INDIAN JOURNAL OF SCIENCE AND TECHNOLOGY

ORIGINAL ARTICLE

OPEN ACCESS

Received: 25/08/2025

Accepted: 03/09/2025

Published: 19/09/2025

Citation: Vijayasimha M, Jayaswal RP, Jayarajan D, R, Alam I, Priya M, Yadav A (2025) Seroprevalence of Hepatitis A and E Viruses: A Four-Year Retrospective Analysis from a Private Diagnostic Laboratory in Gurugram, India. Indian Journal of Science and Technology 18(34): 2821-2826. https://doi.org/10.17485/IJST/v18i34.1493

* **Corresponding author**.

mvsimha@gmail.com

Funding: None

Competing Interests: None

Published By Indian Society for Education and Environment (iSee)

ISSN
Print: 0974-6846
Electronic: 0974-5645

Seroprevalence of Hepatitis A and E Viruses: A Four-Year Retrospective Analysis from a Private Diagnostic Laboratory in Gurugram, India

M Vijayasimha[1]*, R P Jayaswal[1], D Jayarajan[2], Rosy [1], Inkashaf Alam[1], M Priya[3], Ashok Yadav[4]

1 Department of MLT, UIAHS, Chandigarh University, Mohali-140413, Punjab, India
2 Faculty of Paramedical Sciences, Assam Downtown University, Guwahati, Assam, India
3 Department of Medicine, Sri Venkateswara Institute of Medical Sciences, Tirupathi, Andhra Pradesh, India
4 Department of MLT, School of Allied Health Sciences, G D Goenka University, Sona, Haryana, India

Abstract

Objectives: This study examined the seroprevalence of Hepatitis A virus (HAV), Hepatitis E virus (HEV), and their co-infections in patients presenting with clinical features of acute viral hepatitis in the Gurugram region. Beyond prevalence, demographic patterns, seasonal distribution, and biochemical correlates were evaluated to generate evidence relevant for public health interventions. **Method:** A retrospective, observational study was undertaken at a NABL-accredited private diagnostic laboratory in Delhi–NCR. A total of 977 serum samples were analyzed between August 2021 and July 2025 from patients clinically suspected of acute viral hepatitis. Anti-HAV IgM and anti-HEV IgM antibodies were detected using commercial ELISA kits. Demographic profiles, liver function parameters, and clinical characteristics were assessed. Data were analyzed using descriptive statistics and Chi-square tests, with significance set at $p < 0.05$. **Findings:** Of 977 samples, 322 (32.95%) were seropositive for HAV, HEV, or both. HAV was more prevalent (22.92%) than HEV (10.03%), while 3.48% of patients exhibited co-infection. HAV infections were significantly more common in children (72.7%), whereas HEV predominated among adults (71.1%). Male patients showed higher seropositivity across both viruses. Cases with dual HAV–HEV infection demonstrated the most marked biochemical abnormalities, including elevated bilirubin and ALT levels. Clear seasonal clustering was observed, with the highest burden during the monsoon months. **Conclusion/Novelty:** This is the first four-year, laboratory-based surveillance study from the Delhi NCR–Gurugram region providing systematic evidence on HAV, HEV, and co-infections, alongside demographic, seasonal, and biochemical correlates. The results demonstrate HAV predominance in children (72.7%), support the need for pediatric HAV vaccination, and highlight the clinical significance of early identification of co-infections to mitigate risks of acute liver failure.

Keywords: Hepatitis A; Co-infection; Hepatitis E; Seroprevalence; Delhi NCR; Acute viral hepatitis; Public health surveillance

1 Introduction

Hepatitis A virus (HAV) and hepatitis E virus (HEV) are major causes of acute viral hepatitis worldwide and continue to pose a considerable public health burden. Although most infections resolve spontaneously, both can lead to significant morbidity and, in some cases, acute liver failure (ALF)[(1)]. Transmitted primarily through the fecal–oral route, these infections are most prevalent in developing regions where sanitation remains inadequate[(2)]. Globally, HAV causes an estimated 1.4 million infections each year, while HEV affects nearly 20 million people annually, leading to around 44,000 deaths in 2015[(3)].

