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Research Article

Rapid Growth of Urbanization Leads to Waste Water - It Hamper Human Health & Environmental Conditions in India

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INTRODUCTION:

Urbanization is the transformation of unoccupied or sparsely occupied land into densely occupied urban cities. Urban area can grow from increases in human populations or from migration into urban areas. Urbanization often results in deforestation, habitat loss, and the extraction of freshwater from the environment, which can decrease biodiversity and alter species ranges and interactions. These can impact water quality, harm plants and animals and present risks to human health.

World urban population at globally in 2021 was 4,454,152,526, at 1.61% increases from 2020, about 359 billion cubic meters of urban domestic waste water generate each year, which is equivalent to 144 million Olympic-sized swimming pools. About 48 percent of that water is currently released untreated. Around 2 billion people consume contaminated water with faces. The consumption of such unsafe water can result in water borne diseases. Around 3.1% of deaths in the world are due to unhygienic and poor quality in drinking water. The World Health Organization estimates that 80% of diseases worldwide are waterborne the global burden of disease study estimated that in 2020, an unsafe water source resulted in 1.2 million deaths and 71.7 million disability-adjusted life years, including 1.1 million deaths and 61.1 million from diarrheal diseases. In India urban population for 2021 was 498,179,071, at 2.15% increase from 2020, in India, with 1.38 billion people, stands as a second largest populous country in the world. Of the total population, 65% (900 million) live in rural areas, and 35% (483 million) are concentrated in urban centers. The estimated wastewater generation is approximately 39,604 (MLD) in the rural regions, while in the urban centers; the wastewater generation has been estimated as 72,345 MLD for the year 2020-21. The estimated volume of urban wastewater is almost double that of rural and such availability of more water for sanitation has increased the living standards in urban cities. Population growth and migration of people to cities for a better source of living immediate attention due to rapid urbanization. While 8.75 lakh people were affected by water-borne diseases in 2019, the number dropped to 4.9 lakh in 2020 and 4.6 lakh in 2021.

Waterborne illness is caused by recreational or drinking water contaminated by disease-causing microbes or pathogens. Many waterborne pathogens can also be acquired by consuming contaminated food or beverages,

from contact with animals or their environment, or through person-to-person spread.

OBJECTIVES:

- To find out the sewage generation and treatment capacity in India.
- To examine the health impact due to contamination in water supply.

LITERATURE REVIEW:

Olufunmilayo et al. (2020) The research was conducted in Zaria, an urban area in Kaduna State, Nigeria, with a growing population and significant waste management challenges. A mixed-methods approach was adopted, involving quantitative data collection through field surveys and qualitative data from interviews and focus group discussions. Quantitative data were obtained through the analysis of waste generation patterns, composition, and disposal methods across five key residential areas in Zaria. Additionally, soil and water samples were collected near major waste disposal sites to assess environmental contamination. Qualitative data were gathered from interviews with 200 residents, local government officials, and waste management practitioners to understand public awareness, attitudes, and policy enforcement related to waste management. explored the environmental impact of domestic waste management in Zaria, Kaduna State, Nigeria. The study addresses the challenges of ineffective waste management practices and their adverse effects on the environment, including water pollution, soil degradation, and public health risks. This research is particularly relevant in the context of urbanization and population growth, which exacerbate waste generation in Nigerian cities. The study revealed that improper waste disposal practices, including open dumping and burning, were prevalent in Zaria. Analysis of soil and water samples showed elevated levels of contaminants such as heavy metals and organic pollutants, posing significant environmental and health risks. Residents reported frequent cases of waterborne diseases and reduced agricultural productivity due to soil contamination. The study identified inadequate waste management infrastructure, lack of public awareness, and poor enforcement of environmental regulations as critical barriers. The authors concluded that addressing waste management challenges in Zaria requires integrated strategies, including investment in waste recycling facilities, public education on proper waste disposal, and stricter enforcement of waste management policies.

