



Analysis of Trend and Distribution of Infectious Disease Outbreaks in the Indian Himalayan Region over a Period of 12 Years (2009-2021)

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ABSTRACT

The Indian Himalayan Region (IHR) is endemic to various infectious diseases. More recently, the phenomenon of climate change has further escalated the problems in these regions by causing rapid and complex developmental challenges. Climate change has also affected the intensity and distribution of infectious diseases in this region. Objectives: The objective of this study is to analyse the trend and distribution of infectious diseases in the IHR region from 2009 to 2021.

Methods: Findings were focused on the 13 IHR states/union territories of India. The key variables for analysis of infectious disease outbreaks were collected from the Weekly Outbreak reports of the Integrated Disease Surveillance Program (IDSP) from June 2009 to August 2021.

Results: The study found that there is an increase in the trend of infectious disease outbreaks in the Indian Himalayan region. The highest outbreak was reported for Acute Diarrhoeal Disease followed by Food poisoning and Chickenpox. Among those reported, zoonotic diseases included Rabies, Leptospirosis and Scrub typhus. Avian influenza outbreak causing cases and deaths in birds was reported. Based on the mode of transmission, food and water-borne diseases are seen to be reported the highest in the Indian Himalayan Region, followed by Airborne and vector-borne diseases.

Conclusion: There is an increase in the trend of infectious disease outbreaks in the IHR. The mode of transmission of these outbreaks varies for the states which will help understand the situation specific to this region and tailor interventions according to the needs and findings of each state.

Keywords: Indian himalayan region; Infectious disease outbreaks; Trend

INTRODUCTION

The Indian Himalayan Region (IHR) is spread across 13 Indian States/Union Territories namely Jammu and Kashmir, Ladakh, Uttarakhand, Himachal Pradesh, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, Assam (Cachar and Karbi Anglong), West Bengal (Darjeeling) [1]. Nearly 50 million people reside in this region, covering about 5.3 lakh km² geographical area and comprises the vast mountain range extending over 2,500 km in length between the Indus and the Brahmaputra river systems. This region is characterized by a diverse demographic, and versatile economic, environmental, social and political systems. Despite mountainous terrain, the IHR region is endemic to various infectious diseases.

Among the states in this region, Uttarakhand, Arunachal Pradesh, Assam and the northern districts of West Bengal report outbreaks of various vector-borne diseases including malaria, JE, dengue,

etc. Further, outbreaks of diarrhoea, lower respiratory infections and other food and water-borne diseases are also reported in the states of Manipur, Meghalaya, Nagaland, etc. These infectious diseases result in diverse consequences of mortality and morbidity along with complex social and economic outcomes adding to the difficulties faced by the people living in the IHR where living conditions are already extreme.

More recently, the phenomenon of climate change has further escalated the problems in these regions by causing rapid and complex developmental challenges. Climate change has also affected the intensity and distribution of infectious diseases in this region [2]. Therefore, this study discusses the trend and distribution of infectious diseases in the IHR region which will help us understand the situation specific to this region and tailor the interventions according to the needs and based on the findings from each state (Figure 1).

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MATERIALS AND METHODS

Findings were focused on the 13 IHR states/union territories of India. The key variables for analysis of infectious disease outbreaks were collected from the Weekly Outbreak reports of the Integrated Disease Surveillance Program (IDSP) from June 2009 to August 2021 [3].

Secondary Data analysis of infectious disease outbreaks was done in the thirteen IHR states/union territories of India. The key variables recorded were (a) the date of the outbreak (b) the state and district where the outbreak occurred (c) disease reported (d) the number of cases and deaths reported during the outbreak.

This data was collected and entry was done using a preformed data entry template designed on Microsoft excel. The trend lines were also plotted using Microsoft Excel. The findings were interpreted logically along with simple graphs, tables and charts.

