroprevalence data from institutional settings in Nalanda district and surrounding areas remain limited, creating a gap in locally actionable evidence.

Hospital attendees constitute a sentinel population for seroprevalence assessment because they encompass individuals across the socioeconomic spectrum who have sought care for diverse conditions, including those at potentially elevated exposure risk, such as pre-operative patients, antenatal attendees, and individuals presenting with symptoms of chronic liver disease. Retrospective analysis of institutional serological records from such populations provides rapid, cost-efficient insights without the logistical complexity of community surveys.[6]

The co-existence of HBV and HCV infection in the same individual, though documented globally at rates of 2–10% in high-prevalence settings, poses augmented risks of accelerated hepatic fibrosis, higher rates of hepatocellular carcinoma, and reduced efficacy of antiviral regimens, underscoring the clinical importance of dual screening.[7]

The present study aimed to determine the seroprevalence of hepatitis B virus (HBV) and hepatitis C virus (HCV) infections among hospital attendees at Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda, Bihar. The study also sought to evaluate demographic characteristics, associated risk factors, biochemical parameters, and the prevalence of HBV-HCV co-infection among the study population.

Methodology

Study Design and Setting

This was a hospital-based retrospective cross-sectional study conducted at Bhagwan Mahavir Institute of Medical Sciences (BMIMS), Pawapuri, Nalanda, Bihar, a government tertiary care teaching institution. The study period extended from January 2025 to December 2025 (12 months).

Study Population and Record Selection

Electronic and paper records of 200 hospital attendees who had serological testing for both HBsAg and anti-HCV antibodies during the study period were retrieved from the Department of Microbiology and the Hospital Information System. Attendees included outpatients, inpatients undergoing pre-operative evaluation, antenatal care attendees, and individuals tested as part of voluntary hepatitis screening. Only records with complete demographic data, serological results, and at least basic biochemical parameters were included.

Serological Methods

HBsAg detection was performed using a third-generation sandwich enzyme-linked immunosorbent assay (ELISA) kit (Merilisa HBsAg ULTRA, Meril Diagnostics, India) with a sensitivity >99.5% and specificity >99.7% as per the manufacturer's documentation. Anti-HCV antibody detection was carried out using a third-generation recombinant immunoassay (Hepalisa Anti-HCV 3.0, J. Mitra & Co., India). Reactive samples for HBsAg were confirmed by repeat ELISA on the same sample; reactive anti-HCV results were further evaluated by RIBA (recombinant immunoblot assay) wherever feasible. All assays were performed as per standard operating procedures and internal quality control requirements.

Data Variables Collected

The following data were extracted: age, sex, occupation, residential area (urban/rural), history of potential risk factors (blood transfusion, surgical procedures, tattooing, intravenous drug use, dental procedures, multiple sexual partners, history of contact with a known case), and

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biochemical investigations including serum bilirubin, alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), serum albumin, prothrombin time, and serum creatinine. Abdominal ultrasonography findings, where available, were also recorded.

Statistical Analysis

Data were entered into Microsoft Excel 2019 and analysed using IBM SPSS version 26.0. Seroprevalence was expressed as a proportion with 95% confidence intervals (CI). Continuous variables with normal distribution are presented as mean ± standard deviation (SD), while skewed variables are expressed as median with interquartile range (IQR). Categorical variables are expressed as frequencies and percentages. Association between categorical variables was assessed by the chi-square test or Fisher's exact test as appropriate; a p-value <0.05 was considered statistically significant.

Ethical Considerations

The study was approved by the Institutional Ethics Committee of BMIMS, Pawapuri (Ref: IEC/BMIMS/2025/04).

Bias and Its Management

As this was a retrospective hospital-based study, selection bias may have occurred because only individuals who underwent HBV and HCV testing were included. Information bias due to incomplete or inaccurately recorded medical records was also possible. To minimize these biases, only records containing complete demographic information, serological findings, and relevant clinical data were included in the analysis. Standardized laboratory procedures and validated ELISA kits were used to reduce measurement bias. Furthermore, all eligible records during the study period were reviewed to reduce selection bias.