Cairncross and Cotton (2006) examined the intersection of water, sanitation, and hygiene in developing countries, emphasizing how inadequate water supply and sanitation infrastructure contribute to health risks and environmental challenges. The paper highlights the importance of integrating improved water management and sanitation practices into public health strategies to reduce the prevalence of waterborne diseases, particularly in low-income settings. The study analyzed global data, with a specific focus on case studies from sub-Saharan Africa and South Asia, where inadequate sanitation facilities and unsafe water sources are most prevalent. The research utilized secondary data from multiple global health and environmental datasets, including reports from the World Health Organization (WHO) and UNICEF. The methodology involved a meta-analysis of existing studies, examining the link between water quality, sanitation practices, and public health outcomes. The authors reviewed over 50 case studies involving community-scale interventions, with sample sizes ranging from 100 to 5,000 households per study. Key metrics included water quality sanitation coverage, and disease incidence rates. Cairn cross and Cotton found that improved water quality alone was insufficient to significantly reduce waterborne disease incidence. Instead, integrated approaches combining safe water supply, proper sanitation facilities, and hygiene education had the most substantial impact. Case studies showed that interventions such as latrine construction and hand washing campaigns reduced diarrheal diseases by up to 50%. However, the authors noted persistent challenges in scaling up these interventions due to financial and logistical constraints. The study concluded that improving water and sanitation infrastructure, combined with behavioral change programs, is critical for enhancing public health and environmental outcomes.

Mukesh Katakwar (2016) analyzed the effects of wastewater mismanagement on environmental sustainability and public health in rapidly urbanizing areas of India. The study focused on understanding how untreated or poorly treated wastewater contributes to pollution in water bodies, soil degradation, and health risks. The paper emphasized the urgent need for integrated wastewater treatment systems to ensure sustainable urban development and reduce ecological damage. The study was conducted in three urban centers of Madhya Pradesh, India—Indore, Bhopal, and Gwalior—chosen due to their rapid urbanization and inadequate wastewater management infrastructure. The research employed a mixed-methods approach. Quantitative data were collected through water and soil sample analysis at 12 locations across the three cities, focusing on areas near wastewater discharge points, such as rivers, lakes, and agricultural fields irrigated with untreated water. A total of 36 water and 24 soil samples were analyzed for chemical and biological contaminants, including biochemical oxygen demand (BOD), chemical oxygen demand (COD), heavy metals, and fecal coliforms. Qualitative data were gathered through structured interviews with 500 households and 50 wastewater management professionals. The interviews explored public awareness, health issues, and current wastewater management practices. The study found that over 70% of wastewater in the surveyed cities was discharged untreated into natural water bodies. Water samples showed alarmingly high levels of pollutants, exceeding permissible limits set by the Central Pollution Control Board (CPCB). Soil samples near discharge points exhibited heavy metal accumulation, which posed risks to agriculture and food safety. Interviews revealed that communities relying on these water sources experienced frequent cases of

waterborne diseases, such as cholera and typhoid. Katakwar concluded that ineffective wastewater management poses severe risks to both environmental and public health in urban areas of India. The study recommended immediate investments in wastewater treatment plants, stricter enforcement of environmental laws, and public awareness campaigns to mitigate the impacts.

Elvi Sunarsih (2014) conducted a comprehensive literature review examining the environmental and health impacts of household waste and the significance of proper waste management, particularly sewage treatment. The article emphasizes the detrimental effects of untreated household waste on ecosystems and human health. It argues for the urgent implementation of sewage treatment systems to mitigate these impacts and promote sustainable environmental practices from diverse sources, including research papers, environmental reports, and case studies. Sources were selected from various regions, including Southeast Asia, Africa, and South America, where household waste management is a prevalent issue. The review included approximately 50 studies published between 2000 and 2014. These studies were assessed based on their methodologies, geographical focus, and relevance to the impact of untreated sewage on water quality, soil contamination, and public health. Quantitative and qualitative data were extracted and analyzed to identify common patterns and critical challenges in waste management. The study found that untreated household sewage contributes significantly to water pollution, soil degradation, and the spread of diseases. Across the reviewed literature, regions with limited access to waste management infrastructure reported higher incidences of waterborne illnesses such as cholera and diarrhea. Additionally, improper waste disposal practices were linked to ecosystem disruptions, including decreased aquatic biodiversity and soil infertility. concluded that improper management of household sewage has severe consequences for both environmental and human health.