RESULTS

Overview of outbreaks

Over a period of 12 years (2009-2021), a total of 1277 outbreaks of infectious disease were reported in the IHR region, affecting a total of 82,770 cases and resulting in 545 deaths. The highest percentage of outbreaks was reported in J&K (33%) followed by Uttarakhand (17.5%) and Arunachal Pradesh (12.6%) (Figure 1).

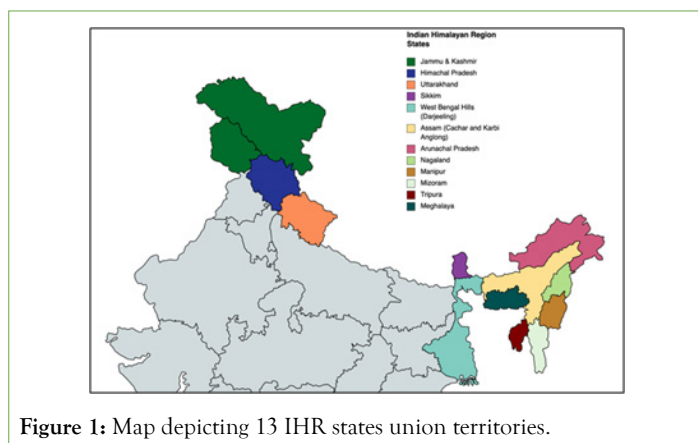


Figure 1: Map depicting 13 IHR states union territories.

Trend of Infectious disease outbreaks in the IHR

The trend of outbreaks has been increasing over the years from 2008 to 2021. The highest number of outbreaks was reported in 2019 and the lowest in 2020 (Figure 2).

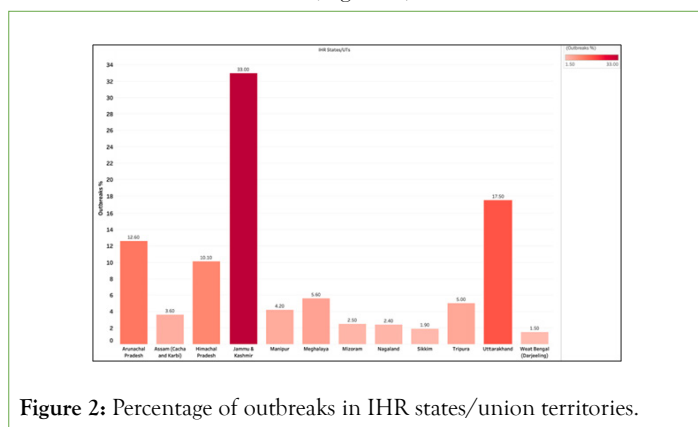


Figure 2: Percentage of outbreaks in IHR states/union territories.

Overview of cases

The highest percentage of cases was reported in J&K (34%) followed

by Himachal Pradesh (Figure 3).

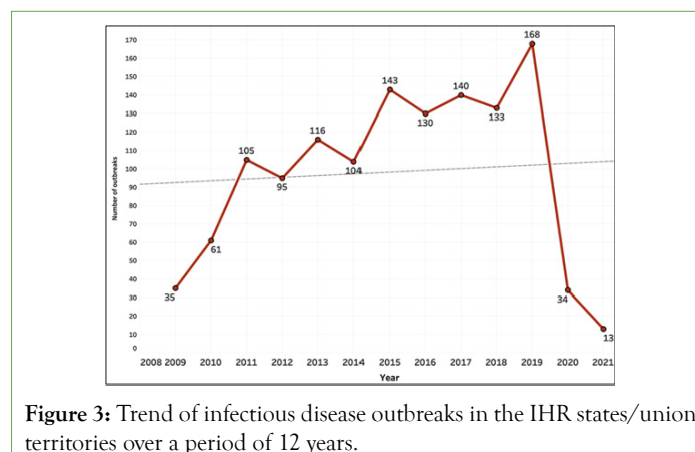


Figure 3: Trend of infectious disease outbreaks in the IHR states/union territories over a period of 12 years.

