ORIGINAL ARTICLE

Perception and Practices regarding diarrhoea management in Dibrugarh, Assam: A mixed-method study

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ABSTRACT

Background: Acute Diarrhoeal Disease (ADD) outbreak, a major public health concern, cholera the most severe forms, frequently occurs in vulnerable settings, like tea garden communities. Timely management can reduce case fatality rate (CFR) from >10% to <1%. It's crucial to comprehend and develop prevention and response plans, tailored to particular environment. **Objectives:** To assess household level water, sanitation and environmental exposure amongst affected families and to explore their perceptions of diarrhoeal illness and its management. **Methods:** Explanatory sequential mixed-method study was conducted in Dinjoy tea estate, Dibrugarh following diarrhoea outbreak. Quantitative data captured environmental vulnerabilities entered and analysed using SPSS 25; followed by in-depth interview through reflexive thematic analysis. Integration of both strands was achieved through force-field analysis. **Results:** ADD reported in 25 patients, CFR was 20%. There was substantial environmental vulnerability. Tubewell was used primary source of drinking water by 84% . Outbreak served as a turning point for risk perception. There was hidden financial aftermath and varying beliefs on traditional and biomedical care. Community solidarity emerged as coping mechanism. **Conclusion:** Cholera exerts multidimensional impacts which extends beyond morbidity and mortality. Prioritizing WASH strengthening is need of hour, focusing on most vulnerable among tea tribes of Assam.

KEYWORDS

Diarrhoea, Cholera, Outbreak, Perceptions, Environmental Vulnerabilities

INTRODUCTION

Water borne diseases remain a scourge despite better health care delivery services. Among all diarrhoeal diseases, cholera has been a symbol for social inequalities affecting vulnerable population of society and is a common occurrence amid social and economic upheaval.(1) Its transmission between humans increase in packed or dense living environment with intermittent access to safe water.(1,2)

Dibrugarh, tea intensive district of Assam, with recurrent cholera and ADD outbreaks indicating persistent vulnerabilities in water, sanitation and hygiene (WASH) systems. Surveillance data showed multiple outbreaks affecting rural and tea-garden communities, where groundwater use and sharing of water source is common. Laboratory confirmed *Vibrio cholerae* was found in several recent episodes linked with contaminated shallow tubewell use, inadequate water treatment with delay in the community detection leading to case clustering and death sometimes.(3,4,5)

One such outbreak with death occurred in Dinjoy Tea Estate, Dibrugarh in 2025, acted as a critical turning point for the affected community.(6,7) Therefore the current study was planned with the following objectives.

Objectives

1. To assess household-level water, sanitation, and environmental exposure factors among outbreak-affected families
2. To explore family's perceptions and barriers regarding the cause, severity and meaning of diarrhoeal illness and its management during outbreak

MATERIAL & METHODS

Setting and study population : Dinjoy (Dinjoye) Tea Estate, located in Chabua circle of Dibrugarh district, Assam. Dinjoy Tea Estate is an active tea garden that contains multiple worker lines (colony) and is administratively adjacent to several human habitations such as Dinjoy Chapori and Dinjoy Satra. Recent public health reports identified the Pucca Line within Dinjoy Tea Estate as one of the focal points of the recent diarrhoeal/cholera outbreak. Baseline population data for nearby census habitations are taken from the Census of India 2011, Dinjoy Chapori (population 299; 61

households) and Dinjoy Satra (population 869; 175 households).(8)

Study design and sample size: An explanatory sequential mixed-methods study was conducted following a cholera outbreak in Dinjoy Tea Estate. The quantitative component preceded the qualitative inquiry to describe household-level exposure conditions, followed by qualitative exploration to understand perceptions, practices, and care-seeking experiences.

The quantitative component included all households listed in the outbreak line-list (n = 25), using a complete enumeration approach. Quantitative data were collected through house to house interviews using a semi-structured interview schedule, capturing information on water source, sanitation facilities, environmental conditions, and basic clinical characteristics. Data were collected during field visits conducted shortly after the outbreak.

Data collection stretegy : For the qualitative component, descriptive exploratory design was used and parents, caregivers, or other adult family members more than 18 years old capable of giving informed consent from outbreak-affected households were selected using purposive sampling and data was collected through in-depth interviews (IDIs) using an interview guide exploring perceptions of diarrhoeal illness, severity, management practices, and barriers and facilitators to care-seeking.

