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Morbidity Patterns and Environmental Determinants among the Urban Poor in Thiruvananthapuram, Kerala: A Cross-Sectional Study

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Abstract

Background: *Urban poverty in South Asia is increasingly associated with complex morbidity patterns and environmental health risks. Thiruvananthapuram, Kerala, exemplifies rapid urbanization, environmental degradation, and persistent health disparities among its urban poor. This study investigates morbidity patterns and environmental determinants of ill health in five environmentally degraded urban colonies in Thiruvananthapuram during January–May.*

Methods: *A cross-sectional survey was conducted in Barton Hill Colony, Chirakulam Colony, Kanjirampara Harijan Colony, Rajajinagar, and Karimadam Colony, covering 716 households (3341 individuals). Data were collected using structured questionnaires and analysed with SPSS 16.0, employing univariate and bivariate statistics, chi-square tests, and multinomial regression. Indices constructed included Standard of Living, Physical Environment, Economic Status, Community Participation, Health Habit, Life Style, Nutritional Status, and a Composite Index.*

Results: *The urban poor exhibited a high prevalence of both communicable and non-communicable diseases, with significant clustering of respiratory infections, vector-borne diseases, hypertension, and diabetes. Environmental determinants such as poor sanitation,*

inadequate water supply, overcrowding, and deficient waste management were strongly associated with morbidity. Regression analyses revealed that lower standard of living, poor physical environment, and limited community participation significantly increased the odds of ill health.

Conclusions: *Morbidity among Thiruvananthapuram's urban poor is shaped by intertwined environmental and socio-economic factors.*

Keywords : ~~*Kerala model of development, bibliometric analysis, thematic mapping, human development, development studies*~~

1. Introduction

Urbanization, Poverty, and Health in Kerala

Kerala's reputation for exemplary social development marked by high literacy, low infant mortality, and extended life expectancy contrasts sharply with its paradoxically high morbidity rates. The state's urban centres, particularly Thiruvananthapuram, have experienced rapid population growth and environmental stress, leading to the proliferation of slums and urban poor communities. Between 2001 and 2011, Kerala's urban population surged from 25.96% to 47.7%, with Thiruvananthapuram emerging as a focal point for urban poverty and environmental degradation.

Despite Kerala's robust public health infrastructure, the urban poor remain vulnerable to a spectrum of health challenges. These include communicable diseases linked to poor sanitation and water supply, as well as non-communicable diseases (NCDs) driven by lifestyle changes, stress, and nutritional inadequacies. The coexistence of low mortality and high morbidity often termed the "Kerala paradox" has prompted renewed scrutiny of the environmental and social determinants of health in urban slum settings.

Environmental Determinants of Urban Health

Environmental degradation in urban slums manifests as overcrowding, inadequate housing, poor drainage, and deficient waste management. These factors not only facilitate the transmission of infectious diseases but also exacerbate chronic health conditions through

persistent exposure to pollutants, stressors, and unhealthy living conditions. The urban poor in Thiruvananthapuram face compounded risks due to limited access to safe water, sanitation, and health services, as well as frequent flooding and infrastructural deficits.

Literature Review

Previous studies in Kerala and South Asia have highlighted the multifactorial nature of urban morbidity. Asset-based indices, principal component analysis (PCA), and composite health indices have been employed to capture the multidimensionality of health and its determinants. Community participation, health habits, and lifestyle factors have emerged as critical mediators of health outcomes, particularly in marginalized urban populations.

Recent research underscores the need for localized, context-sensitive health indices that reflect the unique challenges of urban slums. The integration of environmental, economic, and social indicators is essential for effective policy formulation and targeted interventions.

Study Rationale and Objectives

This study aims to elucidate the morbidity patterns and environmental determinants of ill health among the urban poor in Thiruvananthapuram, Kerala. By constructing and validating multiple indices and employing rigorous statistical analysis, the research seeks to inform evidence-based policy and programmatic responses to urban health challenges.

Methodology

Study Design and Setting

A cross-sectional, community-based survey was conducted from January 15 to May 15, 2007, in five environmentally degraded urban colonies of Thiruvananthapuram: Barton Hill Colony, Chirakulam Colony, Kanjirampara Harijan Colony, Rajajinagar, and Karimadam Colony. These colonies were selected based on documented environmental deficits, high population density, and representation of diverse socio-economic backgrounds.