HAV, a non-enveloped, single-stranded RNA virus from the Picornaviridae family[(4)], does not progress to chronic disease. While infections are often mild—manifesting as fever, nausea, or jaundice—rare cases of fulminant hepatitis occur[(5)]. With an effective vaccine available, and natural infection conferring lifelong immunity, HAV seropositivity exceeds 80% in adulthood[(6)]. Children are disproportionately affected[(7)].

HEV, a single-stranded RNA virus from the Hepeviridae family[(8)], shares transmission pathways with HAV but carries greater clinical risk, especially in pregnant women, where fulminant hepatitis and mortality are more frequent. Unlike HAV, HEV primarily affects adults and presents as sporadic infections or outbreaks[(9)].

In India, HAV accounts for 10–30% and HEV for 10–40% of acute viral hepatitis cases, with 5–15% and 15–45%, respectively, progressing to ALF[(10)]. Although HAV–HEV co-infections are relatively uncommon, they are associated with disproportionately severe outcomes and higher mortality[(11)].

Despite their clinical importance, significant research gaps remain. Most existing Indian studies focus on outbreak investigations, hospital-based cohorts, or specific subpopulations. Such approaches, while valuable, do not adequately capture the community-level burden or reflect transmission dynamics in large, diverse urban populations. Particularly in high-density regions like Delhi NCR, where sanitation varies widely and population mobility is high, the true prevalence and distribution of HAV and HEV remain poorly understood. This lack of reliable regional data hampers effective surveillance, early diagnosis, and targeted public health interventions.

To address this gap, the present retrospective study analyzes laboratory-based prevalence data for HAV and HEV from a large private diagnostic network in Delhi NCR. By generating comprehensive, region-specific insights, the study aims to improve understanding of the local epidemiology, strengthen surveillance capacity, and inform more effective prevention strategies.

2 Methodology

A retrospective look-back study was conducted at Micro Path Lab in Gurugram to see how common HAV, HEV, and their co-infections are among patients showing symptoms of acute viral hepatitis. Clinically suspected acute viral hepatitis cases were defined as patients presenting with jaundice, fever, abdominal pain, nausea/vomiting, dark urine, hepatomegaly, malaise, or diarrhea, as assessed by the treating clinician. Only such clinically referred cases were included. Some of the typical symptoms included yellowing of the skin and eyes (jaundice), fever, stomach pain, vomiting, dark-colored urine, enlarged liver, malaise, and diarrhoea. The study examined clinical samples collected over a 4-year period from August 2021 to July 2025. Only the cases that met certain conditions—like showing symptoms of acute viral hepatitis and being of good enough quality—were included. The entire study plan was reviewed and approved by the Institutional Ethics Committee of Micro Path Lab, Gurugram, under letter no. MPL/IEC/2021/174.

2.1 Serological Investigations:

Venous blood samples received in the laboratory were processed under standard protocols for serum separation. After clotting at room temperature, samples were centrifuged at 1500 rpm for 10 minutes, and the separated serum was stored at 2–8 °C until testing. Acute HAV and HEV infections were identified using commercially available enzyme-linked immunosorbent assay (ELISA) kits (anti-HAV IgM and anti-HEV IgM, DIA PRO Diagnostic). According to the manufacturer's data, the anti-HAV IgM ELISA kit has a sensitivity of 98.6% and specificity of 99.1%, while the anti-HEV IgM ELISA kit has a sensitivity of 97.8% and specificity of 98.9%. Each assay was performed with appropriate positive and negative controls to ensure validity. All procedures strictly adhered to the manufacturer's instructions. Internal quality controls (positive and negative) were included in each run. The laboratory is NABL-accredited and participated in NABL-mandated external proficiency testing during the study period, ensuring continuous validation of assay performance

2.2 Statistical Analysis:

Demographic details, clinical information, and laboratory findings were compiled and analyzed systematically. The Chi-square test with Yates' correction was used to compare proportions of seronegative (absence of antibodies) and seropositive (presence

of antibodies) cases for HAV and HEV. A p-value of <0.05 was considered statistically significant, suggesting that differences between the HAV and HEV groups were unlikely due to random variation.