For IDIs, students of sanitary inspector course enrolled at Rural Health Training Centre, Chabua, belonging to the same community were trained as interviewers to minimize language barriers and enhance participant openness during interviews. Prior to fieldwork, students received structured training on qualitative interviewing techniques, ethical considerations, informed consent, use of the interview guide, and appropriate probing methods. Mock interviews and feedback sessions were conducted as part of the training. Interviews were carried out in local language, audio-recorded with consent, and conducted under investigators' supervision to ensure data quality and consistency. Audio recordings were transcribed verbatim and translated into English. Transcripts were cross-checked against recordings for accuracy.

Data analysis : Quantitative data were entered and analysed using SPSS version 25, and findings were summarised using descriptive statistics. Qualitative data were analysed using Braun and Clarke's reflexive thematic analysis. Transcripts were read repeatedly for familiarisation, followed by inductive open coding. Codes were iteratively reviewed, grouped into categories, and refined into broader themes. Reflexive team discussions were undertaken to minimise interpretive bias.

To achieve integration of quantitative and qualitative findings, force-field analysis was used at the interpretation stage, organizing findings into driving and restraining forces influencing diarrhoea management and care-seeking during the outbreak.

Measurement tool : A structured scoring tool was subsequently developed using Google Forms, and each identified force was rated independently by ten subject-matter experts from the Department of Community Medicine on a numeric scale reflecting perceived driving and restraining forces. Mean scores were calculated for each force and used to categorise factors as dominant driving or restraining influences. Based on the mean scores, force-field diagram was constructed providing an integrated interpretation.

To enhance the study's rigor, three investigators of the study exhaustively reviewed data collation and analysis. To ensure quality of reporting the findings, consolidated criteria for reporting qualitative studies (COREQ) checklist was used.

Ethical consideration: The study proposal was approved by the Institutional Ethics Committee(H) vide letter no.AMC/EC/2926/02. In line with ethical principles, participants of in-depth interview were identified by numerical codes, to ensure anonymity and confidentiality.

RESULTS

A total of 25 individuals reported with Acute Diarrhoeal Disease symptoms with the Case fatality rate of 20% (death of 5 individuals) and majority were adult male. Table 1 shows the socio-demographic and clinical profile of affected individuals. The results also showed substantial environmental vulnerability amongst the households affected during the cholera outbreak with 84% households reported tubewell to be primary source of drinking water with majority having septic tank near water source (Table 2). Most affected households belonged to tea-garden worker families, residing in closely packed residential area with shared environmental infrastructure.

Key exposure factors identified were, use of untreated drinking water, inadequate protection of water sources, potential fecal contamination due to nearby latrines and septic tanks. Sanitation assessment revealed: Open or poorly maintained drainage systems, accumulation of stagnant wastewater in and around houses allowing contaminated water to enter living areas. These conditions were uniformly reported across several affected households.

A total of 12 in-depth interviews were conducted, and reflexive thematic analysis yielded six major inter-related themes and sub-themes describing perceptions, practices, and lived experiences during the outbreak.

Shock experience reshaping risk perception:

Sub-theme 1: Sudden unexpected deaths as turning-point events

The sudden clinical deterioration with death created a sense of shock and disbelief. This lead to reassessment of seriousness of symptoms which were considered as minor by the affected families.

P1"....we don't take it lightly now after what we have seen…even small symptoms feel serious"

P2"After those deaths, we realised this disease is very serious"

Sub-theme 2: Collapse and death of young boy as traumatic memory

Participants described unexpected deaths, especially among the youngs, as a pivotal moment that changed their perception of diarrhoeal illness.

P4*".....he was fine in the morning and by evening he died — after that everyone became scared."*

P7"He had gone out to play… after coming home he suddenly collapsed within a short time. Only then we realised how serious this illness is."

Environmental & structural vulnerability despite household hygiene efforts:

Sub-theme 1: Drainage, filth and stagnant water near houses

Persistent environmental exposures by participants perceived as unavoidable risk factor as narratives indicate that these conditions were viewed as external threats which is beyond individual control.

P5"The surroundings were very dirty… drain water used to collect near the house."

P4"During heavy rain, dirty water even came inside the house."