Overview of deaths

The highest percentage of deaths was reported in Tripura (22%) followed by Manipur and Meghalaya (14.3%) and Uttarakhand (13.4%) (Figure 4).

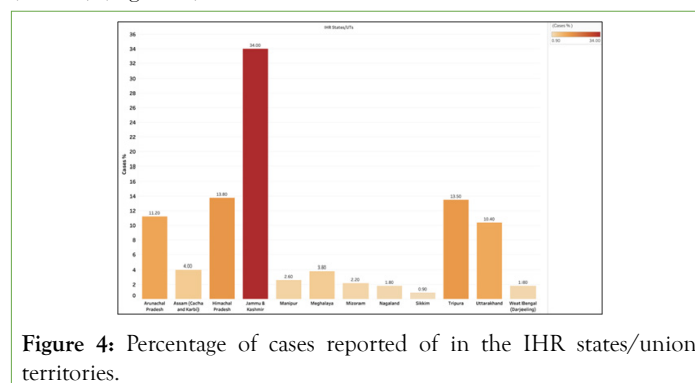


Figure 4: Percentage of cases reported of in the IHR states/union territories.

Among the 1277 outbreaks, a total of 69 diseases were reported however 12 were suspected diseases and not the final diagnosis. Most of the diseases reported only 1 outbreak in the 12 years. The highest outbreak was reported for Acute Diarrhoeal Disease (24%) followed by food poisoning (10.4%) and chickenpox (9.7%) (Table 1).

Distribution of disease based on the mode of transmission

The diseases were then divided into different categories based on the mode of transmission. The categories were; airborne, air droplet, blood/sexual/mother to child, foodborne, food waterborne, vector-borne, waterborne, zoonotic and unknown. Among these categories, food/waterborne disease type was the highest reported followed by airborne and vector-borne diseases (Figure 5).

State-wise distribution of outbreaks

The below figures depict the disease types for each of the states/union territories of the Indian Himalayan Region. Seven states namely, Himachal Pradesh, Jammu and Kashmir, Mizoram, Meghalaya, Tripura, Uttarakhand and West Bengal represent food and waterborne diseases the most. Assam, Manipur and Nagaland represent vector-borne disease outbreaks the most. Sikkim and Arunachal Pradesh reported airborne disease outbreaks the most (Figure 6).

Epizootic outbreak reported

In the state of J&K, Udhampur district, cases and death of Birds was reported. A total of 425 bird deaths were reported in January 2021 (Table 2) (Figure 7).

Table 1: Diarrhoeal diseases and final diagnosis diseases in the outbreaks.

Diseases reported in the outbreaks		
Acute Diarrhoeal Disease	Hepatitis E	Measles
Food Poisoning	Influenza Type B	Acute Gastroenteritis
Chickenpox	Mumps	Hepatitis B
Enteric Fever	Jaundice	Acute Viral Conjunctivitis
Hepatitis A	Hand, foot and mouth disease	Pertussis
Acute Respiratory Infection	Dengue	Malaria
Fever with rash	Viral Fever	Trichinellosis
Influenza H1N1	Acute Viral Hepatitis	Hepatitis
Upper Respiratory tract infection	Japanese Encephalitis	Hepatitis C
Fever	Rubella	Trichinella
ARI H3N2	PUO	Acute Encephalitis Syndrome
Typhoid		Acute Flaccid Paralysis
Chikungunya	Cholera	Acute Respiratory Illness
Shigellosis	Leptospirosis	Dysentery
Scrub Typhus	Dengue & JE	Dog Bite
Rabies	Diphtheria	Bacillary Dysentery
Cholera (Classical)	Acute Meningitis	
Mushroom Poisoning	Meningococcal Meningitis	
Suspected Enteric Fever	Suspected Pertussis	
Suspected Diphtheria	Suspected Typhoid	
Suspected Seasonal Influenza	Suspected Enteric Fever	
Suspected Meningitis	Suspected Enteric Fever	
Suspected Typhoid Fever	Suspected Measles	
Suspected Enteric Fever	Suspected Mumps	
Suspected Enteric Fever	Suspected Dengue	