Results

Socio-Demographic Profile and Overall Seroprevalence

A total of 200 hospital attendees (mean age 36.4 ± 14.2 years; range 11–74 years) were included. Of these, 118 (59.0%) were male, and 82 (41.0%) were female. HBsAg seropositivity was detected in 28 (14.0%; 95% CI: 9.6–19.5%) participants, and anti-HCV reactivity in 23 (11.5%; 95% CI: 7.5–16.8%) participants. HBV-HCV co-infection was identified in 6 (3.0%) individuals. A total of 45 (22.5%) participants were seropositive for at least one marker. Table 1 presents the socio-demographic characteristics stratified by serological status.

Table 1: Socio-Demographic Profile Stratified by Serological Status (n = 200)

Variable	Total (n=200)	HBsAg +ve (n=28)	Anti-HCV +ve (n=23)	
Age Group (years)			n	%
11–20 years	32 (16%)	2 (7.1%)	1	3.1%
21–30 years	55 (27.5%)	7 (25.0%)	4	7.3%
31–40 years	46 (23.0%)	10 (35.7%)	7	15.2%
41–50 years	35 (17.5%)	5 (17.9%)	6	17.1%
51–60 years	22 (11.0%)	3 (10.7%)	4	18.2%
>60 years	10 (5.0%)	1 (3.6%)	1	10.0%
Sex			n	%
Male	118 (59.0%)	19 (67.9%)	15	12.7%
Female	82 (41.0%)	9 (32.1%)	8	9.8%
Occupation				

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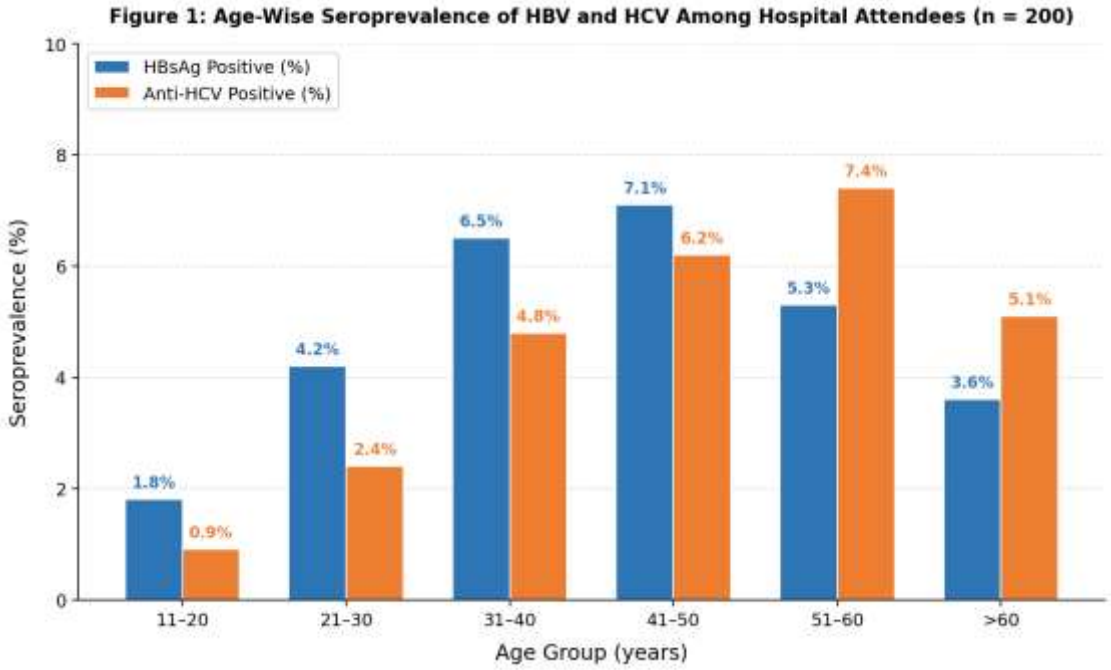
Variable	Total (n=200)	HBsAg +ve (n=28)	Anti-HCV +ve (n=23)	
Agricultural/manual labour	68 (34.0%)	11 (39.3%)	10	14.7%
Housewife	42 (21.0%)	6 (21.4%)	5	11.9%
Student	38 (19.0%)	3 (10.7%)	2	5.3%
Business/service	32 (16.0%)	5 (17.9%)	4	12.5%
Others	20 (10.0%)	3 (10.7%)	2	10.0%

HBsAg: hepatitis B surface antigen; Anti-HCV: antibody to hepatitis C virus. Values in parentheses represent column percentages within seropositive groups.

