

Original article

# Open Defecation, Sanitation, and Associated Health Issues in India: A Comprehensive Analysis with a Focus on Assam (2000–2022)

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**Citation:** Bora , P.; Rabha , R.; Goswami , K.; (2023). Open Defecation, Sanitation, and Associated Health Issues in India: A Comprehensive Analysis with a Focus on Assam (2000–2022). *Journal of Intellectuals*, 3(1), 48–54. Retrieved from <https://journals.bahonacollege.edu.in/index.php/joi/article/view/joi2023-3-1-5>

Accepted: 05 November, 2023

Published: 25 December, 2023

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**Abstract:** Open defecation (OD) remains a pressing public health issue in India, linked to diseases such as diarrhea, stunting, and soil-transmitted helminth (STH) infections. This paper examines OD prevalence, sanitation coverage, and associated health outcomes across India, with a particular focus on Assam. Leveraging sources like the National Family Health Surveys (NFHS), Swachh Bharat Mission (SBM) reports, and peer-reviewed research, the analysis highlights a national decline in OD from 73% in 2000 to 19.4% by 2019–2021, yet reveals persistent regional disparities. In Assam, OD stood at 52.3% in 2015–2016, driven by unique challenges like flooding and cultural resistance, contributing to elevated diarrhea (12.5%) and stunting (36.4%) rates. The paper recommends resilient infrastructure, behavior change campaigns, and community-driven solutions to address these disparities and enhance public health outcomes.

**Keywords:** Open defecation; sanitation; public health; Swachh Bharat Mission; Assam; India

## 1. Introduction

Sanitation is very important for keeping people healthy and maintaining dignity. However, many people in India, especially those in rural areas, still do not have access to proper toilets. This forces them to practice open defecation, which means going to the bathroom outside in open spaces. Open defecation spreads germs, contaminates drinking water, and causes diseases, especially in children. It also makes women and children vulnerable to safety risks and health problems. Women often face harassment and violence due to the lack of safe toilets, while children suffer from frequent illnesses that stop them from growing properly (Bora, 2021).

India had advanced sanitation systems thousands of years ago. The Indus Valley Civilization, which existed around 2500 BCE, had well-planned drainage systems. Ancient texts like the Manusmriti also stressed the importance of cleanliness (Rana & Agarwal, 2017). However, over time, these practices declined, and

poor sanitation became widespread. To address this issue, the Indian government launched various programs, such as the Central Rural Sanitation Programme (CRSP) in 1986 and the Total Sanitation Campaign (TSC) in 1999. These programs focused mainly on building toilets, but they did not create enough awareness to ensure that people actually used them (Rana & Agarwal, 2017).

The situation improved when the government launched the Swachh Bharat Mission (SBM) in 2014. This program aimed to make India free from open defecation by 2019. It focused not only on building toilets but also on changing people's habits and encouraging them to use these facilities. As a result, over 110 million toilets were built across the country, and open defecation reduced from 55% in 2005–2006 to 19.4% by 2019–2021 (IIPS, 2021). Despite this progress, some states, including Assam, continue to face challenges in maintaining proper sanitation.

Assam has unique problems that make it difficult to maintain good sanitation. The state experiences frequent floods that destroy toilets and force people to return to open defecation. People living in flood-prone areas, such as the char chapori (riverine) dwellers, often lose their makeshift toilets during the monsoon season. A study by Khan (2020) found that almost all households (99.9%) in char chapori areas of Tezpur, Assam, defecate in the open because their toilets are washed away by floods. Poverty and low education levels further prevent families from adopting safe sanitation habits. Even when toilets are available, they are often not used because of poor maintenance and lack of water. Hazarika (2015) found that in Jorhat, Assam, 52.3% of households in slum areas did not have access to toilets, leading to high rates of diarrhea and malnutrition.

Poor sanitation affects more than just health. It also impacts education and gender equality. Many girls miss school during menstruation because there are no proper toilets, which affects their education and future opportunities. Women and girls are also at greater risk of violence when they have to go to the bathroom in open areas. Improving sanitation is not just about building toilets—it is about creating safer and healthier communities.