Sub-theme 2: Helplessness despite awareness

There was a sense of resignation amongst the families who showed awareness regarding sanitation risks but felt powerless to change their living standards.

P4"We know it is not good… but what can we do, the surroundings are like this only."

P9"The tube-well is close to the latrine and we feel that is risky."

Hidden financial aftermath of illness and economic burden:

Sub-theme 1: Emergency borrowing during treatment

The household experienced an immediate financial shock and emergency borrowing emerged as coping strategy to manage the treatment-related expenses. It was revealed that how acute acute health events was transformed into prolonged financial strain.

P6"First they gave Rs2000 and later Rs3000 more, even then we had to manage extra expenses."

P8"Even now I have not been able to repay the loans from that time."

Sub-theme 2: Wage loss during illness days

There was indirect economic consequences of illness, particularly income loss due to missed workdays among daily-wage earners.

P7"When we miss work because of sickness, they cut our wages."

P6"The manager helped with money and transport… but still we had to spend extra."

Communication Gaps & Diagnosis Disclosure:

Sub-theme 1: Diagnosis disclosed only at discharge

There were gaps in provider–patient communication, where participants reported delayed or incomplete disclosure of the cholera diagnosis during hospitalisation.

P8They didn't tell us openly at first. They kept her in the Model Hospital for about a week. "We came to know it was cholera only when we were taking her home."

P6"They treated her, but did not clearly explain the condition."

Sub-theme 2: Media pressure triggered stronger response

There were perceptions that intensified administrative and health-system action occurred primarily after media attention.

P8".....reporters asked why the health department officials hadn't taken any measures when such a big incident occurred"

Feeding & Caregiving Practices During Illness:

Sub-theme 1: Parallel use of local / traditional remedies

There was coexistence of biomedical and traditional practices in household-level illness management. Participants described initially relying on home remedies alongside ORS, reflecting culturally embedded care practices and gradual escalation to formal healthcare when symptoms worsened.

P11"Along with ORS, we also used some village medicine."

P7"At first we gave her lemons and tried some home remedies….when it didn't improve, we took her to the hospital"

Sub-theme 2: Confusion about breastfeeding during diarrhea

There was uncertainty arising from inconsistent advice regarding infant feeding during diarrhoea and narratives demonstrated conflicting messages that led to confusion among caregivers, thereby affecting optimal feeding practices during illness.

P7"First they said milk should continue but later they told us to stop."

P3"The child continued to eat and drink milk and we did not stop feeding."

Behavioural Adaptation Variation Across Households:

Sub-theme 1: Behaviour change triggered after outbreak

Following outbreak, reactive behavioural adaptations was seen as from narratives revealed that these changes were motivated by fear and heightened risk perception.

P5"Earlier we used to drink directly but after the outbreak we started boiling water."

P4"After that incident we stopped drinking tube-well water… now we drink only tap water."

Sub-theme 2: No change despite awareness

There were limited choices and entrenched living conditions which restricted the household's ability to adopt protective beahviours.

P7"We know the water is dirty, but we cannot change anything….everything around us is like that only."

Community solidarity with collective responsibility:

Sub-theme 1: Neighbour and community support during illness

The role of social cohesion along with support networks during outbreak was reflected here. Participants described the emotional and logistical support from neighbours and tea garden officials reflecting community solidarity as coping mechanism after crisis.

P6"People came and helped… they brought fruits and helped us."

P9"Even though no one in our house was sick, we received ration and water supply."

Sub-theme 2: Collective cleanliness enforcement

There was an emerging collective norms around environmental hygiene, where community members actively monitored and corrected behaviours perceived as risky.

P1"If someone dirties the surroundings, we scold them and tell them to keep it clean."

P5"They put medicine in the tap water and in the tube-well also."

Findings from quantitative exposure assessment and qualitative narratives were integrated using **force-field analysis**.(fig.1) to find out the driving forces and restraining forces of diarrheal management. This

integration highlighted how **structural vulnerability and socioeconomic constraints opposed protective behaviours**, while community and health-system support facilitated improved diarrhoea management during the outbreak.