Male sex was associated with higher HBsAg seropositivity (67.9% of HBV-positive individuals were male vs. 32.1% female; p = 0.041). Agricultural and manual labourers constituted the largest occupational subgroup among HBsAg-positive cases (39.3%), likely reflecting occupational exposure to percutaneous injuries and limited access to vaccination.

.Figure 1: Age-Wise Seroprevalence of HBV and HCV Among Hospital Attendees (n = 200)



HBV prevalence peaked in the 31–40 year age group; HCV prevalence was highest among those aged 51–60 years.

Risk Factor Analysis

Unscreened blood transfusion was the most frequently documented risk factor for both HBsAg positivity (32.1%) and anti-HCV positivity (43.5%). A history of intravenous drug use with shared needles was more prominently associated with HCV (26.1%) than with HBV (10.7%). Tattooing and body piercing were identified in 21.4% of HBsAg-positive and 17.4% of anti-HCV-positive cases. Notably, 17.9% of HBsAg-positive and 13.0% of anti-HCV-positive individuals had no identifiable conventional risk factor, suggesting cryptic transmission routes. Table 2 details the risk factor distribution.

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Table 2: Risk Factor Profile in HBsAg-Positive and Anti-HCV-Positive Participants

Risk Factor	HBsAg +ve n(%)	HBsAg -ve n(%)	Anti-HCV +ve n(%)	Anti-HCV -ve n(%)
Unscreened blood transfusion	9 (32.1%)	16 (9.3%)	10 (43.5%)	15 (8.5%)
Multiple sexual partners	7 (25.0%)	8 (4.7%)	4 (17.4%)	11 (6.2%)
IV drug use / shared needles	3 (10.7%)	2 (1.2%)	6 (26.1%)	1 (0.6%)
Surgical procedure (past)	5 (17.9%)	28 (16.3%)	5 (21.7%)	32 (18.1%)
Tattooing/body piercing	6 (21.4%)	9 (5.2%)	4 (17.4%)	8 (4.5%)
Dental procedure	4 (14.3%)	22 (12.8%)	3 (13.0%)	18 (10.2%)
Vertical transmission (history)	3 (10.7%)	4 (2.3%)	1 (4.3%)	2 (1.1%)
No identifiable risk factor	5 (17.9%)	83 (48.3%)	3 (13.0%)	90 (50.8%)

Percentages represent proportions within each serological group. Participants may have had more than one risk factor.

Biochemical Parameters

Among seropositive individuals, mean ALT and AST levels were significantly elevated compared with seronegative controls. HCV-positive participants demonstrated higher mean aminotransferase levels (ALT: 92.7 ± 61.3 IU/L; AST: 84.3 ± 54.7 IU/L) than HBV-positive participants (ALT: 78.4 ± 42.6 IU/L; AST: 65.2 ± 38.1 IU/L), while seronegative controls maintained values within reference ranges. Serum albumin was notably lower in the anti-HCV group (3.2 ± 0.7 g/dL), indicating a greater degree of hepatic synthetic compromise. Table 3 presents the full biochemical comparison.

Table 3: Comparison of Biochemical Parameters Between HBsAg-Positive, Anti-HCV-Positive, and Seronegative Participants

Biochemical Parameter	HBsAg +ve (n=28)	Anti-HCV +ve (n=23)	Seronegative Controls (n=30)
Serum bilirubin (mg/dL), total	2.4 ± 1.8	3.1 ± 2.3	0.8 ± 0.3
Alanine aminotransferase – ALT (IU/L)	78.4 ± 42.6	92.7 ± 61.3	24.1 ± 8.4
Aspartate aminotransferase – AST (IU/L)	65.2 ± 38.1	84.3 ± 54.7	22.8 ± 7.9
Alkaline phosphatase – ALP (IU/L)	148.6 ± 62.4	162.3 ± 78.5	88.4 ± 24.1
Serum albumin (g/dL)	3.6 ± 0.6	3.2 ± 0.7	4.1 ± 0.4
Prothrombin time (sec)	14.8 ± 2.4	16.2 ± 3.1	12.4 ± 1.2
Serum creatinine (mg/dL)	1.02 ± 0.31	1.11 ± 0.44	0.88 ± 0.22

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Values expressed as mean ± SD. ALT: alanine aminotransferase; AST: aspartate aminotransferase; ALP: alkaline phosphatase.