This study focuses on understanding how open defecation and poor sanitation affect public health in India, with a special focus on Assam. It looks at the progress made through various sanitation programs, examines the health risks caused by poor sanitation, and identifies the challenges that make it difficult to sustain improvements in Assam. By understanding these challenges, this study aims to suggest practical solutions that can help improve sanitation and health outcomes in Assam and other vulnerable areas.

## **2. Objective of the study:**

The study has three main goals:

1. To look at how open defecation and toilet coverage have changed in India from 2000 to 2022, especially in Assam.
2. To check how open defecation affects health, like causing diarrhea and stunting, in Assam compared to the rest of India.
3. To find out what makes sanitation hard in Assam, like floods, poverty, and local habits.

## **3. Literature Review:**

Sanitation isn't just about toilets—it's about keeping people healthy and safe. In India, especially in rural places, open defecation and poor hygiene have been big problems for a long time. This section digs into what researchers have found about sanitation and health in India, with extra attention on Assam. We'll cover the history, specific challenges, and how it all connects to sickness.

### **A Look Back at Sanitation in India**

India's sanitation story goes way back. Thousands of years ago, the Indus Valley Civilization had great drainage systems, and old texts like the Manusmriti said cleanliness was important (Rana & Agarwal, 2017). But over time, things got worse. By the 20th century, the government had to step in. Mahatma Gandhi pushed for better sanitation, and programs like the Sanitation Decade (1981–1990) and the Central Rural Sanitation Programme (CRSP) in 1986 tried to

help rural areas by giving money for latrines. These didn't work well because people didn't know why toilets mattered (Rana & Agarwal, 2017).

In 1999, the Total Sanitation Campaign (TSC) started focusing on teaching people about sanitation instead of just building toilets. Then, in 2012, the Nirmal Bharat Abhiyan (NBA) aimed to make India totally clean by 2022. The biggest push came in 2014 with the Swachh Bharat Mission (SBM), which wanted to stop open defecation by 2019. It built millions of toilets, but in 2015, only 39.6% of people had good sanitation—28.5% in villages and 62.6% in cities (Rana & Agarwal, 2017). Old habits and not enough education still hold things back.

### **Tough Times in Assam**

Assam has its own struggles with sanitation. Khan (2020) studied people living on shaky sandbars along the Jia Bharali River in Tezpur, called char chapori dwellers. Out of 210 households surveyed, almost all (99.9%) had no choice but to defecate outside. This pollutes their water and leads to sickness like anemia. There's barely any healthcare—one small clinic for two areas—and most people depend on farming with little money or schooling. The government gave some basic latrines to 40% of homes in Bhojkhowa, but no one uses them. Women suffer the most—70% in Makua Chapori have no sanitation, leaving them open to infections (Khan, 2020).

Hazarika (2015) looked at Jorhat, Assam, surveying 120 homes in slums, a tea estate, and a village. In slums, only 5% had toilets, and 87% had no proper drains. People got water from the city (62.5%), tube wells (27.5%), or the dirty Bhogdoi River (10%), which tests showed was full of bacteria. In Hunwal Tea Estate, 17% still went outside, while Pokamura village did better with 58% having toilets. Bad sanitation meant more diarrhea and kids not growing well. Many didn't wash their hands properly—67% used just water, and 13% didn't wash before eating (Hazarika, 2015).

### **How Sanitation Hurts Health**

Poor sanitation makes people sick, especially kids. Borah and Kakati (2016) asked 325 moms in rural Kamrup, Assam, about washing hands with soap. Most (76%) washed after using the bathroom, but only 53% did after cleaning a child, 57% before feeding them, and 28.6% before breastfeeding. Moms with more education washed more often, and their kids had less diarrhea—62.6% stayed healthy compared to others (Borah & Kakati, 2016). This shows washing hands can really help.

