



Seasonal Variations of Acute Diarrheal Disease Outbreaks in India (2010 – 2018)

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Received: May 28, 2019; **Published:** June 20, 2019

Abstract

During diarrhea, a patient will have a frequent abnormal passage of loose, liquid or watery stools and causes depletion of body fluids, resulting in profound dehydration. Acute diarrhea refers to the episodes of infectious diarrhea, which have a rapid onset and lasts for about 3 to 7 days but may last up to 10 to 14 days. When two or more people in a community or geographical area have a similar illness or proven infection due to common exposure then it is termed as an outbreak. Variations in weather and climate conditions will influence the intensity of disease outbreaks and thus understanding the influence of the seasons on the infectious disease outbreaks is very important for public health monitoring. The objective of this study is to understand the seasonal variations of the acute diarrheal disease (ADD) outbreaks in India. We analyzed the weekly ADD outbreaks data from 2010 till 2018 that is published as a part of the Integrated Disease Surveillance Programme by National Centre for Disease Control, Directorate General of Health Services. The results of the analysis show that in India, ADD outbreaks will be more during the month of May (peak summer) but predominantly maximum during the month of July (when monsoon prevails)

Keywords: Acute Diarrheal Diseases; Outbreaks; Seasonal Variation; India; Public Health

Introduction

Hippocrates wisdom conveys that the weather and climate are dominant public health influencing factors. Occurrence and severity of infectious diseases are highly correlated with unusual or extreme climatic conditions [1]. Works done by Ballester, *et al.* strongly suggests that seasonal variations should be considered as prime factor when analyzing the public health [2].

Diarrheal diseases remain a leading cause of preventable death and responsible for enormous health problems worldwide [3]. The annual economic impact of the diarrheal diseases will be in the order of billions of dollars, low productivity, and very high utilization of health resources to treat diarrheal diseases. During diarrhea, a patient will have a frequent abnormal passage of loose, liquid or watery stools and causes depletion of body fluids, result-

ing in profound dehydration. Acute diarrhea refers to the episodes of infectious diarrhea, which have a rapid onset and lasts for about 3 to 7 days but may last up to 10 to 14 days. The aetiology of acute diarrheal diseases contains causative agents like viruses, bacteria, and parasitic (protozoan and helminths) [4]. Smith, *et al.* reported that Diarrheal diseases up to 86 per cent affect young children and are related mostly with the environmental factors like poor sanitation, hygiene, and access to clean water/food [5]. Most of diarrheal transmissions are due to faecal-oral transmission.

The epidemiological profiles of India reported by various researches in health sectors has drawn the conclusion that diarrheal diseases have been a major problem right from the independence era and continue to remain the same till date. Troeger, *et al.* estimated and confirmed that diarrheal burden is very high in India

[3]. Recently, scholars have estimated diarrheal diseases burden in India and shown with evidence that there is glaring dent in gross domestic product (GDP) due to diarrheal diseases [7,8].

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Materials and Methods

To achieve the objective, i.e., to derive the seasonal variation of ADD outbreaks in India, we analyzed the weekly ADD outbreaks data from 2010 till 2018 that is published as a part of the Integrated Disease Surveillance Programme (IDSP). IDSP is maintained by the National Centre for Disease Control (NCDC) which works under Directorate General of Health Services, Ministry of Health & Family Welfare. IDSP is responsible to report weekly surveillance across India for outbreaks of epidemic-prone diseases. The portal is accessible to the public at <https://idsp.nic.in>. IDSP with its 15 years of implementation has given a boost in analyzing the nature of public health and enables addressing important questions in public health and biomedical sciences.

Earlier publications has earlier discussed about IDSP in detail [9,10]. Debnath and Ponnaiah have reported the improved timeliness nature of reporting acute diarrhoeal diseases (ADD) outbreaks under IDSP [11].

