

Research Article

Clinico-Epidemiological Status of Leptospirosis in Nainital District, Uttarakhand: A Retrospective Analysis of Routine Surveillance Data (2023–2025)

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DOI: <https://doi.org/10.24321/0019.5138.202649>

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How to cite this article:

Singh V, Pant H C, Kandpal M, Kashyap J P, Kandpal N K, Clinico-Epidemiological Status of Leptospirosis in Nainital District, Uttarakhand: A Retrospective Analysis of Routine Surveillance Data (2023–2025). J Commun Dis. 2026;58(3):13-17.

Date of Submission: 2026-05-02

Date of Acceptance: 2026-09-11

A B S T R A C T

Leptospirosis is an emerging zoonotic disease with increasing public health concern in India, especially in hilly and ecologically sensitive areas. The present study showed the current status, epidemiological patterns, risk factors and public health response to leptospirosis in the Nainital district, Uttarakhand. The study is based on surveillance data from the District Surveillance Unit and hospital-based reports from 2023 to 2025. Blood samples were collected from each febrile patient admitted to the hospital with clinical suspicion of leptospirosis or associated with infected animals or an environment contaminated with animal urine and processed for qualitative detection of leptospiral IgM antibody by ELISA. The total of 1557 blood samples screened for leptospirosis, out of which 193 (12.4%) were positive. A chi-square test was performed to compare positivity rates across the years 2023, 2024 and 2025. The overall positivity rate was 14.13% (39/276) in 2023, 16.19% (103/636) in 2024 and 7.91% (51/645) in 2025. The analysis showed a statistically significant difference among the three years ($\chi^2 = 21.19$, $df = 2$, $p = 0.000025$). In terms of age distribution, the present study revealed that the higher prevalence age group is 21-30 years, and in terms of gender distribution, females are slightly more highly infected (53%) with leptospirosis. The study underlines the need for integrated disease surveillance, early diagnostic interventions, public education, and intersectoral coordination to mitigate these zoonotic threats.

Keywords: Leptospirosis, Zoonotic Disease, Epidemiology, Disease Surveillance, ELISA, IgM Antibody, Febrile Illness, Uttarakhand, Emerging Infectious Diseases

Introduction

Leptospirosis is a zoonotic disease with epidemic potential. It is caused by the bacterium *Leptospira* spp. The disease is endemic in countries with humid subtropical, tropical and temperate climates. India is known for outbreaks of leptospirosis and has been documented in India since 1931. The disease is endemic in Kerala, Tamil Nadu, Karnataka, Gujarat, Maharashtra and the Andaman and Nicobar Islands. It has also been reported from Andhra Pradesh, Goa, Orissa, West Bengal, Uttar Pradesh, Delhi, Puducherry, Dadar & Nagar Haveli, Daman & Diu (Shivakumar S. 2008; Shukla et.al., 2022).^{1,2} Leptospirosis has been reported as a significant emerging and re-emerging disease by the World Health Organization (WHO). It widely spreads among humans and animals due to rapid ecological changes such as rapid urbanisation, poor sanitation, poor or improper waste management, poor surveillance programmes and control plans, and negligence of the disease (Karpagam and Ganesh 2020).³ They remain neglected even in the most endemic countries because of the lack of awareness, clinical suspicion, and absence of suitable diagnostic tools - effectively putting them in the category of Neglected Zoonotic Diseases (NZDs). Moreover, significant under-reporting and under-diagnosis of leptospirosis cases have been noticed (WHO 2011).⁴