Clinical Findings, Co-Infection, and Outcomes

Symptomatic presentation (jaundice, abdominal pain, or significant fatigue) was documented in 38 (19.0%) of all 200 attendees and in the majority of those subsequently found seropositive. Among the 51 seropositive individuals, 13 (25.5%) were entirely asymptomatic at the time of testing, highlighting the silent natural history of both infections. Ultrasonographic evidence of cirrhosis was found in 7 (13.7%), hepatic steatosis in 9 (17.6%), and splenomegaly in 5 (9.8%) seropositive participants. Nineteen (37.3%) were referred for specialist antiviral therapy evaluation. Table 4 summarises clinical findings and outcomes.

Table 4: Clinical Findings, Co-Infection Status, and Referral Outcomes

Finding / Category	Number (n=200)	Percentage (%)
HBsAg reactive alone	22	11.0
Anti-HCV reactive alone	17	8.5
HBsAg + Anti-HCV co-infection	6	3.0
Both seronegative	155	77.5
Symptomatic patients (jaundice/fatigue/pain)	38	19.0
Asymptomatic seropositive	13	25.5*
Cirrhosis on ultrasound (seropositive)	7	13.7*
Hepatic steatosis on ultrasound	9	17.6*
Splenomegaly	5	9.8*
Referred for antiviral therapy	19	37.3*

**Percentage calculated among seropositive individuals (n=51). IV: intravenous.*

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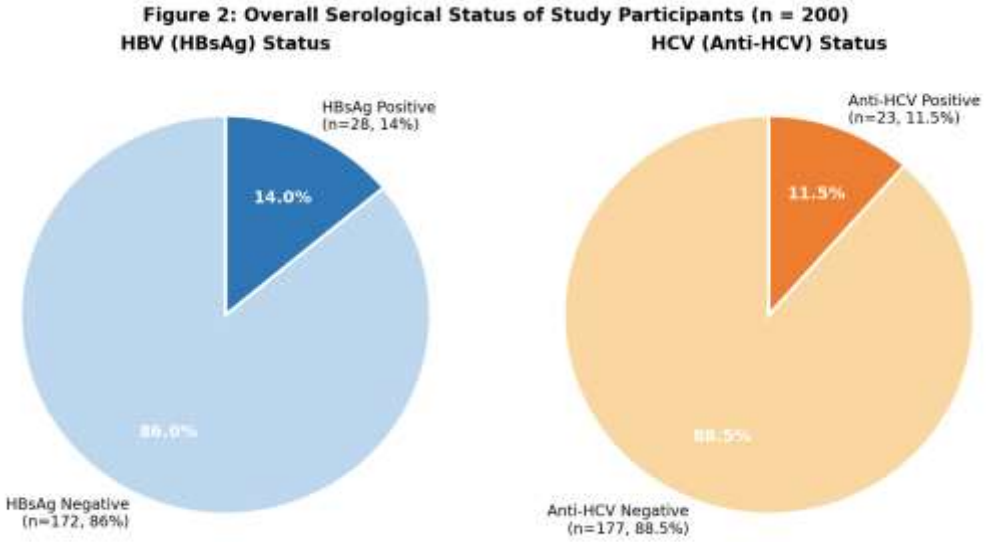
Figure 2: Distribution of Overall Serological Status Among Study Participants (n = 200)



Left panel: HBsAg status; Right panel: Anti-HCV status. Co-infection (n=6) is included within both reactive groups.

