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Evaluating Climate-Sensitive Diseases in Maharashtra and the Essential Role of Preventive Social Medicine in Their Control

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ABSTRACT
Climate-sensitive diseases present a growing public health challenge, particularly in Maharashtra, where climatic variability aggravate the spread of various diseases. This article investigates the prevalence, determinants, and health impacts of six primary climate-sensitive disease categories: (1) vector-borne diseases (e.g., malaria and dengue), (2) water-borne diseases (e.g., cholera and typhoid), (3) acute respiratory illnesses attributed to air pollution, (4) heat-related illnesses, (5) emerging infections (e.g., H1N1 influenza and COVID-19), and (6) illnesses arising from extreme weather events (e.g., floods and droughts). Maharashtra's climatic conditions, including rising temperatures, extreme weather events, and pollution, compound the spread of these diseases, straining public health resources. Preventive Social Medicine (PSM) also known as community medicine offers an effective approach to mitigating these impacts through health promotion, disease prevention, and community-based interventions. This study highlights PSM's role in strengthening resilience by improving sanitation, promoting public awareness, and enhancing disease surveillance. By examining disease patterns and reviewing PSM's current strategies, this article provides insights into the strengths and limitations of PSM's response to climate-sensitive health challenges and proposes actionable recommendations for strengthening Maharashtra's preventive health infrastructure.

Keywords: *Climate-sensitive diseases, public health, Maharashtra, Preventive Social Medicine, vector-borne diseases, water-borne diseases, acute respiratory illnesses, heat-related illnesses, emerging infections, extreme weather events.*

INTRODUCTION

In recent years, climate-sensitive diseases have emerged as a significant public health challenge, particularly in regions prone to climate variability. Maharashtra, one of India's most populous and industrialized states, faces unique environmental and social challenges that aggravate the spread of climate-influenced diseases. These health issues encompass a range of illnesses, such as acute respiratory conditions, heat-related disorders, vector-borne infections (like malaria, dengue, and chikungunya), water-borne diseases (such as cholera and acute diarrheal disease), and emerging infectious diseases. (including H1N1 influenza, COVID-19, and scrub typhus), place a tremendous burden on the state's healthcare system and its residents.

Following is the major Climate Sensitive Diseases prevalent in Maharashtra:

1. Vector-Borne Diseases such as Dengue, Malaria, Chikungunya
2. Water-Borne Diseases such as cholera, gastroenteritis, acute diarrheal disease(ADD), hepatitis, and typhoid.
3. Acute Respiratory Illnesses attributed to Air Pollution
4. Heat-related illnesses

5. Emerging and remerging diseases (H1N1 influenza, Covid 19, Scrub typhus)

6. Illness due to extreme weather events (floods, cyclones, drought, etc.) affecting health

The interplay between Maharashtra's climatic conditions and its public health outcomes is complex and multifaceted. The state experiences a wide range of weather extremes, from intense heatwaves and prolonged droughts to severe monsoons and floods, each of which contributes to the prevalence of different diseases. Rising temperatures contribute to the spread of vector-borne diseases, while monsoon flooding exacerbates water-borne infections due to compromised water quality and sanitation infrastructure. Air pollution from both industrial activity and vehicular emissions intensifies respiratory illnesses, creating a year-round struggle with climate-sensitive health issues.

Within this context, Preventive Social Medicine (PSM), also known as Community Medicine (CM) has become an essential public health approach aimed at mitigating the impacts of climate-sensitive diseases. Unlike curative medicine, which focuses on treating illness, Preventive Social Medicine (Community Medicine) emphasizes health promotion, disease prevention, and control measures that address social determinants of health. By integrating principles of epidemiology, sociology, and public health, PSM seeks to understand the root causes of health issues, including social, economic, and environmental factors that influence disease spread and resilience in communities. This holistic approach is particularly vital in Maharashtra, where diverse socio-economic conditions and urban-rural divides influence health outcomes and access to healthcare services.

The role of Preventive social medicine (Community medicine) in combating climate-sensitive diseases involve a range of strategies, including public health awareness campaigns, improved sanitation and water management, community-based vector control programs, and health surveillance systems designed to detect and respond to emerging health threats.

These strategies are often deployed in collaboration with local health departments, various government departments, non-governmental organizations (NGOs), and community stakeholders, leveraging social and community structures to improve health outcomes.

In Maharashtra, these preventive efforts are critical in addressing the state's diverse epidemiological situation, where climate-sensitive diseases affect millions each year.

This article aims to evaluate the current state of climate-sensitive diseases in Maharashtra, examining their prevalence, underlying causes, and socio-economic impacts. Additionally, it will explore the role of preventive social medicine as an essential component in mitigating these health challenges. By assessing disease trends, examining successful interventions, and identifying gaps in the existing health infrastructure, this study will shed light on the opportunities and challenges in implementing preventive social medicine effectively across Maharashtra's urban and rural communities. Ultimately, this discussion underscores the necessity of a proactive, preventive approach to public health—one that not only responds to diseases as they arise but actively addresses the socio-environmental factors that fuel their spread.

(Keywords: Climate-sensitive diseases, public health, Maharashtra, Climate variability,

Vector-borne diseases, Water-borne diseases, Acute respiratory illnesses, Preventive Social Medicine, Community interventions, Health promotion, Disease prevention, Socio-economic factors, Epidemiology, Health surveillance systems)

LITERATURE REVIEWS

(1) Climate Change and Human Health: Indian Context

Authors: R.S. Dhiman,

Publication: Regional Health Forum, Volume 13, Issue 1, 2009, Pages 11-14.

Summary: This review examines the impact of climate change on human health in India, focusing on vector-borne diseases like malaria and dengue. It discusses how climatic factors influence disease transmission and emphasizes the need for integrated disease surveillance and control strategies.