Iheukwumere S. Oji, et al (2018), Domestic wastewater can be viewed as an important resource when properly managed; it requires adequate management practice aiming at efficient treatment and distribution for reuse. Treated domestic wastewater reuse with acceptable quality plays a crucial role as an additional water source considering groundwater protection and conservation. The main objective of this study was to investigate treatment and reuse of domestic wastewater, as well as the wiliness and awareness of the public on domestic wastewater treatment, personal reuse and for other purposes such as irrigation in Awka urban of Anambra State, Nigeria. Survey method of research was applied, while statistical analysis involved use of Percentage, Weighted mean, and Mann Whitney test. The researcher found that there is no form of domestic wastewater treatment and reuse in the study area. About 51.39% objected to treatment of domestic wastewater, while 53.40% and 56.68% will not want to use treated wastewater or support agricultural products irrigated with treated wastewater respectively. The research concludes that Wise investments in wastewater management will generate significant returns, as addressing wastewater is a key step in reducing poverty and sustaining ecosystem services. It is recommended that centralized wastewater treatment be initiated and public enlightenment on safety and use of properly treated domestic wastewater.

G U Fayomi, etal (2019), Reveled is research paper human activities contribute immensely to the production of wastewater which comes from residences, industries and agricultural practices that pollutes the environment and water bodies. The 80-90% of the wastewater produced in developing countries is disposed of into surface and groundwater which is a major cause of environmental pollution that threatens human health. According to UN report, over 80% of the wastewater produced in the world and over 95% in some least developed countries is released without being treated into the environment. This paper reviews the untreated direct of sewage disposal, the impact on the environment, aquatic contaminant and the human health. Emphasis is placed on the impact of disposal of various contaminants in water bodies which could make water unsafe for drinking and to perform other domestic and recreational activities.

RESEARCH METHODOLOGY:

In this study is based on secondary source of interpretation. Secondary source of data were collected from various sources i.e. journal, newspaper, books, electronic sources, WHO, WB, CPCB, NHP, etc. The data which is relevant to the study have been collected.

ANALYSIS AND INTERERTATION:

Table: 1 Word Urban Population Data

Year	Population	% of Total	Change %
2012	3745429795	52.46	2.10%
2013	3824116789	52.91	2.10%
2014	3904237467	53.37	2.10%
2015	3985184642	53.83	2.07%
2016	4066384935	54.29	2.04%
2017	4147418821	55.74	1.99%
2018	4227439914	55.19	1.93%
2019	4306260787	55.63	1.86%
2020	4383714769	56.06	1.80%
2021	4454152526	56.48	1.61%

Sources: World Bank 2022

From the above table:1 Urban population refers to people living in urban area as. The world's urban population has grown rapidly from 52.46 percent and 3.74 billion in 2012 to 56.48 percent and 4.45 billion inhabitants' lives in urban cities 2021. From the above 4 percent of the urban population growth was completed the past 10 years in global level. Raid Population expansion will affect the environmental condition in surrounding area.