Incidences of the presence of pathogenic leptospires have been reported in a variety of domestic or pet animals, such as dogs, cattle, horses, rats, and pigs, and also in several wildlife animals, including coyotes, sea lions, raccoons, opossums, bats, and white-tailed deer, and surprisingly in frogs and caimans (Costa et al., 2015; Khurana et al., 2016; Barragan et al., 2017).⁵⁻⁷ Rats, canines, buffaloes, and cattle are the hosts for leptospirosis (Rohilla et al., 2020).⁸ Humans or animals are infected accidentally by direct or indirect contact with leptospira-infected animals or contaminated water or urine (Dhanze et al., 2013; Bhatia et al., 2019).^{9,10} Infection is also possible by other methods, like handling clinically infected animal tissues, inhalation of droplets of urine and consuming contaminated food and water. Rodents, especially the common rat (*Rattus norvegicus*) are the most common host (WHO, 2018).¹¹ Certain serovars are linked with particular animal hosts, e.g., Icterohemorrhagiae with rats, canicola in dogs, and Hardjo in cattle (Dutta and Christopher 2005; Andre-Fontaine 2006).^{12,13}

The Nainital district of Uttarakhand has unique ecological and socio-economic features that provide a potentially conducive environment for the transmission of leptospirosis. The district is also characterised by high seasonal rainfall, and the diverse topography, agricultural methods, animal husbandry and the presence of rodent populations may increase the likelihood of human exposure to *Leptospira* -contaminated soil and water. Moreover, Nainital itself is

a major tourist destination with high seasonal population movement, which may increase the contact with contaminated environmental sources. Collectively, these factors call for enhanced surveillance and early detection of leptospirosis in the district. The present study showed the status of leptospirosis, a comparison of positivity rate in three years and revealed a decline of positivity rate due to improved surveillance, early detection of positive cases, public awareness and health interventions.

Materials and methods

The present study was done over three years (January 2023 to December 2025), and the data for the present study was collected from the District Surveillance Unit, IDSP, all health facilities and the Government Medical College of Nainital district. During the study period, blood samples were collected from all febrile patients attending the OPD and admitted in the hospital with clinical suspicion of leptospirosis i.e., acute febrile illness with headache, myalgia, prostration, jaundice, haemorrhagic manifestations, meningeal irritation, nausea, vomiting, abdominal pain, and diarrhoea associated with a history of exposure to infected animals or an environment contaminated with animal urine, and processed for qualitative detection of leptospiral IgM antibody by using the Panbio *Leptospira* IgM ELISA (enzyme-linked immunosorbent assay) kit. Testing was performed at the Viral Research and Diagnostic Laboratory (VRDL), Department of Microbiology, Medical College, and at the Pathology Laboratories of the health facilities. These serologically confirmed patients of leptospirosis were evaluated by their clinical history, presentation and laboratory parameters. National case definition was applied, based on the NCDC/MoHFW National Guidelines for Diagnosis, Case Management, Prevention and Control of Leptospirosis. The data obtained were analysed using descriptive statistics. The chi-square test was used to find out the p-values of the results; a p-value < 0.05 was considered significant.

Result

This retrospective study showed the comparison of leptospirosis cases over the last three years (2023 to 2025) in Nainital district. The total of 1557 blood samples screened for leptospirosis, out of which 193 (12.4%) were positive. In 2023 a total of 39 cases were recorded, whereas in 2024 a total of 103 cases and in 2025 a total of 51 cases were recorded (Fig. 1 & Table 1).

In terms of age group, the distribution of IgM-positive cases by age group is of 18-25 years with 34 cases (18%) and 26-30 years with 27 cases (14%) out of 193 cases. In terms of sex-specific distribution among IgM-positive cases, out of 193 cases (Fig. 2), 91 were males (47%) and 102 were females (53%) (Fig. 3).

A chi-square test was performed to compare positivity rates across the years 2023, 2024 and 2025. The overall positivity rate was 14.13% (39/276) in 2023, 16.19% (103/636) in 2024 and 7.91% (51/645) in 2025. The analysis showed a statistically significant difference among the three years ($\chi^2 = 21.19$, $df = 2$, $p = 0.000025$). Since $p < 0.05$, there is a statistically significant declining trend in monthly leptospirosis positivity from 2023 to 2025. This means, on average, the positivity rate decreased by about

0.36% per month. The decline of positive cases in 2025 is consistent with the overall fall pattern. In August 2023 and August-September 2024 there is a marked positivity peak. Conversely, in 2025, there was no strong late monsoon peak, and the positivity remained relatively lower in the corresponding period. The results suggest a temporal association with increased leptospirosis positivity during the monsoon season, especially in the years 2023 and 2024. This decrease in 2025 is attributed to early diagnosis, improved surveillance and awareness of the public.