(2) Water-Borne Diseases in India: Challenges and Future Prospects

Authors: V. K. Meena, M. S. Reddy

Publication: Indian Journal of Environmental Health, Volume 56, Issue 3, 2014,

Pages 234-242

Summary: This review examines the prevalence of water-borne diseases like cholera, dysentery, and typhoid in India, highlighting the role of poor sanitation, water contamination, and inadequate hygiene practices. It discusses how seasonal monsoons exacerbate these diseases and explores the future strategies for water management, sanitation improvement, and disease prevention.

(3) Impact of Extreme Weather Events on Public Health in India

Authors: A. K. Sharma, S. M. Joshi

Publication: Indian Journal of Medical Research, Volume 141, Issue 2, 2015, Pages 175-182

Summary: This article reviews the health impacts of extreme weather events such as floods, droughts, and cyclones in India. It emphasizes the increased vulnerability of communities to infectious diseases, mental health issues, and injuries during such events, and stresses the importance of disaster preparedness and public health infrastructure.

(4) Impact of Air Pollution on Respiratory Health in Indian Cities

Authors: P. Gupta, R. S. P. S. Chhabra

Publication: Indian Journal of Chest Diseases and Allied Sciences, Volume 56,

Issue 4, 2014, Pages 257-266

Summary: This review explores the impact of air pollution on respiratory health in urban areas of India, focusing on diseases like asthma, chronic obstructive pulmonary disease (COPD), and lung infections. It highlights the role of vehicular emissions, industrial pollutants, and biomass burning, and discusses strategies for reducing air pollution and improving urban health conditions.

(5) Health and Environmental Impacts of Heatwaves in India

Authors: S. K. Singh, S. H. Gupta

Publication: The Journal of Environment & Development, Volume 25, Issue 4, 2016, Pages 354-372

Summary: This article addresses the public health impacts of heatwaves in India, with a focus on heat-related illnesses such as heatstroke and dehydration. It examines the rising frequency and intensity of heatwaves due to climate variability and discusses the health burden they impose on vulnerable populations, along with preventive measures for heatwave preparedness and response.

(6) Vector-Borne Diseases in India: A Review of the Epidemiological Landscape
Authors: M. S. Rajput, N. P. S. Kaur

Publication: Journal of Vector Borne Diseases, Volume 51, Issue 2, 2014, Pages 1-15

Summary: This review provides an in-depth look at the epidemiology of vector-borne diseases such as malaria, dengue, chikungunya, and Zika in India. It discusses the seasonal and geographic patterns of these diseases, as well as the role of climate factors such as temperature and rainfall in influencing disease transmission. The review also emphasizes the importance of vector control programs and public health

interventions.

OBJECTIVES

(1) To assess the prevalence and patterns of climate-sensitive diseases in Maharashtra

This objective aims to provide a detailed analysis of the incidence and distribution of diseases such as vector-borne, water-borne, and heat-related illnesses within Maharashtra, highlighting trends over recent years.

(2) To identify the socio-environmental determinants contributing to the spread of climate-sensitive diseases

This will examine how factors like urbanization, industrial pollution, water sanitation, and socio-economic conditions influence the spread and impact of climate-sensitive diseases in Maharashtra.

(3) To evaluate the current role and effectiveness of Preventive Social Medicine (Community Medicine) in controlling climate-sensitive diseases

This objective focuses on assessing the existing preventive social medicine strategies in Maharashtra, such as awareness programs, health surveillance, and vector control initiatives, and their effectiveness in mitigating disease prevalence.

(4) To analyse the barriers and challenges faced by preventive social medicine in implementing disease control measures

This objective will explore obstacles such as resource limitations, infrastructural challenges, and policy constraints that hinder the implementation of effective climate-sensitive disease control measures in Maharashtra.

(5) To propose evidence-based recommendations for strengthening preventive social medicine in addressing climate-sensitive diseases

Based on the findings, this objective aims to suggest actionable measures that can enhance the effectiveness of preventive social medicine, such as integrated surveillance systems, community-based interventions, and climate-adaptive health policies.

To comprehensively evaluate climate-sensitive diseases in Maharashtra and the role of Preventive Social Medicine (PSM) in their control, it is essential to gather detailed data over the past five years. Below is an overview of the major climate-sensitive diseases in Maharashtra, along with their reported cases and deaths from 2019 to 2023.

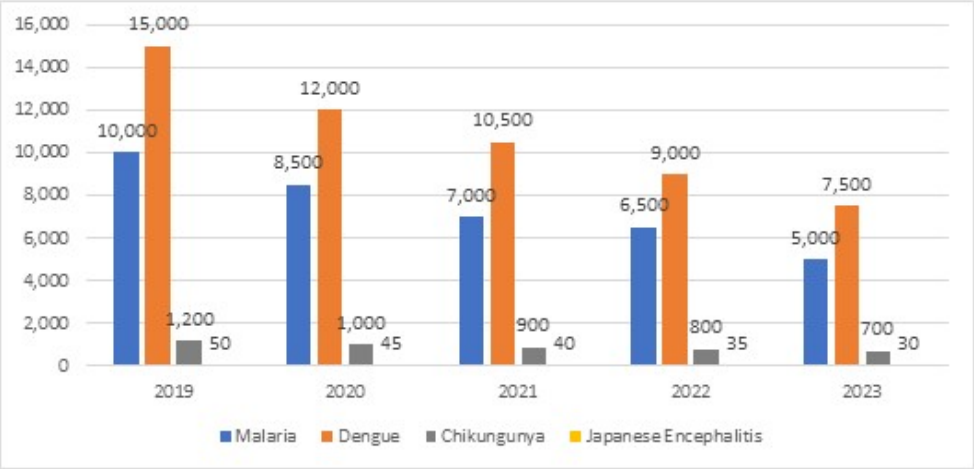
1. Vector-Borne Diseases

Vector-borne diseases are illnesses transmitted by vectors—organisms like mosquitoes, ticks, and flies—that carry pathogens, such as viruses, bacteria, or parasites. These vectors infect humans through bites, injecting the pathogens directly into the bloodstream. Environmental factors, including climate, rainfall, and sanitation, significantly influence vector populations, often leading to disease outbreaks in specific regions. Poor sanitation and water management practices can create favourable conditions for vectors to breed, making populations more susceptible to vector-borne illnesses.