3 Results

A total of 977 serum specimens from clinically suspected acute viral hepatitis cases were collected between August 2021 and July 2025. Of these, 604 (62%) were from males and 373 (38%) from females. Urban residents contributed 587 samples (60%), while 390 (40%) were from rural areas. The overall mean age of participants was 27.5 years (SD ±19), with males averaging 28.5 years and females 24.6 years.

Of the total samples, 322 (33%) were seropositive for hepatitis A virus (HAV), hepatitis E virus (HEV), or both. Male patients accounted for a higher proportion of seropositive cases [196 (61%)] compared to females [126 (39%)]. Among positive samples, 224 (23%) demonstrated anti-HAV antibodies, 98 (10%) were positive for anti-HEV antibodies, and 34 (3.5%) showed evidence of HAV–HEV co-infection (Table 1).

3.1 Sex-based distribution of seropositivity:

HAV seropositivity was more frequent in males [132 (58.92%)] than females [92 (41%)]. Similarly, HEV seropositivity was higher in males [65 (66.32%)] compared to females [33 (33.67%)]. HAV–HEV co-infections also demonstrated male predominance, with 19 cases (55.88%) in males and 15 cases (44.12%) in females (Table 1).

3.2 Age-based distribution of seropositivity:

HAV was significantly more common in the pediatric age group (0–14 years), with 163 cases (72.7%), compared to 61 cases (27.3%) in adults. In contrast, HEV infection predominated in adults [70 (71.4%)] relative to children [28 (28.6%)]. The distribution of HAV–HEV co-infection was closer to HAV, with a higher frequency in children [21 (61.7%)] compared to adults [13 (38.3%)], though this difference did not reach statistical significance (Table 2).

3.3 Liver function biomarkers and seropositivity:

Patients testing positive for either HAV or HEV exhibited marked increases in total serum bilirubin and alanine aminotransferase (ALT), reflecting hepatic injury. The most pronounced elevations were observed among individuals with HAV–HEV co-infections, suggesting a synergistic effect that amplifies liver damage.

3.4 Seasonal distribution of seropositivity:

Seropositive cases were identified across all seasons. The peak incidence occurred during the monsoon period (July–October), accounting for 181 cases, followed by winter months (November–February). In contrast, the lowest prevalence was observed in summer (March–June), with 73 cases reported.

Table 1. Spread of HAV, HEV, and HAV/HEV Co-infections by Residence (Urban vs. Rural) and Gender

Characteristics	Total cases n (%)	Total positive n (%)	HAV+ n (%)	HEV+ n (%)	HAV–HEV co-infection n (%)
Overall cases	977 (100)	322 (32.95)	224 (22.92)	98 (10.03)	34 (3.48)
Urban	587 (60.08)	200 (62.11)	140 (62.50)	60 (10.22)	20 (3.40)
Rural	390 (39.91)	122 (37.88)	84 (37.50)	38 (9.74)	14 (3.58)
Male	604 (61.80)	196 (60.86)	132 (58.92)	65 (66.32)	19 (55.88)
Female	373 (38.20)	126 (39.13)	92 (41.07)	33 (33.67)	15 (44.12)
p-value	—	<0.00001	0.0027	0.05	0.715

4 Discussion

Of 977 suspected acute viral hepatitis cases, 322 (32.95%) were positive for HAV, HEV, or both. HAV seropositivity (22.92%) exceeded HEV (10.03%), while 3.48% represented co-infections. This distribution reflects global epidemiology, where HAV and HEV remain leading causes of acute viral hepatitis [1]. Although usually self-limiting, both viruses can lead to fulminant liver failure in high-risk populations, particularly pregnant women [9].

Table 2. Spread of HAV and HEV Infections in Children and Adult Groups (with 95% CI)

Cases	Seropositive (n)	Pediatric n (%)	Adult n (%)	Pediatric % (95% CI)	p-value
HAV	224	163 (72.7%)	57 (25.2%)	72.8% (95% CI: 66.9–78.6)	<0.00001
HEV	98	28 (28.6%)	69(71.1%)	28.6% (95% CI: 19.6–37.5)	0.0009
Co-infection	34	21 (61.7%)	11 (34.4%)	61.8% (95% CI: 45.4–78.1)	0.2173

Values reported as n (%). 95% CI calculated for pediatric proportions. Age distribution presented as both mean ± SD and median (IQR) due to skewness.