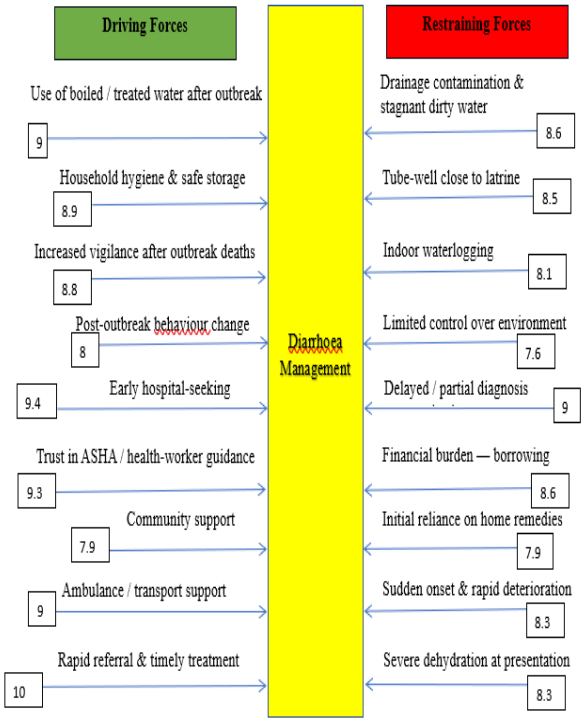
Table 1: Distribution of patients according to socio-demographic and clinical profile

Variables	n(%)
Age(in years)	
<=18	1(4)
19-29	8(32)
30-39	6(24)
40-59	8(32)
>=60	2(8)
Gender	
male	16(64)
female	9(36)
Education	
illiterate	10(40)
primary school	3(12)
middle school	6(24)
high school	4(16)
graduate	2(8)
Occupation	
Tea Garden worker	19(76)
self employed	2(8)
retired	1(4)
housewife	3(12)
Indicator	
Symptomatic during investigation	10(40)
Admitted at Model Hospital	6(24)
Admitted at AMCH	4(16)
Deaths	5(20)
Symptoms	
Diarrhoea	10(40)
Vomiting	10(40)
Abdominal pain	10(40)
Dehydration	5(20)
Fever	2(8)
Watery stools	8(80)
Rice-water stools	2(20)

Table 2: Water, sanitation and environmental characteristics of outbreak-affected households

Exposure	n(%)
Primary water source	
Tubewell	21 (84)
Piped supply	2 (8)
Open well	2 (8)
Water source changed post-outbreak	
Yes	12 (48)
No	13 (52)
Tubewell platform type	
Cemented	19 (76)
Absent	6 (24)
Platform condition	
Cracked	12 (48)
Intact	8 (32)
Water stagnation present	5 (20)
Drainage around platform	
Proper drainage away from source	11 (44)
Inadequate drainage	7 (28)
No drainage	7 (28)
Wastewater stagnation near household	
Yes	15 (60)
No	10 (40)
Septic tank near water source	20 (80)
Distance from septic tank	
< 15 m	20 (80)
≥ 15 m	5 (20)
Relative position of water source	
Uphill	10 (40)
Downhill	7 (28)
Same level	7 (28)
Don't know	1 (4)
Type of toilet facility	
Household latrine	24 (96)
Community toilet	1 (4)
Type of toilet system	
Septic tank	16 (64)
Pit latrine	9 (36)
Water stagnation inside/around house	18 (72)
Solid-waste disposal method	
Burning	15 (60)
Open dumping	7 (28)
Collection	3 (12)

Figure 1: Force-field analysis for diarrhoea management



DISCUSSION

The outbreak predominantly affected the working age adults, males engaged in tea-garden labour in particular, highlighting the occupational and environmental exposure patterns within tea-garden communites.(9) The educational status suggests the underlying social vulnerability as large proportion of individuals were having low levels of formal education which brings us to an important finding of health illiteracy amongst them which may have influenced their inability to recognise

early symptoms, home-based management and delay in deciding to seek care.(10) These might be the reasons for the high case fatality of 20% in our study, which underscores the importance of timely symptom recognition and treatment, specially in geographically and socioeconomically vulnerable communities.