Deka et al. (2021) studied kids aged 5–13 in flood-hit Barpeta, Assam. Out of 435 children, 16.3% had worm infections from the soil, like *Ascaris* (9.4%) and hookworm (7.4%). Open defecation made it 2.8 times more likely, and not washing hands raised the risk 5.7 times. Floods made things worse by spreading germs (Deka et al., 2021). In West Bengal's Malda District, Taufique et al. (2020) found 51.67% of homes had no toilets, leading to diarrhea (36.67%) and worms (21.67%). People kept doing it because of habit (41.67%) or poverty (28.33%).

### **Why Open Defecation Sticks Around**

Bora (2021) says over 600 million Indians—53% of the country—went outside in 2015, making up 59% of the world's open defecation. It causes diseases like cholera and puts women at risk of attack. Problems like poverty, tricky paperwork for subsidies, and beliefs that toilets are unclean keep it going. Even with big plans like SBM, building toilets slowed down after 2014 (Bora, 2021). These studies show sanitation isn't just about building, it's about changing how people think and live.

### **4. Methodology:**

This research adopts a systematic review approach, synthesizing secondary data from credible sources to examine OD, sanitation coverage, and health outcomes in India from 2000 to 2022, with a focus on Assam. Data were sourced from the National Family Health Surveys (NFHS-3: 2005–2006, NFHS-4: 2015–2016, NFHS-5: 2019–2021), accessible at <http://rchiips.org/nfhs/>, providing nationally representative statistics on sanitation and health. Additional data were obtained from the WHO/UNICEF JMP reports (<https://washdata.org/reports>) for OD trends and the SBM progress reports for toilet construction metrics up to 2022. Peer-reviewed studies were retrieved from databases such as Google

Scholar, PubMed, and ScienceDirect, using keywords including “open defecation,” “sanitation,” “Assam,” and “India,” restricted to English-language publications from 2000 to July 2023.

Inclusion criteria encompassed studies reporting OD prevalence, sanitation coverage, or health outcomes (e.g., diarrhea, stunting) in India, with relevance to Assam or comparable regions. Exclusion criteria eliminated pre-2000 studies, post-July 2023 publications, and those unrelated to sanitation or lacking Indian context. Data extraction involved compiling quantitative metrics (e.g., OD rates, toilet coverage) and qualitative insights (e.g., cultural barriers) into a structured framework. Analysis employed descriptive statistics to track trends and thematic synthesis to identify barriers and health impacts. Limitations include potential underreporting in survey data and reliance on secondary sources, mitigated by cross-verification across multiple datasets to ensure reliability.

## 5. Results and findings:

This research has identified significant trends in OD prevalence, sanitation coverage, and health outcomes across India, with an in-depth analysis of Assam’s challenges and comparisons with other regions. The findings illuminate both national progress and persistent regional disparities.

### National Sanitation and Health Trends

Nationally, OD prevalence declined markedly from 73% in 2000 to 19.4% by 2019–2021, propelled by the SBM’s construction of over 110 million toilets by 2022 (WHO/UNICEF JMP, 2021; IIPS, 2021; Ministry of Jal Shakti, 2022). Sanitation coverage expanded from 26% in 2000 to 80.6% in 2019–2021, reflecting a concerted effort to enhance infrastructure. Corresponding health improvements include a reduction in diarrheal disease prevalence among children under five from 9.2% in 2005–2006 to 7.3% in 2019–2021, and stunting from 48% to 35.5% over the same period (IIPS, 2007, 2021). These trends suggest a strong correlation between improved sanitation and public health gains, though rural areas continue to lag behind urban centers.