The weekly outbreaks data from IDSP where ingested in a Geographic Information System (GIS) and analysis has been performed. During this period a total of 4088 ADD outbreaks in India were reported in the IDSP in the span of nine years.

Results and Discussion

States like Karnataka, Maharashtra, West Bengal, and Madhya Pradesh ranks the top list of maximum number of ADD outbreaks. These four states accounts for 36 per cent of total ADD outbreaks in the country. Six districts of West Bengal were categories in top ten districts that are acting as hotspots for ADD outbreaks. Table 1 represents the highlights of the assessment of the ADD outbreaks occurred between 2010 and 2018.

In the North-eastern part of India, states like Manipur, Meghalaya, Mizoram, Sikkim, Tripura, and Nagaland recorded very few instances of ADD outbreaks. Similarly East Kameng in Arunachal

Pradesh reported high frequency of ADD outbreaks during 2010 and 2015, but in recent times it appears to be in well controlled situation. But the ADD outbreaks situation in Assam is alarming and the reason for this may be attributed to frequent floods due to Brahmaputra River.

Highlight	Remark
Outbreaks with most number of cases	<ul style="list-style-type: none"> • ADD outbreak occurred during 11th-17th August, 2014 (33rd week report) with 1496 cases in Kupwara district of Jammu and Kashmir • ADD outbreak occurred during 30th August to 5th September 2010 (36th week) reported 1388 cases in Doda district of Jammu and Kashmir • ADD outbreak occurred during 23rd-30th May, 2010 (22nd week) with 784 cases in Jind district of Haryana
Top five states with more number of ADD outbreaks	<ul style="list-style-type: none"> • Karnataka • Maharashtra • West Bengal • Madhya Pradesh • Gujarat
Top ten districts acting as hotspots for ADD outbreaks	<ul style="list-style-type: none"> • Burdwan (West Bengal) • Bankura (West Bengal) • Chittor (Andhra Pradesh) • Purulia (West Bengal) • Khargon (Madhya Pradesh) • Kadapa (Andhra Pradesh) • Hassan (Karnataka) • Janjgir (Chattisgarh) • North 24 Paragans (West Bengal), Hooghly (West Bengal), and Surat (Gujarat) • West Medinapur (West Bengal) and Jalpaiguri (West Bengal)

Table 1: Significant highlights of the Acute Diarrheal Disease (ADD) outbreaks reported from the year 2010 till 2018.

In the Himalayan region, districts like Baramulla and Kupwara were acting as hotspots for ADD outbreaks in Jammu & Kashmir. Similarly, Mandi district in Himachal Pradesh is acting as ADD outbreak hotspot. Minimum outbreaks (of the order 5 to 10 only) were reported in the tourist places like Nainital (Uttarakhand),

Andaman, Kullu, Goa, Leh, and others during 2010 and 2018. This ensures that administrators have taken necessary precautions in making availability of sanitation and hygienic environment at the important tourist spots.

Figure 1 (top) shows the trend of ADD outbreaks from 2010 till 2018. The trend clearly represents that during the month of July the ADD outbreaks was in peak condition for all the years. Figure 1 (down) shows the generalized trend of ADD outbreaks from the year 2010 till 2018 in India from January to December. From the synthesis of ADD outbreaks it observed that 55 to 60 per cent of outbreaks have occurred during the months of May, June, July, and August. The first upsurge of ADD outbreaks is observed during the month of May and the second upsurge is observed during the July. In India, peak summer and pre-monsoon changes will occur in the month of May and June respectively. Monsoon or rainy seasons will be predominant during the months of July and August.