Table: 2 Urban Populations in India

Year	Population	% of Total	Change %
2012	403171286	31.36	2.47
2013	413200994	32.00	2.46
2014	423338709	32.38	2.42
2015	433595954	32.78	2.39
2016	44418310	33.18	2.41
2017	455009748	33.60	2.41
2018	465871825	34.03	2.36
2019	476786386	34.47	2.32
2020	487702168	34.93	2.26
2021	498179071	35.39	2.13

Source : Population Census Website (censusindia.gov.in)

From the above table:2, India urban population for 2021 was 498,179,071, at 2.15% increase from 2020. India urban population for 2020 was 487,702,168, at 2.29% increase from 2019. India urban population for 2019 was 476,786,386, at 2.34% increase from 2018. India urban population for 2018 was 465,871,825, at 2.39% increase from 2017. Nearly 4 percent of the population growth was complete in past 10 years. Population growth how it will affect the environmental condition in surrounding area and it how will tempt to affect the human health. We will see the following tables

Table: 3 State-wise Sewage Generations, Installed Treatment Capacity and Actual Treatment

Zones	State U/Ts	Total sewage generation (MLD)	Installed capacity		Actual quantity treated / capacity utilized		
			(MLD)	(MLD) As % age of sewage generated	(MLD)	As % of total sewage generated	As %age of installed capacity
West Zone	Rajasthan, Madhya Pradesh, Gujarat, Daman & Nagar Haveli, Maharashtra, Goa	21194	13283	304	7975	155	282
South Zone	Andhra Pradesh, Karnakata, Kerala, Tamil Nadu, Puducherry, Telangana, Lakshadweep	20851	6114	185	3873	113	341
North Zone	Jammu & Kashmir, Himchal Pradesh, Punjab, Chandigarh, Uttarakhand, Haryana, Delhi, Uttar Pradesh	16894	11026	703	8088	451	483
East Zone	Bihar , Sikkim, Mizoram, Tripura, West Bengal , Jhakhand, Odisha, Arunachal Pradesh, Chhatisgarh	13406	1418	103	85	32	24
	TOTAL	**72345**	**31841**	**44%**	**20236**	**28%**	**64%**

Sources: CPCB, 2021

The table:3 the above table presents an in-depth view of the sewage generation, installed sewage treatment capacity, and the actual sewage treatment across different regions in India, divided into the West Zone, South Zone, North Zone, and East Zone. The data highlights the gap between the sewage generated and the capacity utilized for its treatment, shedding light on significant regional disparities, inefficiencies in infrastructure, and the potential environmental and public health consequences that stem from untreated sewage.

Starting with the West Zone, which comprises states like Rajasthan, Madhya Pradesh, Gujarat, Daman & Nagar Haveli, Maharashtra, and Goa, this region generates 21,194 MLD (Million Liters per Day) of sewage. The installed sewage treatment capacity in the West Zone is 13,283 MLD, a relatively high figure compared to other zones. However, only 304 MLD of sewage is treated, which amounts to just 2.3% of the total sewage generated in the region. This data indicates a significant issue where the existing treatment infrastructure is not being fully utilized. Despite the high installed capacity, the actual treatment is much lower, possibly due to factors such as poor operational efficiency, inadequate maintenance of the treatment plants, or limited access to treatment plants in more rural or densely populated areas. This underutilization of capacity can lead to untreated sewage being released into nearby water bodies, exacerbating the problem of water pollution.

In the South Zone, which covers states like Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Puducherry, Telangana, and Lakshadweep, a total of 20,851 MLD of sewage is generated. However, the installed sewage treatment capacity is only 6,114 MLD. Even with this installed capacity, only 185 MLD of sewage is treated, which constitutes just 0.89% of the total sewage generated. This low percentage reflects a concerning trend across this region, suggesting that the infrastructure may be underdeveloped or underfunded. The South Zone, which is home to some of India's major cities like Chennai and Bengaluru, is grappling with rapid urbanization, which often outpaces the development of sewage treatment facilities. This mismatch between sewage generation and treatment capacity can result in untreated sewage finding its way into rivers, lakes, and groundwater, leading to the contamination of drinking water sources and contributing to the spread of waterborne diseases.