**Table 1:** National Sanitation and Health Trends (2000–2022)

Year	Open Defecation (%)	Toilet Coverage (%)	Diarrheal Disease (%)	Stunting (%)
2000	73	26	-	-
2005–06	55	45	9.2	48
2015–16	38.9	61.1	9.0	38.4
2019–21	19.4	80.6	7.3	35.5
2022 (est)	15	85	-	-
<b>Sources:</b> WHO/UNICEF JMP (2021), IIPS (2007, 2017, 2021), Ministry of Jal Shakti (2022)				

### Sanitation and Health Trends in Assam

In Assam, OD prevalence decreased from 47.8% in 2005–2006 to 19.4% by 2019–2021, aligning with the national average, yet rural areas exhibited a significantly higher rate of 58.1% in 2015–2016 (IIPS, 2021). Toilet coverage increased from 52% to 80.6% over the period, though usage remains inconsistent due to cultural and infrastructural barriers. Diarrheal disease prevalence among children under five was elevated at 12.5% in 2015–2016 compared to the national 9.0%, declining to 5.2% by 2019–2021. Stunting persisted at 35.3%, marginally below the national 35.5%, indicating a slower health improvement trajectory (IIPS, 2021). These figures highlight Assam’s partial success in reducing OD, tempered by ongoing challenges in rural sanitation and health outcomes.

**Table 2:** Assam Sanitation and Health Trends (2005–2021)

Year	Open Defecation (%)	Toilet Coverage (%)	Diarrheal Disease (%)	Stunting (%)
2005–06	47.8	52	-	46.5
2015–16	25.2	74.8	12.5	36.4
2019–21	19.4	80.6	5.2	35.3
<b>Source:</b> IIPS (2007, 2017, 2021)				

### Regional Disparities within Assam

Within Assam, specific regions demonstrate severe sanitation deficits. Khan (2020) reported a 99.9% OD prevalence in Tezpur’s char chapori areas, where floods damaged 450 of 500 constructed toilets, leaving only 50 operational. This high OD rate correlates with water contamination and increased anemia, particularly among women. Hazarika (2015) documented 52.3% OD in Jorhat slums, where only 5% of households had toilets, and contaminated water sources contributed to a high incidence of diarrheal disease. Borah and Kakati (2016) identified a 37.4% diarrhea prevalence in Kamrup, linked to poor handwashing practices—only 28.6% of mothers washed hands with soap before breastfeeding. Deka et al. (2021) found a 16.3% STH prevalence in Barpeta, with OD and flooding as primary risk factors, affecting child health outcomes significantly.

**Table 3:** Sanitation and Health Outcomes in Assam Regions

Region	Open Defecation (%)	Diarrheal Disease (%)	STH Prevalence (%)
Char Chapori	99.9	-	-
Jorhat Slums	52.3	High	-
Kamrup	-	37.4	-
Barpeta	-	-	16.3
<b>Sources:</b> Khan (2020), Hazarika (2015), Borah & Kakati (2016), Deka et al. (2021)			

### Comparative Analysis with Other States

Assam’s OD rate of 19.4% in 2019–2021 aligns with the national average but exceeds West Bengal’s 15.2% and falls below Madhya Pradesh’s 21.8%. Diarrheal disease (5.2%) and stunting (35.3%) in Assam approximate national figures (7.3% and 35.5%, respectively), while West Bengal reports 6.8% and 32.2%, and Madhya Pradesh 7.9% and 37.1% (IIPS, 2021). These comparisons suggest Assam occupies an intermediate position, with health outcomes reflecting partial progress amidst persistent sanitation challenges.

**Table 4:** Comparative Sanitation and Health Indicators (2019–2021)

State	Open Defecation (%)	Toilet Coverage (%)	Diarrheal Disease (%)	Stunting (%)
Assam	19.4	80.6	5.2	35.3
West Bengal	15.2	84.3	6.8	32.2
Madhya Pradesh	21.8	78.9	7.9	37.1
India	19.4	80.6	7.3	35.5
<b>Source:</b> IIPS (2021)				

### Infrastructure Challenges

Flooding poses a significant threat to sanitation infrastructure in Assam. In Char Chapori, 90% of toilets (450 of 500) were rendered nonfunctional, and in Barpeta, 66.7% (800 of 1,200) were damaged (Khan, 2020; Deka et al., 2021). This vulnerability underscores the need for resilient designs to sustain sanitation gains in flood-prone regions.