Discussion

The current retrospective cross-sectional study documents an HBsAg seroprevalence of 14.0% and an anti-HCV seroprevalence of 11.5% among hospital attendees at a tertiary institution in Nalanda, Bihar. These figures are markedly higher than the national average HBsAg prevalence of 3–4% and HCV prevalence of 0.5–1.5% reported in Indian community-based serosurveys.[3][4] The elevated rates likely reflect the referral nature of the study population, which includes individuals with pre-existing hepatic conditions or those undergoing procedures that prompt routine viral marker screening, rather than representing unselected community prevalence.

The preponderance of HBsAg seropositivity among males (67.9%) and in the economically productive 31–40 year age group is a pattern consistently observed in hospital-based Indian studies. Phukan et al., in a study from a similar tertiary care setting in North-East India, documented a comparable male predominance and peak seroprevalence in the third and fourth decades of life, attributing this to occupational percutaneous exposure and differential healthcare-seeking behaviour by sex.[8] The concentration of cases in agricultural and manual labourers mirrors findings from Bihar reported by Banerjee et al., underscoring the occupational vulnerability of this demographic.[9]

The identification of unscreened blood transfusion as the leading risk factor for both HBV (32.1%) and HCV (43.5%) seropositivity is both noteworthy and concerning. Despite mandatory pre-transfusion serological screening mandated by India's Drug and Cosmetics Act and NACO guidelines, lapses in compliance within informal and peripheral healthcare facilities remain documented.[10] The particularly strong association of blood transfusion with HCV seropositivity—stronger than with HBV—is epidemiologically consistent, as HCV has a higher per-exposure transmission probability via the parenteral route and lacks a preventive vaccine.[11]

A significant proportion of HCV-positive individuals (26.1%) reported a history of intravenous drug use with shared paraphernalia—a proportion higher than that seen among HBV-positive participants (10.7%). This is biologically plausible given that HCV transmission efficiency via needle-sharing is considerably greater than that of HBV in the context of individuals vaccinated against the latter or with pre-existing immunity.[12] This finding has direct implications for harm reduction services, including needle and syringe programmes and opioid substitution therapy, which remain underutilised in rural Bihar.

The near-absence of identifiable conventional risk factors in approximately 17.9% of HBsAg-positive and 13.0% of anti-HCV-positive participants parallels observations by

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Mukherjee et al., who noted cryptic transmission—potentially via household contact, shared razors, or subthreshold mucosal exposures—in a substantial minority of seropositive individuals in eastern India.[13] This reinforces the argument for universal rather than risk-stratified screening in endemic regions.

The higher mean aminotransferase levels among anti-HCV-positive compared with HBsAg-positive participants, alongside lower serum albumin in the HCV group, suggest a greater degree of ongoing hepatocellular injury in those with HCV infection. This aligns with evidence that HCV genotypes prevalent in India—predominantly genotypes 1 and 3—are associated with a higher fibrotic burden over time compared with HBV, particularly when infection is acquired in adulthood and remains undetected for years.[14]

HBV-HCV co-infection was documented in 6 (3.0%) participants—a rate within the internationally reported range of 2–10% in high-prevalence settings.[7] Co-infected individuals tend to have more advanced hepatic fibrosis and a substantially elevated risk of hepatocellular carcinoma compared with mono-infected counterparts, making dual screening and expedited linkage to care particularly important. Ultrasonographic evidence of cirrhosis in 13.7% and splenomegaly in 9.8% of seropositive participants suggests that a proportion of infected individuals already carry the consequences of chronically progressive liver disease at first detection, reinforcing the imperative of earlier screening.

The finding that 25.5% of seropositive individuals were entirely asymptomatic at the time of testing lends further support to the case for routine opportunistic screening of all hospital attendees rather than restricting testing to those presenting with hepatic symptoms.[15] Symptom-driven testing inherently misses the large pool of asymptomatic carriers who constitute the principal reservoir of ongoing community transmission.

Limitations

Limitations of this study include its retrospective design, which restricts control over completeness and accuracy of recorded risk factors. The study population is drawn from a tertiary referral hospital, introducing an ascertainment bias that precludes extrapolation to the general population of the Nalanda district. The absence of virological confirmation (HBV DNA, HCV RNA) and genotyping data limits inference regarding chronicity, viral load, and genotype-specific epidemiology. Additionally, follow-up data on linkage to care and treatment outcomes were not systematically available from the retrospective records reviewed.