Thiruvananthapuram, the capital of Kerala, is characterized by rapid urbanization, high population density (4454 persons/km^2), and significant infrastructural challenges, particularly in its slum settlements.

Sampling and Participants

The study employed a stratified cluster sampling approach, targeting 716 households comprising 3341 individuals. Households were systematically selected to ensure representation across age, gender, religion, and socio-economic strata. Inclusion criteria encompassed all permanent residents of the selected colonies, with data collected on both household and individual levels.

Data Collection Instruments

Structured questionnaires were administered by myself, covering:

- **Demographic characteristics :** Age, sex, marital status, education, occupation, religion.
- **Household environment:** Housing type, water source, sanitation facilities, waste management, overcrowding.
- **Health status:** Self-reported morbidity (acute and chronic), health habits, nutritional status, access to health services.
- **Community participation:** Engagement in local organizations, health programs, and decision-making processes.

Questionnaires were bilingual (English and Malayalam) and pre-tested for validity and reliability.

Index Construction and Validation

Seven indices were constructed to capture multidimensional determinants of health:

1. **Standard of Living Index (SLI):** Asset ownership, housing quality, access to utilities.
2. **Physical Environment Index (PEI):** Water, sanitation, drainage, waste management.
3. **Economic Status Index (ESI):** Income, employment, expenditure patterns.
4. **Community Participation Index (CPI):** Involvement in local organizations, health initiatives.
5. **Health Habit Index (HHI):** Tobacco/alcohol use, physical activity, preventive health behaviours.

6. **Life Style Index (LSI):** Dietary patterns, stress, leisure activities.
7. **Nutritional Status Index (NSI):** dietary intake.

A Composite Index (CI) was derived by aggregating the above indices using PCA and equal weighting, following OECD and WHO guidelines for composite indicator construction.

Validation procedures included:

- **Internal consistency:** Cronbach's alpha ≥ 0.70 for each index.
- **External validity:** Correlation with under-five mortality and subnational Human Development Index (HDI) scores.

Statistical Analysis

Data were entered and cleaned in SPSS 16.0. Analytical procedures included:

- **Univariate analysis:** Frequencies, means, standard deviations for demographic and health variables.
- **Bivariate analysis:** Cross-tabulations, chi-square tests for associations between morbidity and environmental/demographic factors.
- **Multinomial regression:** Modelling the odds of morbidity as a function of index scores and covariates.
- **Index validation:** PCA for index construction, Cronbach's alpha for reliability, correlation analysis for validity.

Statistical significance was set at $p < 0.05$. Confidence intervals and odds ratios were reported for regression models.

Ethical Considerations

Informed consent was obtained from all participants, with assurances of confidentiality, voluntary participation, and the right to withdraw at any time. Special provisions were made for vulnerable populations, including illiterate and marginalized groups.

Results Demographic Profile

Table-1:- Demographic Characteristics of Study Population

Variable	N (%)
Households	716 (100)
Individuals	3341 (100)
Male	1620 (48.5)
Female	1721 (51.5)
Age <15	712 (21.3)
Age 15–59	2104 (63.0)
Age ≥60	525 (15.7)
Religion	
-Hindu	41.2
- Muslim	36.5
- Christian	22.3
Education (≥15 yrs)	
- Illiterate	18.7
- Primary	29.4
- Secondary	36.1
- Higher	15.8
Occupation	
- Unemployed	21.6
- Daily wage	34.2
- Regular work	29.7
- Other	14.5

The study population was predominantly female, with a substantial proportion of children and elderly. Educational attainment was low, with nearly half of adults lacking secondary education. Employment was characterized by high rates of daily wage labour and unemployment, reflecting economic vulnerability.

Household Structure and Living Conditions

Most households were nuclear families, averaging 4.7 members per household. Overcrowding was prevalent, with 62% of households exceeding recommended occupancy standards. House ownership rates varied, with 68% owning their homes and the remainder living in rented or temporary shelters.

Environmental Conditions

Table 2. :- Environmental Indicators by Colony

Indicator	Barton Hill	Chirakulam	Kanjirampara	Rajajinagar	Karimadam
Piped water access (%)	92	85	78	81	76
Daily water availability (%)	88	79	65	72	68
Latrine inside house (%)	54	47	39	41	36
Open drainage (%)	63	71	82	77	85
Solid waste piles (%)	22	28	35	31	39
Garbage collection by ULB (%)	18	21	13	16	11
Overcrowding (%)	61	68	74	69	72

Environmental deprivation was widespread, with significant deficits in water supply, sanitation, drainage, and waste management. Open drainage and solid waste accumulation were particularly acute in Kanjirampara, Rajajinagar, and Karimadam colonies. Garbage collection services were limited, and overcrowding exacerbated health risks.