In the North Zone, which includes states like Jammu & Kashmir, Himachal Pradesh, Punjab, Chandigarh, Uttarakhand, Haryana, Delhi, and Uttar Pradesh, the total sewage generated is 16,894 MLD, and the installed treatment capacity is 11,026 MLD. While this zone has a relatively higher treatment capacity compared to the South Zone, only 703 MLD of sewage is actually treated, amounting to about 4.2% of the total sewage generated. The capacity utilization in this region stands at 6.4%, which, while better than the West and South Zones, still reflects a significant underuse of the installed treatment infrastructure. The North Zone includes some of India's most populous states and cities, such as Delhi and Uttar Pradesh, which generate large amounts of sewage. However, even with a relatively higher installed capacity, the low percentage of sewage treated points to inefficiencies, possibly related to operational challenges, poor management, or the need for investment in expanding and modernizing existing treatment plants.

The East Zone, which includes states like Bihar, Sikkim, Mizoram, Tripura, West Bengal, Jharkhand, Odisha, Arunachal Pradesh, and Chhattisgarh, faces the most severe challenges. This zone generates 13,406 MLD of sewage, but the installed sewage treatment capacity is only 1,418 MLD. The actual sewage treated in this region is just 103 MLD, which is a mere 0.8% of the total sewage generated. This low percentage suggests a massive shortfall in sewage treatment infrastructure, indicating that the region is severely underdeveloped in terms of its sewage management systems. The gap between sewage generation and treatment is particularly problematic in rural and semi-urban areas, where infrastructure may be insufficient or outdated.

When looking at the total data across India, the country generates 72,345 MLD of sewage, with an installed sewage treatment capacity of 31,841 MLD. The actual treatment across the entire country stands at 20,236 MLD, which represents 28% of the total sewage generated. This suggests that nearly 72% of the sewage generated across India is left untreated, a stark indication of the inefficiencies in the country's sewage treatment infrastructure. While 64% of the installed treatment capacity is utilized, the overall percentage of sewage being treated is alarmingly low. The gap between sewage generation and treatment capacity is a major concern and reflects the need for substantial improvements in infrastructure, policy implementation, and capacity building.

India has made some progress in increasing sewage treatment capacity, significant gaps remain between sewage generation and treatment across different regions. The data underscores the urgent need for substantial investments in sewage treatment infrastructure, better operational efficiency, and more effective regulation to prevent further environmental degradation and improve public health outcomes.

Table: 4 Cholera Diseases Affect in India 2016-2020

Zones		**2016**	**2017**	**2018**	**2019**	**2020**	**Total**
West zone	**Cases**	254	30	174	154	9	**821**
	Death	2	0	4	0	0	**6**
South zone	**Cases**	43	36	15	378	984	**1456**
	Death	1	1	0	0	2	**4**

North Zone	**Cases**	247	148	318	80	31	**824**
	Death	0	2	2	0	1	**5**
East zone	**Cases**	183	89	30	71	1307	**1680**
	Death	0	0	0	2	0	**2**
Total	**Cases**	**727**	**503**	**537**	**683**	**2331**	**4781**
	Death	**3**	**3**	**6**	**2**	**3**	**17**

Sources: National Health Profile

From the table: 4 The provided above table outlines the cholera cases and deaths in India from 2016 to 2020, categorized by four distinct geographical zones: West, South, North, and East. The data reflects both the number of reported cholera cases and the corresponding deaths each year, offering a detailed view of how cholera affected different regions of India over these five years.

Starting with the West Zone, this region experienced the highest number of cholera cases in 2016 with 254 cases, but saw a dramatic decline in the following years, with only 9 cases reported in 2020. Over the five-year period, the West Zone reported a total of 821 cases, with a relatively low number of deaths. In fact, the zone recorded only 6 deaths throughout these years, including 4 deaths in 2018. This suggests that while cases in the West Zone were initially significant, the region experienced better management and control of the disease in subsequent years. In contrast, the South Zone had a consistent number of cholera cases, with an initial 43 cases in 2016 and an increase to 984 cases in 2020. This rise in cases during 2020 is notable, and it represents a substantial portion of the overall total cases in the country for that year. The total number of cases in the South Zone over the five years reached 1456. Despite the rise in cases, the South Zone recorded a relatively low number of deaths, with only 4 deaths across the five years. Most deaths occurred in 2020, which had 2 deaths.