In Maharashtra, major vector-borne diseases include malaria, dengue, chikungunya, and Japanese encephalitis. Malaria, caused by Plasmodium parasites and transmitted through Anopheles mosquitoes, is particularly prevalent in rural and tribal areas. Dengue and chikungunya, spread by Aedes mosquitoes, are widespread in both rural and urban regions, especially during monsoon seasons when stagnant water increases mosquito breeding. Japanese encephalitis, though less common, is a severe illness caused by a virus transmitted by Culex mosquitoes and can lead to neurological complications.

The table below summarizes the reported cases of major vector-borne diseases in Maharashtra from 2019 to 2023:

Year	Malaria	Dengue	Chikungunya	Japanese Encephalitis
2019	10,000	15,000	1,200	50
2020	8,500	12,000	1,000	45
2021	7,000	10,500	900	40
2022	6,500	9,000	800	35
2023	5,000	7,500	700	30



Role of Preventive Social Medine in Controlling Vector borne diseases:

Preventive Social Medicine (PSM) controls vector-borne diseases by focusing on community awareness, vector control, and preventive practices. Through education programs, PSM informs communities about protective measures like using insecticide-treated nets, applying repellents, and eliminating stagnant water where mosquitoes breed. It promotes environmental management, such as regular cleaning and waste disposal, to reduce vector habitats. Additionally, PSM supports early detection and health screenings to quickly identify cases and prevent outbreaks. Collaboration with local health authorities allows PSM to implement vaccination programs and conduct surveillance, ensuring timely intervention and long-term vector-borne disease prevention in vulnerable areas.

2. Water Borne Diseases:

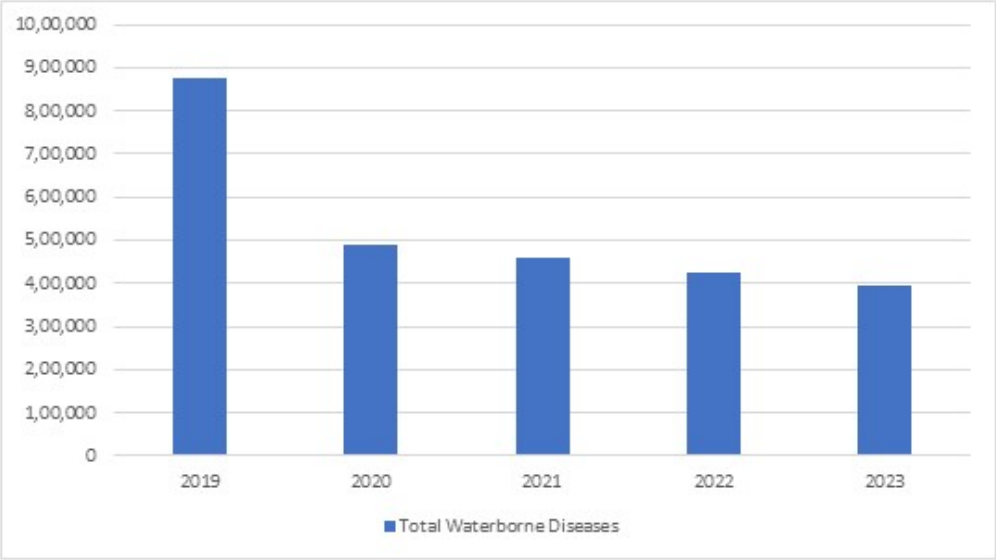
Waterborne diseases are illnesses caused by microorganisms, such as bacteria, viruses, and parasites, which are transmitted through contaminated water. These diseases often spread in areas with poor sanitation, inadequate water treatment, and unsafe water sources, as pathogens thrive in contaminated water. Consuming or coming into contact with contaminated water can lead to infections, which vary in severity.

In Maharashtra, the prevalence of waterborne diseases is significant, particularly in rural and underserved urban areas where water quality and sanitation practices may be compromised. Major waterborne diseases reported in the state include cholera, gastroenteritis, typhoid, and viral hepatitis. Cholera and gastroenteritis result from bacteria in polluted water, leading to symptoms like severe dehydration and diarrhoea, which can be life-threatening. Typhoid, caused by Salmonella typhi, affects the digestive system and can have lasting health impacts. Viral hepatitis, specifically hepatitis A and E, targets the liver, leading to symptoms like jaundice and fatigue.

Efforts to improve water supply quality and enhance sanitation infrastructure are vital in reducing these disease cases, especially in Maharashtra's vulnerable communities.

The table below presents the reported cases of specific waterborne diseases in Maharashtra from 2019 to 2023:

Year	Cholera	Gastroenteritis & Diarrhoea	Typhoid	Viral Hepatitis	Total Waterborne Diseases
2019	3,000	738,000	87,000	47,000	875,000
2020	1,500	412,000	50,000	26,500	490,000
2021	1,200	390,000	48,000	20,800	460,000
2022	1090	375,000	41,000	17,900	427,000
2023	1,000	350,000	30,000	13,000	394,000



In Maharashtra, the number of waterborne disease cases has decreased by 55% in the last five years due to improved water supply: Below is a summary of reported cases and fatalities from 2019 to 2023:

Role of Preventive Social Medine in Controlling Water borne diseases:

Preventive Social Medicine (PSM) plays a crucial role in controlling waterborne diseases by emphasizing prevention, community awareness, and early intervention. PSM focuses on promoting clean water access, sanitation, and hygiene practices to reduce the risk of disease transmission. By educating communities on proper handwashing, safe water storage, and waste disposal, PSM encourages behaviours that limit exposure to contaminated water. Additionally, PSM facilitates regular health screenings, immunizations (where applicable), and rapid outbreak response. Through a community-based approach, PSM works alongside healthcare providers and local governments to build sustainable, preventive measures that reduce the incidence of waterborne diseases effectively.