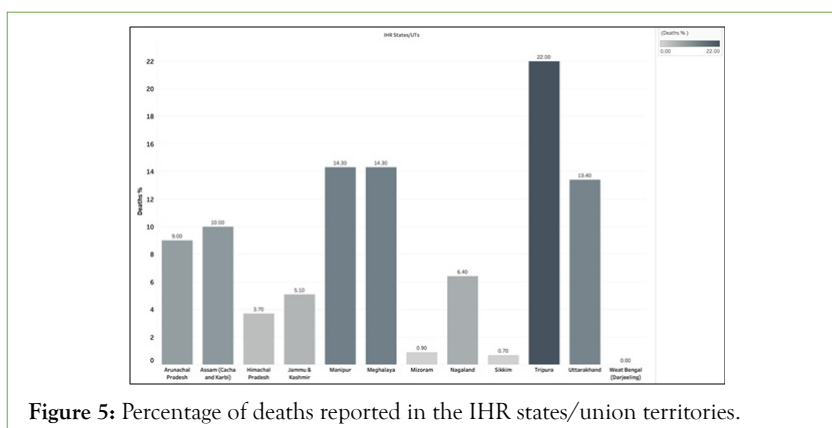


Figure 5: Percentage of deaths reported in the IHR states/union territories.

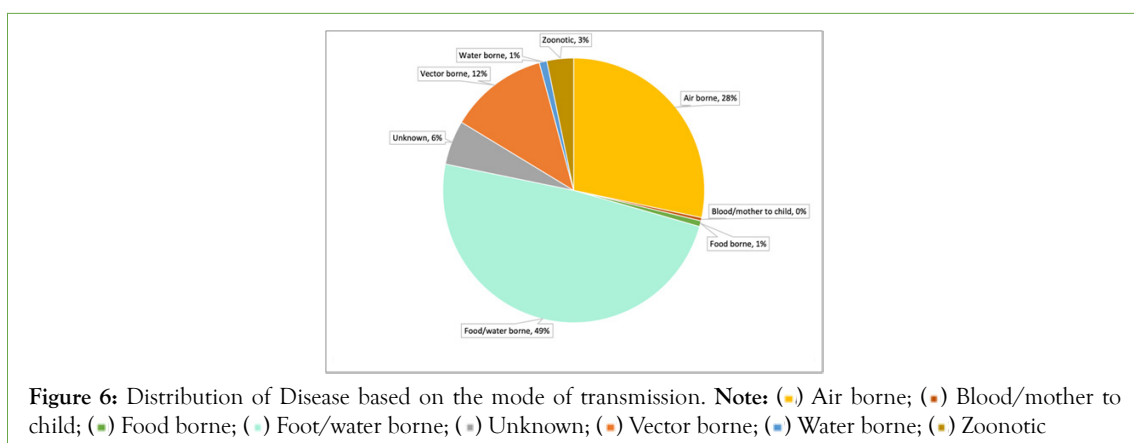
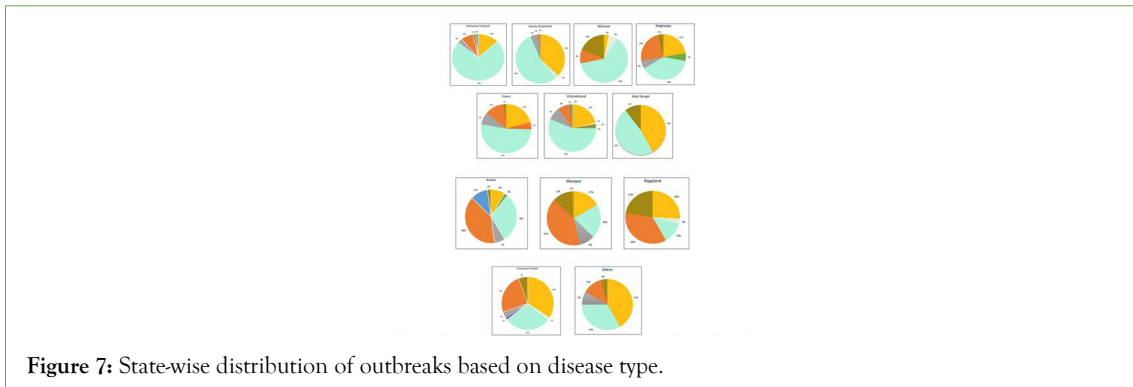