Table 3. Biochemical picture of HAV and HEV patients

Parameter	Total cases (n=322)	HAV+ (n=224)	HEV+ (n=98)	HAV–HEV co-infection (n=34)
Serum bilirubin (mg/dL)	5.51 ± 5.87	7.38 ± 6.65	7.78 ± 7.10	8.34 ± 6.60
ALT (SGPT) (U/L)	631.4 ± 527.47	692.2 ± 498.17	797.8 ± 647.90	826.0 ± 567.60

ALT: Alanine transaminase; SGPT: Serum glutamic-pyruvic transaminase.

Our findings align with Indian data but highlight regional heterogeneity. Jain et al. (Lucknow) reported HAV at 26.96% and HEV at 17.97%, while Joon et al. (Mangalore) observed 19.31% HAV and 10.54% HEV [11]. In Delhi, Agrawal et al. documented lower HAV (9.47%) but higher HEV (23.36%), whereas Rawat et al. (Rohtak) found markedly higher rates (31.1% HAV; 44.9% HEV) [12]. By contrast, Samaddar (Mumbai) and Barde (Jabalpur) reported lower prevalence [11]. More recently, Bansal et al. (North India) reported 16.9% HAV, 14.9% HEV, and 87 co-infections [1]. The present study, showing relatively higher HAV and moderate HEV prevalence, falls within this spectrum and emphasizes the influence of sanitation, food safety, and water quality on regional differences [2].

4.1 Age and Gender Distribution:

Age-specific analysis revealed HAV predominance among children (72.7%), while HEV was more frequent in adults (71.4%). This is consistent with established patterns where HAV primarily affects children due to early exposure, whereas HEV disproportionately impacts adults and pregnant women [12]. Similar trends were observed in Delhi (Panda et al.) [13], North India (Bansal et al.) [1], and Pune (Lalwani et al.), who reported rising anti-HAV seropositivity with age—from 44.9% in children under five to 92.9% in adults—indicating a shift from high to intermediate endemicity [14]. These findings highlight the need to strengthen pediatric HAV vaccination.

Male predominance was also evident, with higher HAV (58.92%) and HEV (66.32%) seropositivity among men. This gender disparity, consistently reported across studies [11], is attributed to greater occupational and environmental exposure, suggesting social and behavioral rather than biological determinants of risk.

4.2 Co-infections and Clinical Correlates:

Co-infections (3.48%) demonstrated the most severe biochemical derangements, particularly elevated bilirubin and ALT, both indicative of significant hepatic injury. Similar findings were reported by Jain RK et al. [11] and Sasaki-Tanaka et al. [15], who identified HAV and HEV as major contributors to acute liver failure (ALF) and acute-on-chronic liver failure (ACLF) in Asia. Severe maternal mortality in HEV-1 pregnancies and severe hepatitis linked to HAV genotype IIIA and HEV genotype 4 have also been described [15]. These findings underscore the importance of early recognition and close monitoring of HAV–HEV co-infections.

4.3 Seasonality:

Infections occurred throughout the year but peaked during the monsoon (July–October; 181 cases). This seasonal rise reflects waterlogging, sewage contamination, and flooding, consistent with prior studies [16]. A secondary winter peak was also observed, potentially linked to food contamination and water stagnation. Similar clustering has been described in dengue patients, where screening for acute hepatitis during high-risk seasons was recommended [17]. These findings highlight the value of intensified preventive measures before monsoon and winter.