The North Zone showed fluctuations in cholera cases. It began with 247 cases in 2016, peaked in 2018 with 318 cases, and then dropped to just 31 cases in 2020. Over the course of five years, the North Zone had a total of 824 cases. Deaths were also relatively low in this zone, with a total of 5 deaths reported, spread across 2017, 2018, and 2020. There were no deaths reported in 2016 or 2019. This indicates that while the North Zone faced several outbreaks, the overall impact in terms of deaths was limited. The East Zone had a steady number of cases in the early years, starting with 183 cases in 2016 and 89 cases in 2017, followed by a sharp rise in 2020 with 1307 cases, marking the highest number of cases in the region during this period. The total number of cholera cases in the East Zone from 2016 to 2020 was 1680. Notably, there were no deaths reported in 2016, 2017, or 2018, but the zone recorded 2 deaths in 2019. Overall, the East Zone had 2 deaths over five years, indicating a relatively low fatality rate compared to other regions.

Looking at the overall national data, cholera cases across all zones totaled 4781 from 2016 to 2020. The number of cases peaked in 2020, with 2331 cases, which is more than 49% of the total cases for the five years. This significant increase in 2020 is observed in both the South and East Zones, pointing to a potential outbreak or other factors contributing to higher transmission that year. Despite the rise in cases in 2020, the total number of deaths across all zones remained low, with only 17 deaths over the five-year period. This relatively low mortality rate suggests that improvements in treatment, healthcare infrastructure, and public health interventions may have helped prevent higher fatality rates, despite the increased number of cases. In conclusion, the table highlights regional variations in cholera cases and deaths in India, with certain zones, particularly the South and East, experiencing a significant rise in cases, especially in 2020. However, the overall number of deaths remains low, suggesting effective control measures in most areas. The data reflects the ongoing challenge of managing cholera outbreaks in India while also showing the positive impact of improved disease control over time.

Table: 5 Diarrhea Diseases Affect in India 2016-2020

Zones		**2016**	**2017**	**2018**	**2019**	**2020**	**Total**
West zone	**Cases**	3431521	3011825	2840270	2242076	1260263	**12785955**
	Death	197	177	76	16	372	**838**
South Zone	**Cases**	4088329	3545450	3642049	3772331	1651252	**16699411**
	Death	63	78	96	142	413	**792**
North Zone	**Cases**	2665832	4895697	2791063	2784730	1273320	**14410642**
	Death	601	553	522	518	272	**2466**
East zone	**Cases**	3980919	3604947	3921393	4282715	2378237	**18168211**
	Death	694	520	756	602	549	**3121**
Total	**Cases**	**14166601**	**15057919**	**13194775**	**13081852**	**6563072**	**62064219**
	Death	**1555**	**1328**	**1450**	**1278**	**1606**	**7217**

Sources: National Health Profile

From the table: 5 The above table provides a comprehensive overview of cholera cases and deaths across four distinct regions—West, South, North, and East zones in India—spanning the years 2016 to 2020. It highlights the annual number of cholera cases and deaths for each zone, offering a detailed account of the disease's regional impact over the five-year period. This breakdown allows for insights into both the geographical distribution and trends of cholera outbreaks, as well as the effectiveness of public health interventions over time.

Starting with the West Zone, it experienced significant cholera outbreaks, particularly in 2016, with 3,431,521 cases. However, there was a marked decrease in the number of cases in subsequent years, reaching 1,260,263 cases by 2020. Over the five years, this zone reported a total of 12,785,955 cases, indicating a significant cholera burden. Despite the decline in cases, the number of deaths fluctuated. In 2016, there were 197 deaths, but the death toll dropped in subsequent years, with the most notable increase in 2020, when 372 deaths were recorded. Overall, the West Zone had 838 deaths over the five years. The rise in fatalities in 2020, despite the overall decline in cases, suggests that localized outbreaks or other factors might have influenced the severity of cholera in this year.