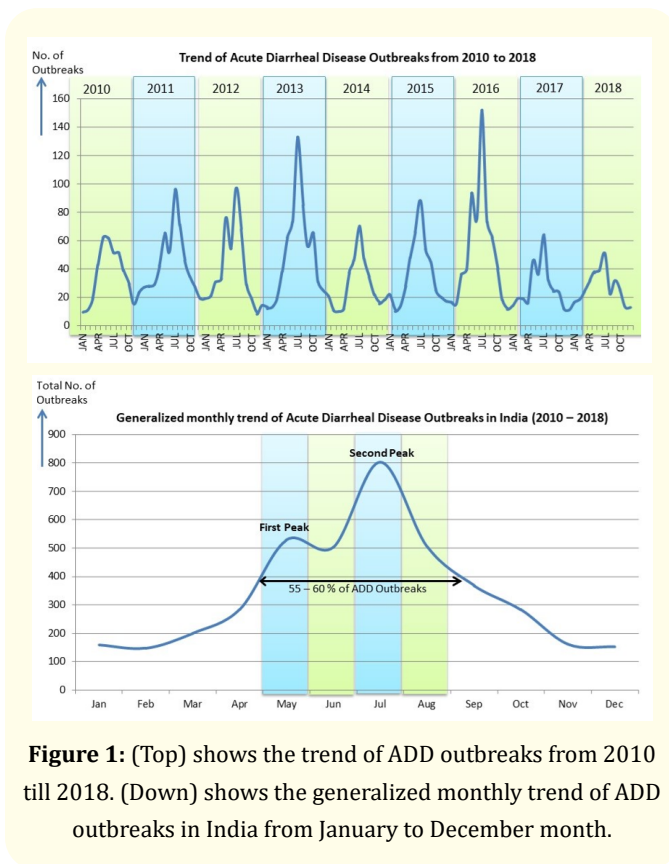


Figure 1: (Top) shows the trend of ADD outbreaks from 2010 till 2018. (Down) shows the generalized monthly trend of ADD outbreaks in India from January to December month.

Exploring the seasonality of diarrhoeal diseases helps in future control and prevention programs that can be implemented by the Governments. Seasonal variation of the outbreaks is a subject of epidemiological phenomena because weather parameters like temperature, humidity, wind-speed, wind-direction and other fac-

tors have their influence on the lifecycle, survival, and population of virus, bacteria, and protozoa.

Conclusion

Distinct seasonal patterns of diarrhea will occur as per the countries climatic conditions. Scholars described the seasonality of diarrhea in China exhibits two peaks every year, one during fall winter seasons and other peak at summer [12,13]. Diarrheal cases were found substantially higher in summer for most part of Nepal region [14]. Literature study affirms two peaks of diarrheal diseases for Gambia country, one during summer rains and the other at winter [15].

Works done by Kumar, *et al.* reported about Viral Hepatitis situation in India with the help of IDSP reports [10]. Kadri, *et al.* Utilized IDSP records from the year 2006 till 2016 and reported the diseases surveillance situation in Kashmir region [16]. Pathak, *et al.* used the field level data from two hospitals and concluded that during the summer and rainy season the probability of diarrheal diseases is higher for part of Ujjain region [17].

Observations that derived in this article strengthens that in India the ADD outbreaks are predominant during the peak summer and till monsoon seasons. Two peaks were observed in the trend of ADD outbreak in India. The first upsurge is in the month of May and the second peak is observed during the month of July. The reasons for these two upsurges of the outbreaks may be because of the season changes and its implications on the public resistivity to the diseases. Peak summer and the onset of rainy seasons may impact the survival conditions and activity of agents of the disease

In this article IDSP weekly reports that are made available in the web portal for public access have provided a better platform for analyzing the seasonal dependency of the outbreaks. IDSP acts as a ready reckoner for analyzing the pattern of the outbreaks in India by enabling with necessary information which will be useful to the policy makers and administrators to circumvent the effect of morbidity and mortality due to outbreaks. Analyzing the nine years ADD outbreak records confirms the two peak trend of diarrheal diseases in India.