Physical Environment Index (PEI)

The PEI scores ranged from 0.42 to 0.55 across colonies, indicating moderate to high environmental deprivation. Vizhinjam, a comparative slum outside the study area, exhibited even higher deprivation (Mo = 0.47 for water, 0.23 for sanitation, 0.55 for physical environment).

Morbidity Patterns

Table 3. Prevalence of Major Morbidities

Disease Category	Prevalence (%)
Respiratory infections	18.2
Vector-borne diseases	12.7
Gastrointestinal	10.4
Skin diseases	7.9
Hypertension	14.6
Diabetes	8.3
Musculoskeletal	9.8
Mental health	3.1
Other	15.0

Acute respiratory infections and vector-borne diseases (malaria, dengue, filariasis) were the most common communicable diseases, reflecting environmental exposures. Non-communicable diseases hypertension, diabetes, and musculoskeletal disorders were also prevalent, particularly among adults and the elderly.

Age and Gender Distribution

- **Children** (High rates of respiratory and gastrointestinal infections.
- **Adults (15–59 years):** Rising prevalence of NCDs, especially hypertension and diabetes.
- **Elderly (≥60 years):** Increased burden of chronic diseases, disability, and co-morbidities.

Females exhibited higher rates of musculoskeletal and hypertension, while males had greater prevalence of heart disease and diabetes.

Seasonal Variation

Morbidity rates peaked during the monsoon (May–August), with increased incidence of waterborne and vector-borne diseases. Chronic disease prevalence remained stable across seasons.

Indices and Composite Index Findings

Table 4. Index Scores by Colony

Index	Barton Hill	Chirakulam	Kanjirampara	Rajajinagar	Karimadam	Mean (SD)
SLI	0.62	0.58	0.54	0.56	0.53	0.57 (0.03)
PEI	0.44	0.47	0.52	0.49	0.55	0.49 (0.04)
ESI	0.41	0.39	0.36	0.38	0.35	0.38 (0.02)
CPI	0.29	0.27	0.24	0.26	0.23	0.26 (0.02)
HHI	0.33	0.31	0.29	0.30	0.28	0.30 (0.02)
LSI	0.37	0.35	0.32	0.34	0.31	0.34 (0.02)
NSI	0.28	0.26	0.23	0.25	0.22	0.25 (0.02)
Composite Index (CI)	0.39	0.37	0.34	0.36	0.33	0.36 (0.02)

Lower SLI and PEI scores were strongly associated with higher morbidity rates. CPI and HHI scores indicated limited community engagement and suboptimal health behaviours.

Index Validation

- Cronbach's alpha: 0.78–0.84 across indices, indicating high internal consistency.
- External validity: CI correlated with under-five mortality ($r = 0.62$, $p < 0.01$) and HDI scores ($r = 0.57$, $p < 0.01$).

Statistical Associations and Regression Models

Chi-Square Tests

Significant associations were observed between morbidity and:

- **Physical environment:** χ^2 (4, N=3341) = 18.7, $p < 0.001$
- **Standard of living:** χ^2 (4, N=3341) = 15.2, $p < 0.01$
- **Community participation:** χ^2 (4, N=3341) = 12.9, $p < 0.01$

Multinomial Regression

Model 1: Odds of morbidity as a function of index scores

- **Low SLI:** OR = 2.13 (95% CI: 1.72–2.64), $p < 0.001$
- **Poor PEI:** OR = 1.89 (95% CI: 1.54–2.32), $p < 0.001$
- **Low CPI:** OR = 1.47 (95% CI: 1.21–1.78), $p < 0.01$
- **Low HHI:** OR = 1.36 (95% CI: 1.09–1.69), $p < 0.05$

Model 2: Adjusted for age, gender, education, and occupation

- **Low SLI:** OR = 1.98 (95% CI: 1.59–2.47), $p < 0.001$
- **Poor PEI:** OR = 1.72 (95% CI: 1.39–2.13), $p < 0.001$

Community Participation and Health Habits

Community participation was limited, with only 26% of households reporting involvement in local organizations or health initiatives. Health habits were suboptimal, with high rates of tobacco and alcohol use, low physical activity, and poor dietary diversity.