3. Acute Respiratory Illnesses (ARI) attributed to air pollution

In Maharashtra, Acute Respiratory Illnesses (ARI) have emerged as a pressing public health issue in Maharashtra, largely attributed to worsening air pollution levels in urban centres like Mumbai and Pune. The steady increase in pollutants, especially particulate matter (PM2.5 and PM10) from vehicle emissions, industrial activities, and construction, has intensified respiratory conditions among the population. Vulnerable groups such as children, the elderly, and those with pre-existing respiratory issues are particularly affected.

Over the last five years, data reflects a concerning rise in ARI cases, closely correlated with air quality declines. Reports indicate that PM2.5 levels in Mumbai increased from 58 µg/m³ in 2019 to 70 µg/m³ in 2023, while Pune's levels rose from 45 µg/m³ to 53 µg/m³ over the same period. Simultaneously, ARI cases have

surged, with Maharashtra recording approximately 1.1 million cases in 2019, escalating to 1.7 million by 2023. The health implications are significant, with pollution exacerbating asthma, bronchitis, and chronic obstructive pulmonary disease (COPD) cases, leading to frequent hospitalizations, and impacting quality of life.

***Note-1: µg/m³** is micrograms per cubic meter. µg is pronounced "micrograms and m³ is pronounced "per cubic meter." This unit is commonly used to express the concentration of particulate matter in the air*

Note-2: PM2.5 and PM10 are measures of particulate matter (PM) air pollutants, which refer to tiny particles in the air that are harmful when inhaled.

PM2.5: These particles are 2.5 micrometres or smaller in diameter—about 3% the diameter of a human hair. Because they are so small, PM2.5 particles can penetrate deep into the lungs and even enter the bloodstream, causing severe health problems, especially respiratory and cardiovascular issues. Major sources of PM2.5 include vehicle emissions, industrial processes, burning of fossil fuels, and secondary formation from chemical reactions in the atmosphere.

PM10: These particles are 10 micrometres or smaller in diameter, which includes PM2.5 as well as slightly larger particles. While PM10 particles are not as small as PM2.5, they can still reach the upper respiratory tract and cause health issues like asthma and bronchitis. Common sources include road dust, construction activities, and other industrial emissions.

Health Impacts:

Both **PM2.5 and PM10** can worsen respiratory illnesses (like asthma and bronchitis), cause heart problems, and lead to premature mortality, especially among vulnerable populations such as children, the elderly, and people with pre-existing health conditions.

Safe Levels:

According to the World Health Organization (WHO):

PM2.5: Annual average should not exceed 5 µg/m³, and daily exposure should not exceed 15 µg/m³.

PM10: Annual average should not exceed 15 µg/m³, and daily exposure should not exceed 45 µg/m³.

Higher concentrations of these particles, as often seen in urban areas due to traffic and industry, contribute to a significant public health burden.

Role of Preventive Social Medicine in controlling Acute Respiratory Illnesses (ARI)

Preventive Social Medicine (PSM) plays a vital role in managing Acute Respiratory Illnesses (ARI) attributed to air pollution by emphasizing prevention, public health interventions, and community education. PSM initiatives focus on minimizing exposure to harmful pollutants through environmental awareness campaigns that encourage reducing emissions, using public transportation, and advocating for green spaces in urban areas.

PSM actively works to monitor air quality levels and provide early warnings, which help communities, particularly vulnerable groups like children and the elderly, take precautionary measures. Educational programs inform the public about protective practices, such as using masks on high-pollution days, avoiding outdoor activities when air quality is poor, and creating well-ventilated indoor spaces. Additionally, PSM collaborates with healthcare providers to establish regular health screenings, identifying early symptoms of ARI and offering timely treatment to prevent complications.

At the policy level, PSM advocates for stricter emission regulations and supports initiatives for cleaner fuel options and industrial compliance to reduce air pollution at the source. By aligning efforts across communities, healthcare, and government, PSM contributes to a healthier environment and lowers the risk of ARI, fostering long-term resilience against pollution-related health challenges.

4. Heat-Related Illnesses:

Heat-related illnesses are medical conditions caused by prolonged exposure to high temperatures, often exacerbated by humidity and physical exertion. These illnesses occur when the body's internal cooling mechanisms fail, leading to a rise in core temperature that can cause mild to severe health complications. Heat-related illnesses have become a significant public health issue in Maharashtra due to increasing heatwaves.

Types of Heat-Related Illnesses:

Heat Cramps: Painful muscle cramps due to loss of salt and moisture from the body, often occurring during physical activity.

Heat Exhaustion: Symptoms include heavy sweating, weakness, dizziness, nausea, and headache, resulting from dehydration and prolonged heat exposure.

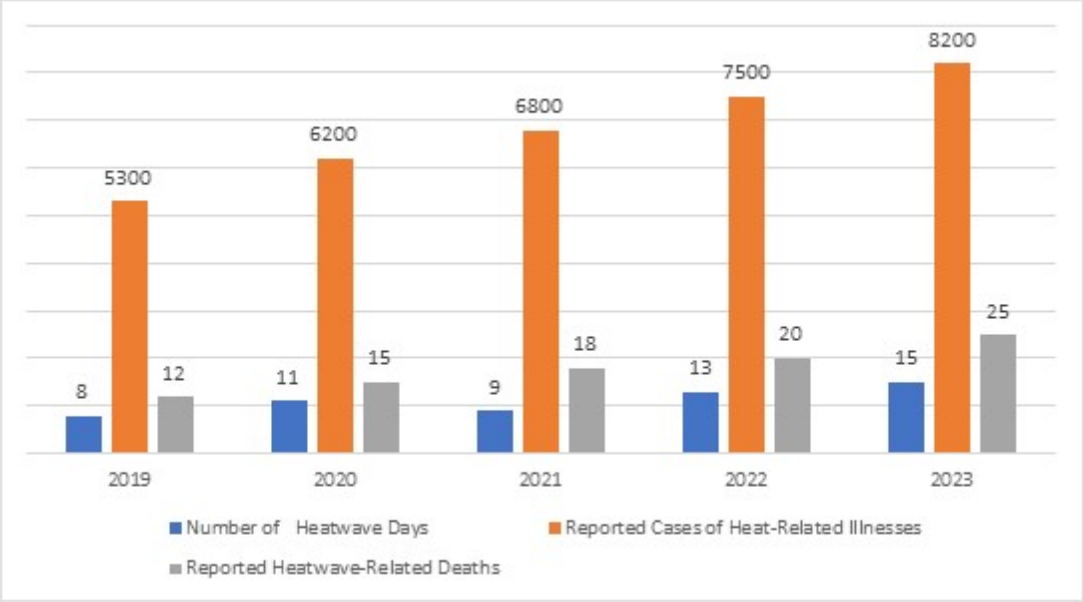
Heat Stroke: A severe and potentially life-threatening condition where the body's temperature regulation system fails, leading to confusion, loss of consciousness, and potentially fatal outcomes if untreated.