The quantitative findings demonstrated substantial water, sanitation and environmental risks, including dependence on tube-well water with problems of cracked platforms, inadequate drainage, wastewater stagnation and close proximity of septic tanks to water sources. These conditions create a conducive environment for fecal contamination and have been recognized as important contributors to cholera transmission in structurally disadvantaged settings.(11) Also, less than 90% population from Assam has an access to clean drinking water as per National Family Health Survey-5 (NFHS-5, 2019-20). From Household survey in Tea Estates, despite the introduction of government sponsored schemes like Jal Jeevan Mission, the labor lines are still miles away from safe and potable drinking water supplies at doorstep. Such inadequate supplies with unequal access has lead to dependence on tubewell water particularly for drinking water requirements. Therefore, the availability of household latrines did not translate into reducing risk, highlighting the fact that spatial layout and infrastructure quality rather than just availability are important factors that determine exposure.

The narratives further added weightage to these findings as it revealed a strong sense of environmental helplessness amongst the affected families. Majority reported to have little control over their environment but had limited agency to improve or modify it particularly the drainage systems and housing conditions.(12,13) These highlight an important insight that knowledge only is insufficient to mitigate such risks without supportive environmental conditions, structural factors must take responsibility instead of household behaviour.

A key finding of our study was sudden and unexpected deaths which acted as a potent catalyst in perceiving risks. Families reported heightened fear and vigilance toward diarrhoea symptoms following deaths, leading to adaptive behaviours like changing water sources for drinking, boiling etc. But these changes are mainly reactive and crisis driven rather than sustained through stable infrastructure or any preventive systems.(14) These suggest that whereas epidemics can momentarily raise risk awareness, systemic interventions that go beyond sporadic behaviour changes are necessary for long term prevention.

The study too revealed significant economic and health system barrier affecting illness management. There was hidden financial burden on already vulnerable families due to emergency borrowing, wage loss and debt following illness. Also, confusion and uncertainty during care-seeking were further exacerbated by delayed diagnosis disclosure.(15,16) Participants believed that visible administrative and health system action only became intense following media coverage suggesting a reactive system response and missed chances for early community mobilisation.

A holistic understanding of diarrhoea management was achieved through force-field analysis. Substantial environmental vulnerability (8.6) and financial burden (8.6) were perceived as major restraining forces for diarrhoea management, as also evident by Behera et.al. (17) This comprehensive and integrated viewpoint demonstrates how protective practices are constantly negotiated in the face of conflicting social and structural forces. (12,15) Overall, the findings suggest that cholera vulnerability in tea-garden communities is not primarily driven by poor individual practices, but by the intersection of environmental exposure, fragile infrastructure, socioeconomic constraints and reactive system response.(11) Strengthening housing conditions with drainage systems, improving mechanisms for early warning signals and enabling of rapid field response and mobilization are essential for preventing similar future outbreaks. Community-based risk communication and frontline worker support remain important but must be complemented by structural WASH improvements and proactive outbreak preparedness, particularly during monsoon periods.

CONCLUSION

Our study has revealed the major problems of water security and safety as an evidence of cholera vulnerability amongst the tea garden community. The mixed-methods integration showed altered risk perception and various constraints particularly socioeconomic has lead to delayed timely care seeking. Prioritizing WASH strengthening is the need of the hour, focusing on the most vulnerable among the tea tribes of Assam. Development of a comprehensive model with integrative approach focusing on Tea garden communities to address recurrent outbreak can be tested in an implementation research.

RECOMMENDATION

This study highlights the need for safe drinking water supply and improvement of basic sanitation especially among vulnerable population living in tea garden colonies. Linking with different Government program for improving WASH facility like “Swachh Bharat Abhiyan”, “Jal Jeevan Mission” and holistic implementation of Intensified diarrhoea control Program has potential to improve the situation. Public Health Enginerring Department can facilitate regular water testing and source improvement activities. Panchyat Members and community based tea garden organization can help in awareness building with involvement of line Department by community engagement.

LIMITATION OF THE STUDY

As our study was conducted in a single tea garden community, therefore the findings may not be generalisable to settings with different environmental and socioeconomic contexts. However, the findings may be analytically transferable to similar structurally vulnerable settlements. Exposure to alternative sources of drinking water other than tube well, including tea garden tank water supplied by management could not be assessed and remains an area of further exploration.

Relevance of the Study

This study addressed relevance of preventable morbidity and mortality by early intervention involving all levels for better awareness, convergence and community participation.

Authors Contribution

All authors have contributed equally.

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Nil

Conflict of Interest

There are no conflicts of interest.

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Declaration of Generative AI and AI Assisted Technologies in the Writing Process

The authors haven't used any generative AI/AI assisted technologies in the writing process.

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