A COMMUNITY-BASED COHORT ANALYSIS OF ENVIRONMENTAL EXPOSURES AND HEALTH OUTCOMES IN RURAL TIRUCHIRAPPALLI

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ABSTRACT:

Environmental conditions such as water quality, sanitation, and waste management play a crucial role in determining the health outcomes of the public. Inadequate environmental infrastructures, continues the vulnerability of communities to preventable diseases. Understanding the factors helps us to plan an effective health intervention. **Objective:** To determine the association between environmental exposures—such as water source, sanitation, waste management, and mosquito nuisance and health outcomes in rural populations of the Tiruchirappalli field practice area of a tertiary care centre. **Methods:** This data were analysed from an ongoing prospective cohort study conducted in rural area of Trichy by a tertiary care hospital. The data were collected using a semi structured questionnaire `that focused on

environment and various other domains. Descriptive and inferential statistics were used to find out the association between environmental factors and health conditions. **Results:** 100 households were surveyed in rural area, although there was availability of water sources, 60% of them drank untreated water. Among the following illness, the prevalence of fever was 71%, cold and cough was 65%, diarrhoea was 47%, skin infections was 33%, and vomiting was 18%. Significant association was found between Environmental factors and illness. Stagnant water showed a strong association with fever incidence ($p < 0.01$), untreated water usage was associated with diarrheal episodes ($p < 0.05$). **Conclusion:** The analysis showed a strong relationship between environmental exposures and negative health outcomes. Effective public health strategies must include improving infrastructure, promoting hygiene awareness, and ensuring sustainable environmental practices in rural communities.

INTRODUCTION:

Environmental factors play an important role in determining the health of humans. According to WHO, 24% of the death among the world is attributed to environmental factors (1). The quality of water supply, availability of sanitation facilities, and methods of waste disposal significantly influence the spread of communicable diseases and overall public health(2). In developing countries like India, these environmental determinants are of particular concern due to rapid population growth, urban-rural disparities, and inadequate resource allocation. The prevalence of disease is more in rural areas due to reliability on the traditional energy resources, improper waste management, agriculture runoff, contaminated water sources and open-air defecation. These leads to various diseases such as dengue, filariasis, malaria, chikungunya (vector borne diseases), diseases due to soil contamination (open air defecation), dermatological disorders (3).

The houses in rural area are poorly built with inadequate ventilation, lighting that may lead to respiratory problems and other health conditions (4). Partially or untreated water intake is associated with hepatitis E and A, gastroenteritis which is still an public health challenges (5).

The present study aimed to explore the association between environmental exposures and health outcomes in rural areas of the Tiruchirappalli field practice area.

Understanding these associations is essential not only for designing effective health interventions but also for informing public policies and local governance strategies. By identifying critical gaps in sanitation, hygiene, and waste management, this study contributes to the broader field of environmental epidemiology and offers practical recommendations for

improving rural health outcomes. The insights gained can support decision-makers, public health workers, and community leaders in developing targeted programs to reduce environmental health risks in similar low-resource settings.

METHODOLOGY

Study Design

A community-based cohort study was started in March 2025 in selected rural areas within the Tiruchirappalli district, Tamil Nadu. This region was chosen due to its known challenges in environmental sanitation and public health infrastructure. The study focused on evaluating environmental exposures at the household level and their association with reported health conditions.

Sample Size

The target population consisted of residents from rural households within the designated field practice area. A purposive sampling method was adopted to select 100 households, ensuring inclusion of diverse environmental settings—such as households near open drains, stagnant water, and those with/without proper sanitation.

Inclusion Criteria:

- Households with at least one member residing continuously for over 6 months

Exclusion Criteria:

- Households under renovation or unavailable during the survey period
- Incomplete or inconsistent responses
- Households not willing to participate in the study

AIMS AND OBJECTIVES

1. To identify the primary sources of drinking water and assess household water treatment practices.
2. To estimate the prevalence of common health complaints such as fever, diarrhoea, skin infections, and respiratory symptoms.

3. To determine the association between environmental factors and reported illnesses in the rural population

DATA COLLECTION

The data were collected using a semi- structured questionnaire and it was designed in English and translated into Tamil to ensure it was understandable to local residents. The tool was validated by public health experts and pre-tested on 10 households in a non-sampled area. Feedback from this pilot test was used to revise ambiguous questions and improve flow.

Data were collected using a face-to-face interview method. Respondents were adult members of the household—either the head of the family or a primary caregiver. Each interview lasted approximately 20–30 minutes. The questionnaire gathered data in several key domains: demographic profile, source and treatment of drinking water, type and availability of toilets, methods of solid and liquid waste disposal, the presence of stagnant water, mosquito nuisance, and recent illnesses experienced by family members. Illnesses reported included fever, diarrhoea, vomiting, skin infections, cough, and cold, based on a 14-day recall period.

Investigators recorded visual signs such as open defecation sites, uncovered drains, pooled stagnant water, and improperly disposed solid waste. These observations helped validate responses and provided direct evidence of environmental exposures.

Informed written consent was obtained from all participants before starting each interview. The purpose of the study, the voluntary nature of participation, and confidentiality of responses were clearly explained.