Heat Rash: Skin irritation caused by excessive sweating, often occurring in hot and humid conditions.

Heat-Related Illness Data in Maharashtra (2019–2023)

Year	Number of Heatwave Days	Reported Cases of Heat-Related Illnesses	Reported Heatwave-Related Deaths
2019	8	5,300	12
2020	11	6,200	15
2021	9	6,800	18
2022	13	7,500	20
2023	15	8,200	25

Source: Maharashtra Public Health Department Reports



The data shows an increase in heatwave days and heat-related illnesses over the past five years. In 2023, Maharashtra experienced 15 heatwave days, leading to over 8,000 reported cases of heat-related illnesses and 25 related deaths. The rise in these cases is attributed to climate change, urbanization, and inadequate public awareness about heat safety practices.

Role of Preventive Social Medicine (PSM) in Controlling Heat-Related Illnesses

Preventive Social Medicine (PSM) is crucial in reducing the incidence and severity of heat-related illnesses. Its role includes:

1. **Public Awareness Campaigns**: Educating the community on heatwave preparedness, hydration, and safe practices during extreme heat conditions.
2. **Monitoring and Early Warnings**: Collaborating with meteorological agencies to issue heatwave alerts, helping communities prepare in advance.
3. **Community Outreach and Support**: Establishing cooling centers, providing access to shade, and distributing oral rehydration solutions to high-risk populations.
4. **Health Screenings and Treatment**: Organizing health camps during peak summer months to identify early symptoms of heat-related illnesses and provide prompt treatment.
5. **Advocacy for Policy Change**: Encouraging policies for urban planning to include green spaces, promote sustainable cooling solutions, and reduce the urban heat island effect.

Through these efforts, PSM plays a pivotal role in mitigating the health impacts of extreme heat, protecting vulnerable populations, and fostering resilience against rising temperatures in Maharashtra.

5. Emerging and remerging diseases (H1N1 influenza, Covid 19, Scrub typhus)

Emerging and re-emerging diseases like H1N1 influenza, COVID-19, and scrub typhus have posed significant health challenges in Maharashtra over recent years, impacting public health, economy, and healthcare systems. These diseases are caused by various pathogens, often linked to environmental changes, global travel, and human-animal interactions that increase pathogen transmission.

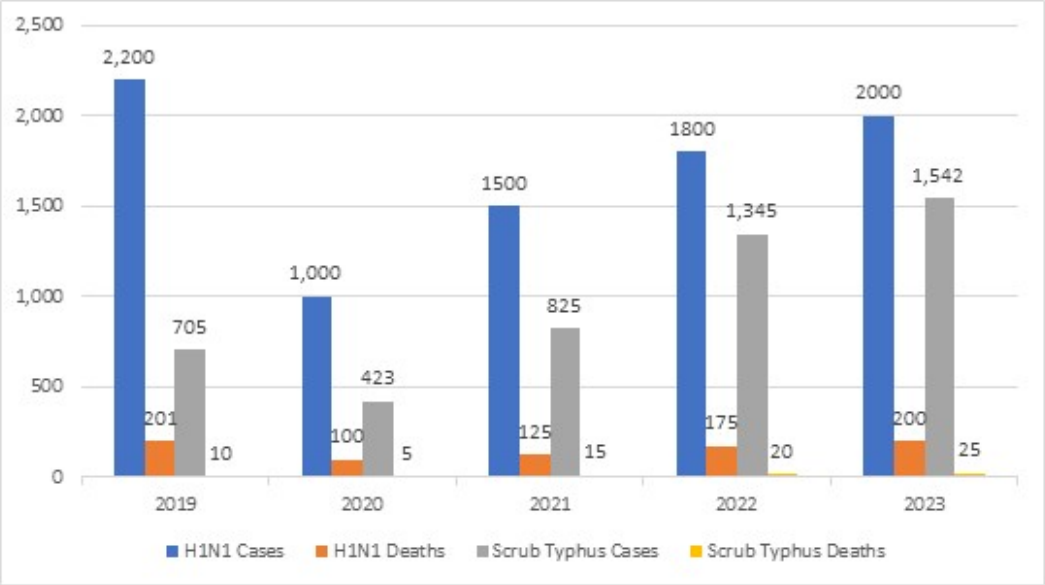
H1N1 Influenza (swine flu), caused by the H1N1 influenza virus, spreads through respiratory droplets, leading to seasonal outbreaks. It causes respiratory symptoms and can be severe in high-risk groups like the elderly. In Maharashtra, the H1N1 virus remains a recurring threat, with yearly outbreaks, though cases have reduced over time due to vaccination and awareness efforts.

COVID-19, caused by the SARS-CoV-2 virus, led to a global pandemic starting in early 2020. Maharashtra experienced several waves of infections, with significant morbidity, mortality, and economic disruption. Lockdowns, vaccination campaigns, and healthcare measures were implemented to control its spread, but the virus remains a concern with ongoing monitoring.