Acknowledgements

Deep gratitude is expressed by the authors to Dr. Kuldeep Singh, Dean (Academics), AIIMS, Jodhpur, India and Shri. Santanu Chowdhury, Director, National Remote Sensing Centre, Hyderabad, India for their valuable guidance and also for providing facilities to carry out research and developmental projects in the area of heterogeneity with Geospatial Technology and Public Health. The authors are

also thankful to Prof. Gollapalli Nageswara Rao, Vice Chancellor, Andhra University, Visakhapatnam, India for his motivation and encouragement.

Conflicts of Interest

There are no conflicts of interest with respect to this study.

Bibliography

1. Falagas Matthew E., *et al.* "Unusual climatic conditions and infectious diseases: observations made by Hippocrates". *Enfermedades infecciosas y microbiología clínica* 28.10 (2010): 716-718.
2. Ballester Ferran., *et al.* "Weather, climate, and public health". *Journal of Epidemiology & Community Health* (2003): 759-760.
3. Troeger Christopher., *et al.* "Estimates of global, regional, and national morbidity, mortality, and aetiologies of diarrhoeal diseases: a systematic analysis for the Global Burden of Disease Study 2015". *The Lancet Infectious Diseases* 17.9 (2017): 909-948.
4. Farthing Michael., *et al.* "Acute diarrhea in adults and children: a global perspective". *Journal of Clinical Gastroenterology* 47.1 (2013): 12-20.
5. Smith Kirk R., *et al.* "How much global ill health is attributable to environmental factors?". *Epidemiology* 10.5 (1999): 573-584.
6. Guerrant Richard L., *et al.* "Practice guidelines for the management of infectious diarrhea". *Clinical infectious diseases* 32.3 (2001): 331-351.
7. Nandi Arindam., *et al.* "Reduced burden of childhood diarrheal diseases through increased access to water and sanitation in India: A modeling analysis". *Social Science & Medicine* 180 (2017): 181-192.
8. Townsend Joy., *et al.* "Costs of diarrhoea and acute respiratory infection attributable to not handwashing: the cases of India and China". *Tropical Medicine & International Health* 22.1 (2017): 74-81.
9. Raut Deepak K and A Bhola. "Integrated disease surveillance in India: Way forward". *Global Journal of Medicine and Public Health* 3.4 (2014).
10. Kumar Tripurari., *et al.* "Viral hepatitis surveillance—India, 2011–2013". *MMWR. Morbidity and Mortality Weekly Report* 64.28 (2015): 758.
11. Debnath Falguni and Manickam Ponnaiah. "Improved timeliness for reporting of acute diarrhoeal disease under surveillance overtime: Evaluation of integrated disease surveillance programme in North 24 Parganas, West Bengal, India, 2015". *Clinical Epidemiology and Global Health* 6.4 (2018): 163-167.
12. Xu Zhiwei., *et al.* "Exploration of diarrhoea seasonality and its drivers in China". *Scientific reports* 5 (2015): 8241.
13. Gong, Xiao-Huan., *et al.* "Epidemiology, aetiology and seasonality of infectious diarrhoea in adult outpatients through active surveillance in Shanghai, China, 2012–2016: a cross-sectional study". *BMJ open* 8.9 (2018): e019699.
14. Dhimal M., *et al.* "Final report on assessment of effects of climate factors on diarrheal diseases at national and sub-national levels in Nepal". Nepal Health Council, World Health Organization Country Office for Nepal (2016).
15. Rowland M G M., *et al.* "A quantitative study into the role of infection in determining nutritional status in Gambian village children". *British journal of nutrition* 37.3 (1977): 441-450.
16. Kadri S M., *et al.* "Ten Years of Disease Surveillance in Kashmir, India under Integrated Disease Surveillance Programme (IDSP) During 2006-2016". *Annals of Medical and Health Sciences Research* 8 (2018) 19-23.
17. Pathak Ashish., *et al.* "Antibiotic prescribing in outpatients: Hospital and seasonal variations in Ujjain, India". *Scandinavian Journal of Infectious Diseases* 43.6-7 (2011): 479-488.

Volume 3 Issue 7 July 2019

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