Figure 6: Distribution of Disease based on the mode of transmission. **Note:** (●) Air borne; (●) Blood/mother to child; (●) Food borne; (●) Foot/water borne; (●) Unknown; (●) Vector borne; (●) Water borne; (●) Zoonotic

Table 2: State of Jammu & Kashmir, Udhampur district, cases and death of Birds was reports.

Epizootic outbreak reported						
Year	Month	State	District	Disease/Illness	No of cases	No of deaths
2021	January	Jammu & Kashmir	Udhampur	Avian Influenza	3 birds	425 birds



DISCUSSION

There is an increase in the trend of infectious disease outbreaks in the Indian Himalayan region. The lowest number of outbreaks was reported in the years 2020 and 2021. However, it should be noted that during 2020, due to the on-going pandemic, surveillance was focused more on COVID-19 outbreaks which might have resulted in the lower number of other outbreaks being reported in these years [4].

The highest outbreak was reported for Acute Diarrhoeal Disease followed by Food poisoning and Chickenpox. Among those reported, zoonotic diseases included Rabies, Leptospirosis and Scrub typhus. Another interesting finding was that of an epizootic outbreak of Avian influenza outbreak causing cases and deaths in birds was reported. One survey for Avian Influenza, which involved Jammu and Kashmir along with other states suggested that there was no full proof of evidence that migratory birds are carriers of avian influenza and very unlikely to spread because of wild birds. Hence, further consideration is required in this aspect like long-term monitoring of migratory bird population in the wetlands and studies involving serum collection for Avian Influenza for selected species. Such measures will provide the baseline information regarding the spread of avian influenza and help implement measures to control the outbreak and ensure the conservation of the bird species [5].

Based on the mode of transmission, food and water-borne diseases are seen to be reported the highest in the Indian Himalayan Region, followed by Airborne and vector-borne diseases. This could be due to associations with climatic factors such as temperature, precipitation, humidity, etc. Majority of studies show significant positive associations of vector-borne diseases with climatic factors. One such study identified that infectious diseases have expanded their geographical ranges over the years, especially in the highlands of the Himalayan region [6].

The occurrence of food and waterborne diseases can be reduced by raising awareness and knowledge regarding WASH (water, sanitation and hygiene) practices, hand washing techniques and other measures that should be prioritized. Similarly, for airborne diseases which include measles and chickenpox, immunization coverage should be increased along with the provision of booster doses and conducting regular vaccination drives in the region.

In order to control vector-borne diseases, measures like the provision and supply of mosquito repellent creams, liquids, coils, insecticide sprays and provision of bed nets can be ensured. Outbreak surveillance and control measures should also be enhanced in these states. More focus should also be given to the area of outbreak surveillance in animals.

CONCLUSION

Strengthening of surveillance, developments in health facilities and interventions to manage and control infectious diseases must continue in this region. To increase the efficacy of prevention and control strategies, it is essential to understand the current state and distribution of diseases in particular areas so that interventions can be tailored and personalized to the region's specific context.

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