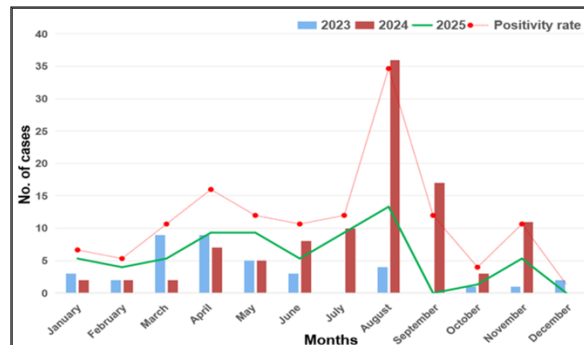


Figure 1.Monthly variation of leptospirosis positive cases in Nainital District (2023 to 2025)

Table 1.Annual variation of sample tested, positives, negatives and positivity rate of leptospirosis cases in Nainital District (2023 to 2025)

Year	Samples Tested	Positives	Negatives	Positivity rate
2023	276	39	237	14.13%
2024	636	103	533	16.19%
2025	645	51	594	7.91%
Total	1557	193	1364	12.40%

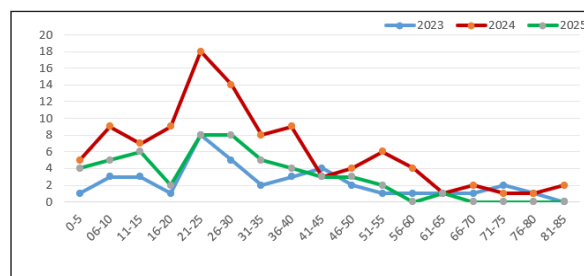


Figure 2.Age group distribution of leptospirosis positive cases in Nainital District (2023 to 2025)

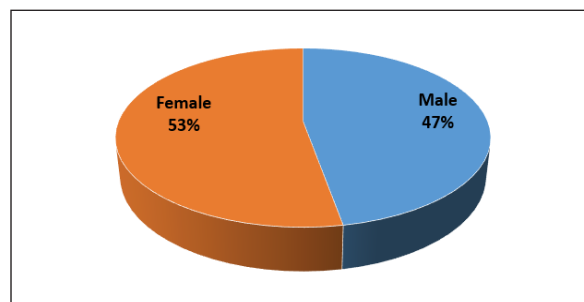


Figure 3.Gender-specific distribution of leptospirosis positive cases in Nainital District (2023 to 2025)

Discussion

The present study showed the comparison of leptospirosis cases from 2023 to 2025. In 2024 the positivity rate increased, particularly during monsoon season, relevant to the known relationship between rainfall and leptospirosis transmission. Heavy rainfall and flooding greatly enhance the chance of contracting leptospirosis, which is closely linked to environmental exposure to water contaminated with animal urine. According to a study from India, the leptospirosis incidences usually increase during and after the monsoon because of waterlogging and the highest human exposure (Charles et.al., 2023).¹⁴ Similarly, a review study of leptospirosis from India revealed that the peak of monsoon season i.e., from July to October, comprises a significant number of cases due to flooding, stagnant water and exposure to rodent (Gupta et.al, 2023).¹⁵

On the other hand, the decline in positivity rate in 2025 indicates the potential impact of enhancing public health interventions. Furthermore, timely public health interventions, such as risk communication about risk and environmental management, are essential for controlling outbreaks, particularly within endemic areas (Antima and Banerjee, S. 2025).¹⁶ In terms of age distribution, the observations of the present study revealed that the higher prevalence age group is 21-30 years, which complies with previous studies. Leptospirosis primarily impacts those individuals who are more susceptible to contaminated environments due to occupational or outdoor activities. Studies conducted in India indicates that professions like agriculture, sewage management and labour-intensive tasks are significant risk factors owing to regular exposure to contaminated water and soil (Gupta et.al., 2023).¹³