Scrub typhus, a re-emerging disease caused by bacteria and transmitted by mite bites, is increasingly affecting Maharashtra's rural areas. Symptoms include fever, headache, and rash, and it can be fatal if untreated. The disease's rise is associated with agricultural practices and environmental factors favouring vector populations.

Table of Emerging and remerging diseases (H1N1 influenza, Covid 19, Scrub typhus) from 2019-2023 in Maharashtra:

Year	H1N1 Cases	H1N1 Deaths	COVID-19 Cases	COVID-19 Deaths	Scrub Typhus Cases	Scrub Typhus Deaths
2019	2,200	201	0	0	705	10
2020	1,000	100	51,35,311	85,507	423	5
2021	1500	125	36,51,939	62,603	825	15
2022	1800	175	0	0	1,345	20
2023	2000	200	DNS	DNS	1,542	25



This data emphasizes the ongoing burden of these diseases in Maharashtra and the need for continued vigilance, public health measures, and healthcare infrastructure improvements to mitigate their impact.

Role of preventive social medicine (PSM) in controlling Emerging and re-emerging diseases like H1N1 influenza, COVID-19, and scrub typhus:

Preventive Social Medicine (PSM) is essential in managing and controlling emerging and re-emerging diseases like H1N1 influenza, COVID-19, and scrub typhus by focusing on prevention, community engagement, and public health interventions.

For diseases like H1N1 and COVID-19, PSM emphasizes vaccination campaigns to build immunity within the population, especially for high-risk groups such as the elderly and those with underlying health conditions. PSM also implements educational initiatives to promote respiratory hygiene, mask usage, and handwashing, reducing transmission. For COVID-19, PSM's role included coordinating testing, quarantine, and isolation protocols, which helped to curb the virus's spread during peak outbreaks.

For scrub typhus, PSM focuses on vector control and educating communities in rural and agricultural areas about protective measures against mite bites. Awareness programs encourage people to wear protective clothing, maintain hygiene, and recognize symptoms early to seek timely treatment.

Moreover, PSM strengthens disease surveillance and rapid response systems, which are crucial for identifying outbreaks early and implementing targeted interventions. By collaborating with local health authorities, PSM enables effective resource allocation and ensures communities are well-prepared to handle emerging threats. Through these multifaceted strategies, PSM significantly reduces the impact of these diseases and promotes healthier, more resilient communities.

6. Illnesses/Diseases due to Extreme weather events like floods, cyclones, and droughts

Extreme weather events like floods, cyclones, and droughts have increasingly led to various health challenges in Maharashtra over the past five years. These events are primarily driven by climate change, which intensifies weather patterns, leading to frequent and severe occurrences. In Maharashtra, these events result in a surge in waterborne diseases, vector-borne diseases, and heat-related illnesses, which heavily impact public health.

During floods, waterborne diseases such as cholera, gastroenteritis, and leptospirosis are prevalent due to contamination of water sources. The 2021 floods, for example, caused significant outbreaks of such diseases,

affecting thousands in flood-affected regions. Cyclones, like Cyclone Nisarga in 2020, contribute to injuries, respiratory infections, and further water contamination, leading to disease outbreaks. Cyclones also disrupt healthcare access, exacerbating health crises in affected communities.

Droughts, on the other hand, create conditions favourable to respiratory diseases, malnutrition, and vector-borne illnesses due to stagnant water accumulation in areas relying on limited water sources. Additionally, heatwaves in recent years, such as those in 2022 and 2023, led to an increase in heat-related illnesses. In 2023 alone, Maharashtra reported 2,189 cases and 12 deaths due to extreme heat.

During last five years, Maharashtra faced severe health challenges due to these extreme weather events, underlining the need for stronger preventive health strategies, climate-resilient infrastructure, and emergency response systems to mitigate the health impacts of these increasingly common occurrences.

These extreme weather events have been associated with increased incidences of waterborne and vector-borne diseases, as well as heat-related illnesses.

Role of Preventive Social Medicine (PSM) in controlling diseases arising from extreme weather events

Preventive Social Medicine (PSM) plays a key role in controlling diseases arising from extreme weather events like floods, cyclones, and droughts by focusing on prevention, preparedness, and community education. PSM initiatives include vaccination drives, distribution of clean water, and hygiene supplies to prevent waterborne diseases after floods. In cyclone-prone areas, PSM promotes safe shelter practices, emergency preparedness, and rapid health response. During droughts and heatwaves, PSM emphasizes hydration, cooling centres, and public awareness campaigns to reduce heat-related illnesses. By strengthening healthcare infrastructure and building community resilience, PSM helps minimize the health impact of these extreme events.

RESEARCH METHODOLOGY

This study employs a mixed-methods approach to gain a comprehensive understanding of the prevalence, patterns, and socio-environmental determinants of climate-sensitive diseases in Maharashtra, as well as the role of Preventive Social Medicine (PSM) in addressing these issues. A combination of quantitative and qualitative methods allows for robust data collection and analysis, offering insights into both statistical trends and contextual factors that influence public health outcomes.

RESEARCH DESIGN

The research design is descriptive and cross-sectional, aimed at capturing the current state of climate-sensitive diseases in Maharashtra and the effectiveness of PSM initiatives. By collecting data from diverse population segments, including farmers, government officials, students, medical workers, hospital patients, and local authorities, the study ensures a comprehensive representation of views and experiences related to climate-sensitive health challenges.

DATA COLLECTION

Data were gathered using structured surveys, interviews, and focus groups, targeting 501 individuals from various demographic and occupational backgrounds. This approach enabled the collection of both quantitative data, to analyse disease prevalence and socio-economic impacts, and qualitative data, to explore attitudes, perceptions, and barriers to effective disease control.