STATISTICAL ANALYSIS

Statistical analysis was performed to summarize the characteristics of the study population and to determine the association between environmental exposure and reported health outcomes. The data were first entered and cleaned in Microsoft Excel 2021, followed by detailed analysis using IBM SPSS Statistics version 25.

Results:

Descriptive statistics summarized the key characteristics of the study population and environmental factors. Frequencies and percentages described categorical variables like water sources, sanitation, and waste disposal methods. Means and standard deviations were calculated for continuous variables where applicable.

Table 1 – Water Sources

WATER SOURCES		
Water Sources	**Frequency n=100**	**Percentage (%)**
Public Tap	55	55%
Borewell	32	32%
Open Well/Others	13	13%

Table 2 – Common Illness Reported in Last 2 Weeks

COMMON ILLNESS REPORTED IN LAST 2 WEEKS		
Illness Type	**Frequency n=100**	**Percentage (%)**
Fever	71	71%
Diarrhoea	47	47%
Skin Infections	33	33%
Cold & Cough	65	65%
Vomiting	18	18%

Table:3 – Association between Water Treatment and Diarrhoea

Water Treatment	**Diarrhoea Present**	**No Diarrhoea**	**Total**
Treated	12	28	40
Un-Treated	35	25	60
Total	47	53	100
Chi-square value =12.23, p-value = 0.0005			

Table:4 – Association between Stagnant Water and Fever

Stagnant Water Present	Fever Reported	No Fever	Total
Yes	60	10	70
No	11	19	30
Total	71	29	100
Chi-square value = 20.18, p-value = 0.00001			

This study was analysed from the responses of 100 rural households in the Tiruchirappalli field practice area to examine the relationship between environmental conditions and reported health outcomes. The study revealed that 55% of households relied on public taps for drinking water, 32% on borewells, and 13% on open wells or other sources. Despite the known risks, only 40% of households reported treating their drinking water. Regarding sanitation, 68% had access to a private or shared toilet, while 32% practiced open defecation. Additionally, 61% of households had stagnant water nearby, and 83% reported mosquito nuisance.

71% of households reported at least one episode of fever, 47% reported diarrhoea, 65% experienced cold and cough, 33% had skin infections, and 18% reported vomiting during the two-week recall period. These findings suggest a high burden of infectious illnesses, likely driven by environmental risk factors.

Those households which were not treating the water had a significantly higher prevalence of diarrhoea (35 out of 60 households) compared to those treating water (12 out of 40 households) with a p value <0.05

Households with stagnant water had a much higher incidence of fever (60 out of 70 households) than those without (11 out of 30 households) with a p value of <0.05 which is highly significant

These results confirm that untreated water and poor waste management (including stagnant water) were major contributors to the health burden in the study population.

Overall, the results reinforce the urgent need for improved environmental hygiene, safe water practices, and community health education. The high rates of preventable diseases emphasize the critical role of public health infrastructure in reducing illness and improving quality of life in rural communities.

DISCUSSION

The findings of this study strongly highlighted the association between environmental exposures and health outcomes in rural households of Tiruchirappalli. The high prevalence of illnesses such as fever (71%), cough (65%), diarrhoea (47%), and skin infections (33%) was closely linked to unsafe water consumption, inadequate sanitation, and poor waste management practices. These outcomes are consistent with the study conducted by Patil et al. and walker et al (6,7).

The association between the drinking water and the diarrhoeal disease was significant. The statistically significant association between untreated water and diarrhoea ($p = 0.0005$) highlights the urgent need for improved access to clean drinking water or adopting water purification methods such as filtration or boiling or chlorination. This finding is similar with a study done by clasen et al.,(8)

Presence of stagnant water was associated with fever, in our study out of 70 house hold which reported fever, 60 houses had stagnant water. With a p value of P=0.00001 which was highly significant. Fever associated with stagnant water was highly indicative of vector borne diseases such as chikungunya, malaria, dengue ., which is consistent with the findings of kar et al (9).

A study done by ezeh et al., have found that household that were exposed to stagnant water resulted in vulnerability of children, women and elderly(10).

In conclusion, the study adds valuable evidence to the body of public health literature by demonstrating how simple, preventable environmental risks continue to impact health outcomes in rural India. It reinforces the importance of investing in water safety, sanitation, waste management, and vector control as public health priorities to reduce disease burden and improve the quality of life in vulnerable communities. Self-reported illness is a limitation to this study which might over or under estimate the prevalence of the study.

CONCLUSION

This study highlights the significant association between environmental exposures and the health of rural households in the Tiruchirappalli field practice area. The analysis revealed that factors such as untreated drinking water, open defecation, poor waste disposal, and presence of stagnant water are strongly associated with the high prevalence of fever, diarrhoea, skin infections, and respiratory illnesses.

The findings suggest that many of these health issues are preventable through basic public health measures. Providing access to clean water, ensuring safe sanitation facilities, controlling mosquito breeding sites, and educating communities about hygiene practices can significantly reduce the disease burden. Despite ongoing public health initiatives, there is a gap in behaviour change, infrastructure access, and environmental management.

Addressing these challenges requires a multi-sectoral approach involving public health authorities, local governance, and community participation. Future research could explore seasonal variations, long-term outcomes, and the impact of targeted interventions. However, this study provides a strong case for immediate action in improving environmental health conditions in rural India to promote better health outcomes and enhance quality of life.

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