In terms of gender distribution, the present study revealed that females accounted for a slightly larger proportion of positive cases (53%) with leptospirosis. In rural areas of Nainital district, most females work in fields and go to the forest to collect fodder for domestic animals, due to which they face more exposure. This could be one of the reasons for the slightly high infection in females in the present study. Josua et. Al., 2026.¹⁷ also showed the positivity rates in females slightly higher than in males. On the other hand, many studies showed higher incidence in males due to occupational exposure (Skufca J. and Arima Y. 2012).¹⁸ Risk is primarily influenced by exposure pattern rather than biological variations, which could be explained by shifting responsibilities in rural and suburban environments (Delight et., al, 2024).¹⁹

The effectiveness of continuous intervention is further supported by the observed falling monthly trend (approximately 0.36% drop every month). Compared to 2023 and mid-2024, there were no significant peaks in 2025, indicating better epidemic preparedness and response.

Environmental research has also demonstrated that better sanitation, surveillance and early intervention techniques may drastically decrease monsoon driven infection such as leptospirosis.

Conclusion

The study concludes that the higher positive rate during monsoon is in line with the known association of rainfall, waterlogging, flooding and increased exposure to contaminated water with animal urine with the environment. The highest positivity was observed in the age group of 21-30 years, indicating the possible role of occupational and outdoor environmental exposure. The slightly higher positivity in females could be due to the differences in exposure patterns, especially among women involved in agriculture and other domestic work in rural areas. The study showed that a significant decline in the leptospirosis positivity rate in the year of 2025 after a peak in the year of 2024 is due to improved surveillance, early detection of positive cases, public awareness and health interventions. The study revealed that maintaining and strengthening this reduction of positivity trend will need consistent efforts in environmental management, active surveillance of positive cases and public awareness.

Ethics statement

This study was based on routine programme data collected through public health surveillance under the Integrated Disease Surveillance Programme (IDSP), supplemented by hospital records from the Office of the Chief Medical Officer, Nainital, obtained with administrative permission from the Chief Medical Officer, Nainital.

Limitations

The study was based on hospital-based passive surveillance data; therefore, mild, asymptomatic, undiagnosed, and non-healthcare-seeking cases may have been missed, and under-reporting cannot be excluded. Diagnosis was based on IgM ELISA alone without confirmatory molecular or culture-based testing. Clinical severity, complications, and organ involvement were not analysed. Additionally, mortality and mortality patterns were not assessed; therefore, the study does not provide information on case-fatality or mortality-associated factors.

Acknowledgement: We are thankful to Dr Harish Chandra Pant, Chief Medical Officer, District Nainital, for giving us the opportunity to carry out the study. We are also thankful to the Director, Health Services, Uttarakhand, for providing all logistic and administrative support during the study.