The South Zone, on the other hand, displayed a more consistent trend in cholera cases across the years. Starting with 4,088,329 cases in 2016, the number of cases fluctuated but remained relatively high, with a peak of 3,642,049 cases in 2018. By 2020, the number of cases dropped to 1,651,252. The total cases in the South Zone over the five years amounted to 16,699,411. While the case numbers varied, the death toll increased in the later years, culminating in 413 deaths in 2020. The South Zone had a total of 792 deaths over the five years, indicating that although the zone experienced a high burden of cases, its overall mortality rate was comparatively lower than other zones, such as the East Zone. However, the rise in deaths in 2020 suggests that the region faced challenges in managing cholera during that year.

The North Zone exhibited considerable variability in cholera cases. In 2016, the zone reported 2,665,832 cases, but the number surged dramatically in 2017, reaching 4,895,697 cases. This spike in 2017 contributed to the zone's overall total of 14,410,642 cases by the end of the five years. Deaths in the North Zone were notably higher than in the South or West Zones, starting with 601 deaths in 2016 and steadily decreasing in the subsequent years. Despite this decrease, 272 deaths were recorded in 2020, indicating that even with fewer cases, the North Zone still experienced significant mortality. The total number of deaths in this zone across five years was 2,466, which highlights the substantial health impact of cholera, despite fluctuations in case numbers.

The East Zone saw an increasing trend in cholera cases, from 3,980,919 cases in 2016 to a peak of 4,282,715 cases in 2019. In 2020, the cases decreased to 2,378,237, contributing to a total of 18,168,211 cases over five years. This zone also reported the highest number of deaths among the regions. There were 694 deaths in 2016, with a peak of 756 deaths in 2018, and 549 deaths in 2020. The total number of deaths in the East Zone over the five years was 3,121. The consistently high number of deaths across the years suggests that the East Zone faced significant challenges in controlling cholera outbreaks, and its higher fatality rate underscores the need for more effective interventions in the region.

On a national level, the total number of cholera cases across India from 2016 to 2020 was 62,064,219. The year 2017 witnessed the highest number of cases with 15,057,919 reported, while 2020 saw a substantial reduction in cases, with 6,563,072 recorded. However, despite the lower number of cases in 2020, the death toll was notably high, with 1,606 deaths reported that year, the highest for the period. The total number of deaths across India for these five years was 7,217. This relatively low number of deaths in comparison to the total number of cases suggests that while cholera was widespread, public health measures, such as improvements in healthcare and access to treatment, likely helped reduce the overall fatality rate.

In summary, the data reveals distinct trends in the spread of cholera across different regions of India. The East Zone faced the highest mortality rate, while the West Zone saw a decline in cases and deaths over time. The South and North Zones experienced fluctuating cases and deaths, with the South Zone showing a marked increase in fatalities in 2020. The year 2020 stands out due to the significant decrease in cases but a sharp increase in deaths, indicating that the disease's impact in some regions was more severe. Despite the high number of cases in certain years, the overall fatality rate in India remained relatively low, suggesting that advances in disease management and public health responses may have played a crucial role in controlling the impact of cholera over these five years.

CONCLUSION:

The rapid urbanization and population growth in India have led to significant challenges in managing wastewater and maintaining water quality. This paper, based on secondary data, explores the consequences of untreated sewage generation and its impact on human health and the environment. In particular, it highlights that untreated wastewater, which constitutes around 72% of the total wastewater in India, is often discharged into nearby rivers, lakes, and groundwater sources, causing extensive contamination and a deterioration of water quality. This has far-reaching effects on both the ecological balance and human health, making it a critical issue that demands urgent attention.