4.4 Comparative Synthesis:

Comparison with recent Indian studies[12–17] highlights several consistent epidemiological trends. Seasonality remains prominent, with the monsoon period representing the peak risk for infection [12,16]. Age-specific patterns continue to show HAV predominance among children and HEV predominance among adults, as reported in Delhi[11], North India[1], and Pune[14]. A persistent male predominance has also been observed across multiple studies[11]. Although less frequent, HAV–HEV co-infections are regularly associated with the most severe clinical outcomes[11,15]. In terms of endemicity, Lalwani et al.[14] demonstrated a shift of HAV toward intermediate endemicity, a trend also supported by our findings. Furthermore, HEV remains strongly associated with adverse maternal outcomes, consistent with evidence from Bansal et al.[2] and Sasaki-Tanaka et al.[15].

4.5 Novelty and Public Health Implications:

The novelty of this study lies in its four-year, large-scale dataset from a NABL-accredited diagnostic laboratory, offering systematic evidence of HAV/HEV epidemiology across demographic, seasonal, and biochemical dimensions. Unlike smaller outbreak-based studies, our findings underscore the clinical importance of co-infections, demonstrate shifting HAV endemicity, and reaffirm the persistent seasonal burden in urban Indian settings.

This study is limited by its retrospective design, absence of clinical outcome data, and reliance on serology without molecular confirmation. Being single-center, generalizability may be restricted. Nonetheless, the large sample size, NABL accreditation, and four-year coverage strengthen its reliability and regional relevance

4.6 Recommendations:

Based on the evidence, the following strategies are proposed:

1. Strengthening community-level surveillance to monitor evolving epidemiology.
2. Expanding pediatric HAV vaccination in the national immunization program.
3. Introducing routine HEV screening in antenatal care to reduce maternal mortality.
4. Improving sanitation and drinking water quality, particularly before monsoon.
5. Combining molecular diagnostics with serology for early co-infection detection.
6. Supporting vaccine and antiviral research, as advocated by Sasaki-Tanaka et al.[15].

5 Conclusion

This study provides large-scale laboratory-based evidence of higher HAV than HEV seroprevalence in Delhi NCR, underscoring the need to routinely test for HAV in suspected viral hepatitis, particularly among children. The detection of HAV–HEV co-infections highlights the clinical value of dual serological and molecular screening to improve diagnosis and outcomes. The novelty of this work lies in addressing a major surveillance gap in a densely populated metropolitan setting, offering actionable data for health policy. To mitigate disease burden, public health strategies should prioritize expansion of safe water and sanitation infrastructure, reinforcement of hygiene and food safety practices, increased HAV vaccination coverage in high-risk groups, and establishment of continuous surveillance systems. By integrating these measures, health systems can curb transmission, reduce morbidity and mortality, and move toward long-term control of enterically transmitted hepatitis.

6 Ethical considerations

The study protocol was reviewed and approved by the Institutional Ethics Committee (approval number: (Approval No. MPL/IEC/2021/174; dated 07th August 2021). Since the study used retrospective, de-identified laboratory records, the requirement for individual informed consent was waived.

7 Acknowledgements

APC is deferred partially by Indian Society for Education and Environment.