References

1. Shivakumar S. Leptospirosis-current scenario in India. Medicine update. 2008;18. [Google Scholar]

2. Shukla S, Mittal V, Karoli R, Singh P, Singh A. Leptospirosis in central & eastern Uttar Pradesh, an underreported disease: A prospective cross-sectional study. *The Indian journal of medical research*. 2022 Jan;155(1):66. [Google Scholar] [PubMed]
3. Karpagam KB, Ganesh B. Leptospirosis: a neglected tropical zoonotic infection of public health importance—an updated review. *European Journal of Clinical Microbiology & Infectious Diseases*. 2020 May;39(5):835-46. [Google Scholar] [PubMed]
4. Choudhary S, Choudhary RK, Kumar M, Singh S, Malik YS. Epidemiological Status of Leptospirosis in India. *Journal of Pure & Applied Microbiology*. 2023 Dec 1;17(4):1968. [Google Scholar]
5. Costa F, Wunder Jr EA, De Oliveira D, Bisht V, Rodrigues G, Reis MG, Ko AI, Begon M, Childs JE. Patterns in *Leptospira* shedding in Norway rats (*Rattus norvegicus*) from Brazilian slum communities at high risk of disease transmission. *PLoS neglected tropical diseases*. 2015 Jun 5;9(6):e0003819. [Google Scholar] [PubMed]
6. Khurana SK, Kuldeep Dhama KD, Minakshi P, Baldev Gulati BG, Malik YS, Kumaragurubaran Karthik KK. Leptospirosis in horses: special reference to equine recurrent uveitis. [Google Scholar]
7. Barragan V, Nieto N, Keim P, Pearson T. Meta-analysis to estimate the load of *Leptospira* excreted in urine: beyond rats as important sources of transmission in low-income rural communities. *BMC research notes*. 2017 Jan 28;10(1):71. [Google Scholar] [PubMed]
8. Rohilla P, Khurana R, Kumar A, Batra K, Gupta R. Detection of *Leptospira* in urine of apparently healthy dogs by quantitative polymerase chain reaction in Haryana, India. *Veterinary World*. 2020 Nov 12;13(11):2411. [Google Scholar] [PubMed]
9. Himani D, Suman MK, Mane BG. Epidemiology of leptospirosis: an Indian perspective. *J Foodborne Zoonotic Dis*. 2013 Jul;1(1):6-13. [Google Scholar]
10. Bhatia M, Kumar P, Gupta P, Gupta PK, Dhar M, Kalita D. Serological evidence of human leptospirosis in patients with acute undifferentiated febrile illness from Uttarakhand, India: A pilot study. *Journal of Laboratory Physicians*. 2019 Jan;11(01):011-6. [Google Scholar] [PubMed]
11. World Health Organization. Report of the second meeting of the leptospirosis burden epidemiology reference group. [Google Scholar]
12. Dutta TK, Christopher M. Leptospirosis-an overview. *JOURNAL-ASSOCIATION OF PHYSICIANS OF INDIA*. 2005;53(N):545. [Google Scholar] [PubMed]
13. Andre-Fontaine G. Canine leptospirosis—Do we have a problem?. *Veterinary microbiology*. 2006 Oct 5;117(1):19-24. [Google Scholar] [PubMed]
14. Charles, M.V.P., Kali, A.,Vidyalakshmi, S.(2023).Impact of Monsoon on the Pattern of Infectious Diseases in the Indian Setting- A Review. *Journal of Clinical and Diagnostic Research*.Vol-17(4): DE01-DE05.
15. Gupta N, Wilson W, Ravindra P. Leptospirosis in India: a systematic review and meta-analysis of clinical profile, treatment and outcomes. *Le infezioni in medicina*. 2023 Sep 1;31(3):290. [Google Scholar] [PubMed]
16. Antima, Banerjee S. Understanding the dynamics and drivers of leptospirosis in tropical and subtropical regions: a mathematical and epidemiological approach: Antima, S. Banerjee et al. *Nonlinear Dynamics*. 2025 May;113(9):10705-27. [Google Scholar]
17. Joshua V, Dhanapaul S, Shanmugam P, Appadurai M. Comparative Evaluation of Serological and Molecular Techniques for the Diagnosis of Leptospirosis in a Tertiary Care Centre. *J Commun Dis*. 2026;58(2):9-16.
18. Skufca J, Arima Y. Sex, gender and emerging infectious disease surveillance: a leptospirosis case study. *Western Pacific surveillance and response journal: WPSAR*. 2012 Aug 2;3(3):37. [Google Scholar] [PubMed]
19. Delight EA, DCdC S, Palma FA, de Oliveira D, Souza FN, Santana JO, Hidano A, YA AL, Reis MG, Ko AI, Marphatia AA. Gender differences in the perception of leptospirosis severity, behaviours, and *Leptospira* exposure risk in urban Brazil: a cross-sectional study. [Google Scholar]