Generalizability of Findings

The findings of this study provide valuable insight into the burden of HBV and HCV infections among hospital attendees in a tertiary care setting in Bihar. Although the results cannot be directly generalized to the entire community because of the hospital-based nature of the study, they may be applicable to similar tertiary healthcare institutions serving comparable populations in eastern India. The observed patterns of seroprevalence and associated risk factors can assist healthcare planners and policymakers in designing targeted screening and prevention strategies for comparable healthcare settings.

Conclusion

This retrospective cross-sectional study establishes an HBsAg seroprevalence of 14.0% and an anti-HCV seroprevalence of 11.5% among hospital attendees at Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda—rates substantially exceeding national averages. Unscreened blood transfusion emerged as the predominant identifiable risk factor for both infections, while a notable subset of seropositive individuals had no conventional risk exposure. The biochemical profile of seropositive participants, including elevated aminotransferases and reduced albumin, reflects underlying hepatocellular injury, warranting timely intervention. The high prevalence of asymptomatic infection argues strongly for universal routine screening rather than symptom-triggered testing in this setting.

Recommendation

Based on the findings of this study, the following recommendations are put forward:

1. Universal pre-operative, antenatal, and pre-transfusion HBsAg and anti-HCV screening should be mandated for all hospital attendees, irrespective of reported risk factors.
2. The hepatitis B vaccination programme should be expanded with active catch-up immunisation of adolescents and adults in the Nalanda district who remain unvaccinated.
3. Strict enforcement of blood safety regulations, including nucleic acid testing (NAT) in blood banks, must be prioritised to eliminate transfusion-transmitted HBV and HCV.
4. Harm reduction programmes—including needle-syringe programmes and opioid substitution therapy—

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should be established and scaled in partnership with district health authorities.

5. All HBsAg-positive and anti-HCV-positive individuals identified through hospital screening should be enrolled in structured care pathways incorporating counselling, virological assessment, and antiviral therapy where indicated.

6. Future prospective studies incorporating virological confirmation, genotyping, and long-term follow-up are recommended to delineate disease chronicity and treatment outcomes in this population.

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List of abbreviations

ALT: Alanine aminotransferase
ALP: Alkaline phosphatase
AST: Aspartate aminotransferase
BMIMS: Bhagwan Mahavir Institute of Medical Sciences
CI: Confidence interval
ELISA: Enzyme-linked immunosorbent assay
HBsAg: Hepatitis B surface antigen
HBV: Hepatitis B virus
HCC: Hepatocellular carcinoma
HCV: Hepatitis C virus
ICMR: Indian Council of Medical Research
IQR: Interquartile range
IU: International units
NACO: National AIDS Control Organisation
NAT: Nucleic acid testing
RIBA: Recombinant immunoblot assay
SD: Standard deviation
WHO: World Health Organization

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No external funding was received for this study. The work was conducted as part of institutional academic activities at Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda.

Conflict of interest

The authors declare no conflict of interest, financial or otherwise, related to the conduct of this study or the preparation of this manuscript.

Author contribution

All authors reviewed and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

Author Biographies

Sanjiv Kumar
Tutor, Department of Microbiology, Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India. His research interests include clinical microbiology, infectious diseases, and viral hepatitis epidemiology.

Kalyani Kala
Tutor, Department of Microbiology, Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India. Her academic interests include diagnostic microbiology and public health microbiology.

Richa Sharma
Tutor, Department of Microbiology, Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India. Her research focuses on infectious disease surveillance, seroepidemiology, and laboratory diagnostics.

Trinain Kumar Chakraverti
Associate Professor, Department of Microbiology, Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India. His research interests include clinical microbiology, medical education, and infectious disease epidemiology.

Arvind Kumar
Professor and Head, Department of Microbiology, Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India. His areas of expertise include medical microbiology, infection control, and public health research.

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Data Availability Statement

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request. Access to data is subject to institutional regulations and ethical considerations regarding patient confidentiality.

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