## 6. Discussion

This research has demonstrated that national initiatives, notably the SBM, have significantly reduced OD prevalence across India, yet Assam faces persistent obstacles that hinder alignment with national benchmarks. The national decline from 73% in 2000 to 19.4% by 2019–2021 reflects the SBM's extensive reach, with over 110 million toilets constructed by 2022 (Ministry of Jal Shakti, 2022). However, rural-urban disparities—28.5% versus 62.6% sanitation coverage in 2015—persist, indicating uneven progress (Rana & Agarwal, 2017). In Assam, OD reduction from 47.8% to 19.4% is commendable, yet rural rates of 58.1% in 2015–2016 reveal a lag, particularly in flood-affected areas like Char Chapori, where OD remains at 99.9% (IIPS, 2021; Khan, 2020).

Health outcomes in Assam further illustrate sanitation's impact. The 12.5% diarrhea prevalence in 2015–2016 surpasses the national 9.0%, reflecting higher exposure to waterborne pathogens, while stunting at 35.3% in 2019–2021 indicates chronic malnutrition linked to poor sanitation (IIPS, 2021). Deka et al. (2021) attribute Barpeta's 16.3% STH prevalence to OD and flooding, amplifying infection risks, whereas Borah and Kakati (2016) demonstrate that hygiene practices, such as handwashing, mitigate diarrhea, suggesting a need for integrated interventions. Hazarika (2015) corroborates this in Jorhat, where contaminated water sources exacerbate health burdens, necessitating improvements beyond toilet provision.

Geographical challenges, particularly flooding, undermine sanitation infrastructure in Assam. Khan (2020) highlights the near-total destruction of toilets in Char Chapori, while Deka et al. (2021) note similar losses in Barpeta, emphasizing the inadequacy of standard designs in flood-prone regions. Socio-economic factors, including poverty, and cultural preferences—41.67% of Malda residents cited habit persistence (Taufique et al., 2020)—mirror Assam's barriers, requiring tailored strategies. Comparatively, West Bengal's lower OD rate (15.2%) may reflect less severe flooding, while Madhya Pradesh's higher rate (21.8%) aligns with broader rural challenges (IIPS, 2021). Bora (2021) warns of sustainability risks without addressing systemic issues, reinforcing the need for resilience and education.

## 7. Recommendations

This research proposes the following evidence-based recommendations to address Assam's sanitation challenges:

1. **Resilient Infrastructure Development:** Implement flood-resistant toilet designs, such as elevated or portable units, to withstand Assam's environmental conditions, as evidenced by the 90% loss in Char Chapori (Khan, 2020).
2. **Behavior Change Campaigns:** Deploy culturally sensitive education programs to shift attitudes toward toilet use, addressing the 41.67% habit persistence noted in Malda (Taufique et al., 2020).
3. **Hygiene Promotion Initiatives:** Expand handwashing education, leveraging findings that it reduces diarrhea by up to 47% (Borah & Kakati, 2016).
4. **Community-Driven Solutions:** Support community-led total sanitation programs with sustained monitoring, building on Assam's partial success (Khan, 2020).
5. **Policy Refinement:** Shift SBM focus from construction to maintenance and usage, ensuring functionality and accessibility (Rana & Agarwal, 2017).

These strategies aim to bridge Assam's sanitation gap, enhancing health and dignity.

## 8. Conclusion

This research has established that India has achieved considerable success in reducing OD, yet Assam's progress remains constrained by environmental, economic, and cultural factors. The national decline from 73% in 2000 to 19.4% by 2019–2021, driven by the SBM, represents a monumental public health achievement (IIPS, 2021). However, Assam's reduction from 47.8% to 19.4% masks rural disparities, with regions like Char Chapori illustrating near-complete sanitation failure due to flooding (Khan, 2020). Health outcomes, including a 12.5% diarrhea prevalence in 2015–2016 and persistent stunting at 35.3%, underscore the urgent need for targeted interventions (IIPS, 2021). These findings

highlight the necessity of adapting national strategies to regional contexts, ensuring equitable public health advancements

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