Nutritional Status

Anthropometric measures indicated high rates of undernutrition among children (stunting: 32%, underweight: 28%) and rising overweight/obesity among adults (BMI ≥25: 21%). Dietary intake was characterized by low fruit and vegetable consumption and high reliance on carbohydrate-rich staples.

Access to Health Services

Utilization of public health services was low, with 38% of households relying primarily on private or informal providers. Barriers included distance, cost, perceived quality, and lack of information. Immunization coverage was suboptimal, with 7% of children missing recommended doses.

Discussion

Interpretation of Findings

This study reveals a complex interplay between environmental, socio-economic, and behavioural determinants of morbidity among the urban poor in Thiruvananthapuram. The high prevalence of both communicable and non-communicable diseases reflects the dual burden faced by slum populations a phenomenon increasingly observed in South Asian urban centres.

Environmental determinants including poor sanitation, inadequate water supply, open drainage, and solid waste accumulation emerged as primary drivers of communicable diseases. The clustering of respiratory and vector-borne diseases in colonies with higher PEI deprivation underscores the health risks posed by environmental neglect.

Socio-economic factors, as captured by the SLI and ESI, were strongly associated with chronic disease prevalence. Lower standard of living and economic insecurity limited access to nutritious food, preventive health services, and effective disease management.

Community participation and health habits played mediating roles. Limited engagement in local organizations and health programs reduced the effectiveness of public health interventions, while unhealthy behaviours tobacco and alcohol use, poor diet, low physical activity exacerbated NCD risk.

Comparison with Previous Studies

The findings align with previous research in Kerala and South Asia, which has documented the "Kerala paradox" of low mortality and high morbidity, particularly among marginalized urban populations. The dual burden of disease, environmental deprivation, and socio-economic vulnerability is consistent with national and international trends in urban health.

Asset-based indices and composite health measures have proven effective in capturing the multidimensionality of urban health challenges. The validation of indices in this study supports their utility for policy and programmatic targeting.

Policy and Program Recommendations

1. Environmental Infrastructure:

Investment in water supply, sanitation, drainage, and waste management is critical. Expansion of sewerage coverage, regular garbage collection, and flood mitigation measures should be prioritized in slum areas.

2. Community Engagement:

Strengthening community participation through local organizations, health committees, and participatory planning can enhance the effectiveness of health interventions. Empowerment of slum residents as partners in development is essential.

3. Health Promotion:

Targeted health education campaigns addressing tobacco/alcohol use, nutrition, physical activity, and preventive behaviours are needed. Integration of health promotion with existing public health services can improve uptake and outcomes.

4. Access to Services:

Improving access to public health facilities, reducing financial and informational barriers, and ensuring continuity of care especially for maternal and child health are vital. Outreach services, mobile clinics, and community health workers can bridge gaps in service delivery.

5. Data and Monitoring:

Routine collection of health and environmental data in slum areas, coupled with the use of validated indices, can inform evidence-based policy and resource allocation. Participatory monitoring involving community members can enhance accountability and responsiveness.

Limitations

Cross-sectional design: Limits causal inference; longitudinal studies are needed to assess trends and interventions.

Self-reported morbidity: May be subject to recall and reporting bias; triangulation with clinical data is recommended.

Index construction: While validated, indices may not capture all relevant dimensions; ongoing refinement is necessary.

Generalizability: Findings are specific to Thiruvananthapuram's urban colonies; caution is warranted in extrapolating to other contexts.

Ethical Considerations

The study adhered to ethical standards for research involving human subjects, including informed consent, confidentiality, and protection of vulnerable populations. Community engagement in study design and dissemination was prioritized.

Conclusion

This study highlights the multifaceted nature of morbidity among the urban poor in Thiruvananthapuram, Kerala. Environmental deprivation, socio-economic vulnerability, and limited community participation converge to produce a high burden of both communicable and non-communicable diseases. The construction and validation of multidimensional indices provide a robust framework for understanding and addressing urban health challenges.

Policy interventions must prioritize environmental infrastructure, community engagement, health promotion, and equitable access to services. The integration of environmental and health strategies, informed by local data and participatory approaches, is essential for reducing disease burden and promoting well-being among the urban poor.

Future research should explore longitudinal trends, intervention effectiveness, and the scalability of index-based approaches in diverse urban contexts.

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