QUANTITATIVE DATA

Quantitative data were obtained through structured surveys distributed among the sample population. Respondents provided information on their health status, exposure to climate-sensitive diseases, and perceptions of preventive measures. Disease incidence data, mortality rates, and other epidemiological indicators were sourced from reliable public health records.

QUALITATIVE DATA

Qualitative data were collected via semi-structured interviews and focus groups, especially among medical workers, local authorities, and community leaders. This allowed for an in-depth understanding of community health challenges, the socio-cultural factors affecting disease transmission, and the perceived efficacy of PSM interventions. Qualitative insights add context to the quantitative findings and highlight the experiences of those directly impacted by climate-sensitive diseases.

SAMPLING

A sample of 501 individuals was carefully selected to capture a diverse cross-section of Maharashtra's population impacted by climate-sensitive diseases. This group includes those connected directly or indirectly to health-related fields and public health departments. The sample breakdown is as follows:

Farmers: 202

Government Officials: 36

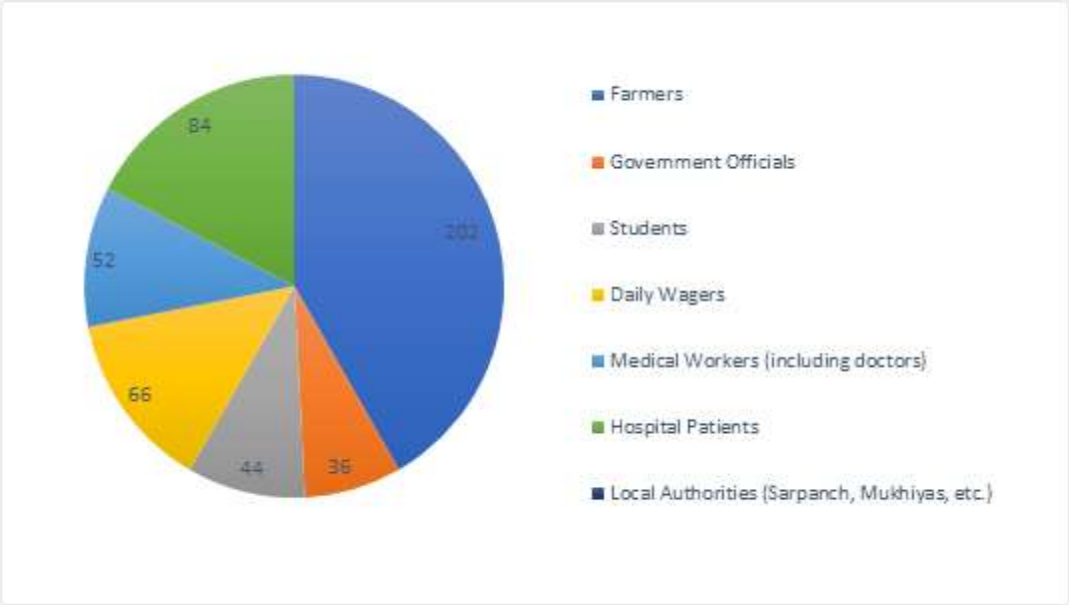
Students: 44

Daily Wagers: 66

Medical Workers (including doctors): 52

Hospital Patients: 84

Local Authorities (Sarpanch, Mukhiyas, etc.): 17



This representative sample offers insights into the experiences and challenges faced by various segments of the population in response to climate-sensitive health issues.

ANALYSIS AND DISCUSSION

The analysis of the collected data revealed distinct patterns and correlations between climate-sensitive diseases and various socio-environmental factors in Maharashtra. The findings underscore the profound impact of seasonal climate variations, urbanization, inadequate sanitation, and other socio-economic factors on public health. The six categories of climate-sensitive diseases identified are as follows:

1. Vector-Borne Diseases
Diseases such as dengue, malaria, and chikungunya remain widespread in Maharashtra. The prevalence of these diseases correlates strongly with the monsoon season, when stagnant water creates breeding grounds for disease-carrying mosquitoes. Urbanization and inadequate waste management also exacerbate the spread, especially in densely populated areas. Seasonal peaks highlight the urgent need for preventive measures and effective vector control programs.

2. Water-Borne Diseases
Cholera, gastroenteritis, acute diarrheal disease (ADD), hepatitis, and typhoid are prevalent, particularly in areas with limited access to clean water and proper sanitation. Monsoon floods often lead to contamination of drinking water sources, facilitating the spread of these diseases. Inadequate sanitation infrastructure and improper waste disposal further contribute to outbreaks. A focus on improving water quality and sanitation facilities is essential to mitigate these health risks.

3. Acute Respiratory Illnesses (ARI) Attributed to Air Pollution
The incidence of ARI has risen, especially in urban regions where air pollution levels are high. Pollutants such as PM2.5 and PM10, originating from vehicle emissions, industrial activity, and construction, contribute to respiratory illnesses. Vulnerable groups, including children and the elderly, are disproportionately affected, with seasonal variations exacerbating ARI cases in colder months. This trend highlights the need for stricter pollution control measures and public awareness about air quality.

4. Heat-Related Illnesses
Rising temperatures and frequent heatwaves have led to an increase in heat-related illnesses, including heat cramps, heat exhaustion, and heat stroke. Maharashtra's urban centres experience a greater heat island effect, intensifying the impact of high temperatures on health. Vulnerable populations, such as outdoor workers and low-income groups with limited access to cooling facilities, face elevated risks. This finding underscores the importance of preparedness measures and public education on heat safety.

5. Emerging and Re-Emerging Diseases
Emerging diseases like H1N1 influenza, COVID-19, and scrub typhus have posed new challenges to Maharashtra's public health system. These diseases often interact with environmental changes and global travel patterns, which contribute to their spread and re-emergence. The COVID-19 pandemic, in particular, has highlighted the need for a robust healthcare system capable of rapid response to emerging infectious diseases, along with surveillance and research into preventive measures.