References

1) Bansal Y, Singla N, Garg K, Sharma G, Gill M, Chander J. Seroprevalence of hepatitis A and hepatitis E in patients at a teaching hospital of northern India over a period of 8 years. *Journal of Family Medicine and Primary Care*. 2022;11:567–572. https://doi.org/10.4103/jfmpc.jfmpc_1212_21.
2) Iqbal H, Mehmood BF, Sohal A, Roytman M. Hepatitis E infection: A review. *World Journal of Virology*. 2023;12(5):262–271. https://doi.org/10.5501/wjv.v12.i5.262.
3) Ouyang G, Pan G, Li Q, Li S, Liu Z. Global burden of acute hepatitis E between 1990 and 2019 and projections until 2030. *Liver International*. 2024;44(6):1329–1342. https://doi.org/10.1111/liv.15883.
4) Gholizadeh O, Akbarzadeh S, Hashemi MG, Gholami M, Amini P, Yekanipour Z, et al. Hepatitis A: Viral structure, classification, life cycle, clinical symptoms, diagnosis error, and vaccination. *Canadian Journal of Infectious Diseases and Medical Microbiology*. 2023;2023:4263309. https://doi.org/10.1155/2023/4263309.
5) Damme PV, Pintó RM, Feng Z, Cui F, Gentile A, Shouval D. Hepatitis A virus infection. *Nature Reviews Disease Primers*. 2023;9(1):51. https://doi.org/10.1038/s41572-023-00461-2.
6) Karasahin EF, Karasahin O. Hepatitis A seroprevalence and demographic risk factors in the susceptible population: a cross-sectional study. *European Review for Medical and Pharmacological Sciences*. 2023;27(11):4936–4941. https://doi.org/10.26355/eurrev_202306_32610.
7) Agarwal J, Srivastava S, Verma BP, Mehrotra P. Age group-specific assessment of changing seroepidemiology of hepatitis A virus infection in North India. *Cureus*. 2022;14(10):e30792. https://doi.org/10.7759/cureus.30792.
8) Kenney SP, Meng XJ. Hepatitis E virus genome structure and replication strategy. *Cold Spring Harbor Perspectives in Medicine*. 2019;9:a031724. https://doi.org/10.1101/cshperspect.a031724.
9) Pérez-Gracia MT, Suay-García B, Mateos-Lindemann ML. Hepatitis E and pregnancy: current state. *Reviews in Medical Virology*. 2017;27(3):e1929. https://doi.org/10.1002/rmv.1929.
10) Palewar MS, Joshi S, Choudhary G, Das R, Sadafale A, Karyakarte R. Prevalence of hepatitis A virus (HAV) and hepatitis E virus (HEV) in patients presenting with acute viral hepatitis: a 3-year retrospective study at a tertiary care hospital in Western India. *Journal of Family Medicine and Primary Care*. 2022;11(6):2437–2441. https://doi.org/10.4103/jfmpc.jfmpc_1746_21.
11) Jain RK, Shrivastava R, Jain SK, Chaurasia D, Jain A, Jain S, et al. Seropositivity and coinfection of hepatitis B and hepatitis C viruses in Central India: a hospital-based study. *Journal of Family Medicine and Primary Care*. 2024;13(10):4413–4418. https://doi.org/10.4103/jfmpc.jfmpc_202_24.
12) Rawat S, Gill PS, Gupta T, Malhotra P, Parmar A. Prevalence of hepatitis A virus and hepatitis E virus in patients presenting with acute viral hepatitis in Rohtak, Haryana, India. *International Journal of Research in Medical Sciences*. 2019;7(5):1792–1795. https://doi.org/10.18203/2320-6012.ijrms20191678.
13) Panda A, Jothi JB, Yadav P, Kumar S. Trends in seroprevalence of enteric transmitted hepatitis virus infections at a tertiary care hospital in Delhi: a 4-year review. *International Journal of Community Medicine and Public Health*. 2023;10(11):4280–4283. https://doi.org/10.18203/2394-6040.ijcmph20233463.
14) Lalwani S, Palkar S, SB, Kaur G, Mitra M, Deshmukh R, et al. Age-stratified prevalence of anti-hepatitis A virus antibodies in four metropolitan Indian cities and recent changes in Pune city. *Indian Journal of Gastroenterology*. 2025. https://doi.org/10.1007/s12664-025-01746-y.
15) Sasaki-Tanaka R, Kanda T, Yokoo T, Abe H, Hayashi K, Sakamaki A, et al. Hepatitis A and E viruses are important agents of acute severe hepatitis in Asia: a narrative review. *Pathogens*. 2025;14:454. https://doi.org/10.3390/pathogens14050454.
16) Tripathy AS, Sharma M, Deoshatwar AR, Babar P, Bharadwaj R, Bharti OK. Study of a hepatitis E virus outbreak involving drinking water and sewage contamination in Shimla, India, 2015–2016. *Transactions of the Royal Society of Tropical Medicine and Hygiene*. 2019;113(12):789–796. https://doi.org/10.1093/trstmh/trz072.
17) Jain RK, Jain A, Chaurasia D, Shrivastava R, Kapoor G, Perumal N, et al. A retrospective analysis on seroprevalence of acute viral hepatitis observed among dengue patients attending a tertiary care centre in Central India. *Indian Journal of Medical Microbiology*. 2024;49:100572. https://doi.org/10.1016/j.ijmmb.2024.100572.