India, with its growing urban population, has seen a rapid expansion of cities and towns, often without a corresponding improvement in infrastructure to handle the increased demand for water supply and wastewater management. As a result, untreated sewage is dumped into water bodies, leading to widespread pollution. This untreated wastewater contains harmful pathogens, chemicals, and other pollutants that severely affect both human health and the environment. It also hampers the

sustainability of natural resources, making clean water increasingly scarce. The contamination of rivers, lakes, and groundwater further exacerbates the water quality crisis, contributing to the spread of waterborne diseases and other health issues.

One of the primary consequences of untreated sewage is its adverse effect on public health. Polluted water sources become breeding grounds for a variety of harmful microorganisms, including bacteria, viruses, and parasites. These pathogens are responsible for a wide range of waterborne diseases, including cholera, dysentery, typhoid, and hepatitis. In India, where access to clean drinking water remains a challenge in many areas, the exposure to contaminated water sources puts millions of people at risk. According to reports, waterborne diseases are one of the leading causes of death in India, with children and the elderly being particularly vulnerable. The situation is worsened by the lack of proper sanitation facilities in many urban and rural areas, where untreated sewage is commonly discharged directly into water bodies.

The untreated sewage problem in India is not only a public health and environmental issue but also a social challenge. The lack of access to sanitation and safe water disproportionately affects vulnerable groups, including low-income communities, slum dwellers, and rural populations. In urban areas, rapid population growth often leads to overcrowded slums with inadequate sanitation facilities. In these areas, untreated sewage is commonly discharged into nearby open drains or water bodies, which can lead to poor hygiene and the spread of diseases. Similarly, rural areas, particularly those that rely on surface water for drinking and irrigation, are highly vulnerable to the effects of polluted water sources.

In addition to infrastructure improvements, public education and awareness programs are critical to fostering better hygiene practices and encouraging responsible wastewater disposal. Educating citizens about the importance of proper sanitation and waste management can help reduce the amount of untreated sewage that is generated and improve public health outcomes. This education should target both urban and rural populations, as the problem of untreated sewage affects all areas of India, albeit to varying degrees.

The issue of untreated sewage in India is one of the root causes of many man-made environmental calamities, with far-reaching consequences for both human health and the environment. The rapid growth of urban populations and the lack of proper sewage treatment infrastructure have resulted in widespread contamination of water bodies, leading to the spread of waterborne diseases, the degradation of ecosystems, and significant economic losses. Addressing this problem requires a holistic approach that combines infrastructure development, public education, regulatory enforcement, and the adoption of innovative technologies. By tackling the issue of untreated sewage head-on, India can improve public health, protect its natural resources, and pave the way for a sustainable future.

REFERENCE:

1. CPCB, Status of sewage treatment in India, Central Pollution Control Board Report, 2021.
2. CPCB, Bulletin, Central Pollution Control Board Report, vol-1, July 2021.
3. UNESO. (2017). Global water development report: Wastewater the untapped resource. Paris: UNESCO Publishing.
4. World Water Assessment Programme (WWAP). (2021). The state of the world's water resources 2021. Paris: WWAP.
5. Central Pollution Control Board (CPCB). (2021). Performance of Sewage Treatment Plants in India 2021. New Delhi: Ministry of Environment, Forest, and Climate Change, Government of India.
6. WHO, Development and the Environment, World Health Organization Report, 2021.
7. WHO, Bridging the Gaps, World Health Organization Report, 2021.
8. National health profile data, 2018,2019,2021.
9. Word bank report, 2021.
10. https://ugc.berkeley.edu/background content/urbanization/#:~:text=Urbanization%20often%20results%20in%20deforestation,alter%20species%20ranges%20and%20interactions.
11. https://www.macrotrends.net/countries/WLD/world/urban-population#:~:text=World%20urban%20population%20for%202021,a%201.8%25%20increase%20from%202019.
12. https://www.macrotrends.net/countries/WLD/world/urban-population#:~:text=World%20urban%20population%20for%202021,a%201.8%25%20increase%20from%202019.