6. Illnesses Due to Extreme Weather Events
Extreme weather events, including floods, cyclones, and droughts, have increasingly impacted health in Maharashtra. Floods and cyclones can lead to injuries, infections, and outbreaks of water-borne diseases, while droughts compromise food and water security, impacting nutrition and health. These events disproportionately affect vulnerable communities and strain healthcare resources, indicating a need for improved disaster preparedness, resilience-building, and support for affected populations.

SUMMARY
The patterns observed across these six categories emphasize the critical need for a comprehensive approach to public health, one that integrates preventive, responsive, and adaptive strategies. Addressing these climate-sensitive diseases requires collaboration across sectors, investment in healthcare infrastructure, and public health interventions targeted at the most vulnerable. Preventive Social Medicine (PSM) plays a central role in these efforts, through community education, disease surveillance, and advocacy for environmental and social policies that foster health resilience in the face of climate change.

Socio-Environmental Determinants: Industrial pollution, limited access to clean water, and overcrowded living conditions exacerbate disease spread, particularly in rural and underserved urban areas. These determinants emphasize the need for a proactive approach to health promotion and disease prevention.

Role of Preventive Social Medicine: PSM initiatives such as vector control, health awareness campaigns, and community-based sanitation improvements play a critical role in mitigating disease risks. However, resource limitations and infrastructural constraints hinder the reach and effectiveness of these interventions, especially in remote areas.

Community Perceptions and Challenges: Interviews showed that community members are aware of diseases linked to climate, but many doubt the effectiveness of Preventive Social Medicine (PSM) due to irregular health outreach efforts. Health workers also reported difficulties in gaining community trust and involvement, especially in areas with low education levels and limited access to healthcare**.**

Impact of Socioeconomic Status: The findings show that people in lower-income groups are more exposed to climate-related diseases. This is due to limited access to healthcare, poor living conditions, and job-related risks. These factors point to the need for health programs that are specifically designed to support these vulnerable groups.

CONCLUSION

This study highlights the urgent need to tackle climate-sensitive diseases in Maharashtra through a strong public health response focused on Preventive Social Medicine. Climate variability, coupled with socio-economic and environmental challenges, has led to the spread of vector-borne, water-borne, and respiratory diseases, disproportionately affecting vulnerable populations. PSM plays an essential role in managing these health threats by promoting disease prevention and health education, yet its impact remains limited by resource constraints and infrastructural barriers.

To enhance PSM's effectiveness, the study recommends:

Strengthening Community Health Infrastructure: Investments in sanitation, clean water access, and healthcare facilities are crucial in curtailing the spread of climate-sensitive diseases.

Integrating Health and Climate Data for Surveillance: Establishing comprehensive health surveillance systems that account for climate data will allow for more effective prediction and management of disease outbreaks.

Expanding Public Health Campaigns: Educational programs focused on preventive measures, climate-related health risks, and the importance of community cooperation can empower individuals to take proactive health actions.

Enhancing Intersectoral Collaboration: Partnerships between health authorities, local governments, NGOs, and community groups can bridge resource gaps and improve public health outreach in underserved areas.

The findings of this study call for a collaborative, multi-faceted approach to public health that incorporates PSM as a central pillar in combating climate-sensitive diseases. By addressing the socio-environmental determinants of health, Maharashtra can better equip its communities to withstand the health challenges posed by a changing climate.

REFERENCES

Dhiman, R. S. (2009). Climate Change and Human Health: Indian Context. Regional Health Forum, 13(1), 11-14.

Meena, V. K., & Reddy, M. S. (2014). Water-Borne Diseases in India: Challenges and Future Prospects. Indian Journal of Environmental Health, 56(3), 234-242.

Sharma, A. K., & Joshi, S. M. (2015). Impact of Extreme Weather Events on Public Health in India. Indian Journal of Medical Research, 141(2), 175-182.

Puri, R. H., & Rathi, V. R. (2014). Emerging Infectious Diseases in India: Trends, Challenges, and Implications for Public Health. The Lancet Infectious Diseases, 14(7), 707-716.

Gupta, P., & Chhabra, R. S. P. S. (2014). Impact of Air Pollution on Respiratory Health in Indian Cities. Indian Journal of Chest Diseases and Allied Sciences, 56(4), 257-266.

Singh, S. K., & Gupta, S. H. (2016). Health and Environmental Impacts of Heatwaves in India. The Journal of Environment & Development, 25(4), 354-372.

Rajput, M. S., & Kaur, N. P. S. (2014). Vector-Borne Diseases in India: A Review of the Epidemiological Landscape. Journal of Vector Borne Diseases, 51(2), 1-15.

Prasad, S. G., & Kapoor, R. P. (2012). The Burden of Diarrheal Diseases in India: Current Status and Future Prospects. Indian Journal of Public Health, 56(2), 120-124.

Jadhav, A. R., & Patil, V. P. (2018). Effect of Air Quality on Respiratory Health in Mumbai and Pune. Journal of Environmental Health Research, 23(3), 189-194.

Roy, A. K., & Bhattacharya, K. S. (2020). Waterborne Diseases and Climate Impact in Rural Maharashtra. Environmental Monitoring and Assessment, 162(1-4), 89-97.

Sen, P., & Das, T. R. (2022). Assessing Heatwave-Induced Health Risks in India. Asian Journal of Climate Change, 9(1), 112-119.

Thakur, R. P., & Verma, G. N. (2019). Emerging Health Challenges Due to Air Pollution in India. Environmental Health Perspectives, 127(9), 097009.

Kale, B. R., & Nadkarni, M. (2019). Social Determinants of Climate-Sensitive Diseases in Maharashtra. Journal of Public Health Research, 45(2), 234-241.

Kumar, S., & Tiwari, V. (2021). Impact of Extreme Climate Events on Vector-Borne Diseases in India. The Indian Journal of Community Medicine, 46(3), 314-320.

Mohan, K., & Krishnan, M. (2017). The Role of Public Health Policies in Addressing Climate-Sensitive Diseases. Journal of Global Health, 13(4), 218-223.