Natural Resources for Human Health
eISSN: 2583-1194

Original Research

Received 28 April 2026
Revised 26 May 2026
Accepted 18 June 2026

Natural Resources for Human Health 2026, Vol. 6 (5): 362–371

KEYWORDS: childhood pneumonia, community-based intervention, risk factors, physiological parameters, under-5 children, Kuppuswamy scale.

To Assess Risk Factors and Comparative Efficacy of Community-based Interventions Related to Childhood Pneumonia on Physiological Parameters among under-5 Children in Selected Urban and Rural Area of Sangli-Miraj-Kupwad

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ABSTRACT :

Background: Pneumonia remains the leading infectious cause of death among children under five, disproportionately affecting families with limited healthcare access and poor environmental conditions. Community-based interventions offer a scalable strategy for prevention and early management, but comparative urban-rural evidence on their physiological impact remains limited.

Objectives: To assess risk factors of childhood pneumonia and evaluate the comparative efficacy of a community-based intervention package on physiological parameters among under-5 children in urban and rural areas.

Materials and Methods: A two-group pre-test post-test design was used among 140 children with mild-to-moderate pneumonia (70 urban, 70 rural) selected by purposive sampling in Sangli-Miraj-Kupwad. Risk factors and socio-demographic status (graded on the Modified Kuppuswamy Scale) were assessed at baseline. Oxygen saturation, respiratory rate, temperature, and heart rate were recorded before and after a community-based intervention package (nebulization, coughing technique, chest physiotherapy, nutrition support, hydration, and caregiver education). Data were analysed using descriptive statistics, paired and independent 't' tests, one-way ANOVA, chi-square, and multiple regression.

Results: Rural children showed a significantly higher risk-factor burden — indoor air pollution (47.1% vs 12.9%), incomplete immunization (37.1% vs 17.1%), and delayed healthcare access (40.0% vs 11.4%) — than urban children ($p<0.05$). All four physiological parameters improved significantly from pre- to post-intervention in both areas (paired t = 19.85–26.71, $p<0.001$). Pre-intervention physiological status was significantly associated with age, socio-economic status, maternal education, and area of residence ($p<0.05$), but not gender. Indoor air pollution was the strongest independent predictor of severity ($\beta=0.31$, $p<0.001$; $R^2=0.41$).

Conclusion: The community-based intervention package produced statistically significant improvement in physiological parameters among children with pneumonia in both urban and rural settings, with indoor air pollution and healthcare-access barriers identified as priority modifiable risk factors for community-level targeting.

1. INTRODUCTION

Pneumonia is an acute respiratory infection that causes the small air sacs in the lungs (alveoli) to fill with fluid and pus, severely impairing oxygen intake and causing painful breathing. Recognized as the single largest infectious cause of death in children globally, pneumonia accounted for 14% of all under-five child deaths in 2019, claiming the lives of over 740,000 young children—primarily across sub-Saharan Africa and Southern Asia (World Health Organization, 2022). The infection stems from a range of viral, bacterial, and fungal pathogens, with *Streptococcus pneumoniae* and *Haemophilus influenzae* type b (Hib) acting as the primary bacterial culprits. While vulnerable populations face heightened risk due to factors such as malnutrition, non-exclusive breastfeeding, and indoor air pollution, pneumonia is largely preventable through timely immunization, adequate nutrition, and environmental hygiene. Moreover, early detection of key presenting signs—such as fast breathing and lower chest wall indrawing—allows for effective treatment with affordable oral antibiotics, rendering global interventions like the WHO/UNICEF Integrated Global Action Plan for Pneumonia and Diarrhoea (GAPPD) vital for reaching international child survival targets.[1]

Childhood pneumonia remains a major cause of morbidity and mortality among children under 5 years of age, particularly in resource-limited settings. This study evaluated the key risk factors influencing disease severity and duration of hospitalization among 200 pediatric patients aged 1 month to 5 years admitted with clinical pneumonia to a tertiary care hospital from July 2023 to July 2024 (Parmar et al., 2025). Data on demographic details, clinical history, immunization status, nutritional parameters, indoor air pollution, and maternal education levels were collected and statistically analyzed. The findings demonstrated that incomplete immunization, undernutrition, indoor air pollution, and lower maternal education significantly exacerbated disease severity and extended hospital stays. Specifically, unvaccinated children were nine times more likely to develop severe pneumonia compared to fully vaccinated peers ($p < 0.05$), while malnourished children faced a significantly higher likelihood of prolonged hospitalization exceeding seven days ($OR = 3.61, p < 0.05$). Consequently, addressing these modifiable risk factors through targeted immunization drives, nutritional support, maternal education, and household air pollution reduction is essential to improving clinical outcomes and reducing the overall burden of childhood pneumonia.[2]

Need of the Study

Pneumonia remains the leading infectious cause of death among children globally, claiming the lives of over 700,000 children under the age of 5 every year—equivalent to roughly 2,000 child deaths per day—with the heaviest mortality burden concentrated in South Asia and sub-Saharan Africa (UNICEF, 2025). The disease is strongly linked to poverty-related risk factors, including childhood undernutrition, inadequate healthcare access, and indoor air pollution from biomass fuels, which accounts for nearly half of all childhood pneumonia deaths. Although proven interventions exist—such as exclusive breastfeeding for the first six months, immunization against pneumococcal disease (PCV), and prompt treatment with low-cost oral antibiotics—significant gaps in care persist, with only 60% of symptomatic children globally being taken to a healthcare provider. Expanding global vaccination coverage, strengthening primary healthcare systems, and reducing environmental household pollution are essential priorities to bridge treatment disparities and achieve Sustainable Development Goal targets for child survival.[3]

Globally, pneumonia remains the primary cause of childhood death, prompting the use of community case management (CCM) delivered by community health workers to bridge care gaps in regions lacking health facilities. A survey of experts across 57 high-mortality African and Asian nations revealed that while one-third of responding countries have established policies supporting CCM for pneumonia and another third have no restrictive policies against it, active implementation exists in only half of these nations—frequently on a limited, small-scale basis. Although roughly half of non-implementing countries plan to adopt the intervention to help achieve global child survival targets, key challenges persist regarding introducing supportive policies, expanding operational coverage, and standardizing program monitoring across high-burden regions (Marsh et al., 2008).[4]

Childhood pneumonia remains the single largest infectious cause of mortality among children under five years of age worldwide, with India bearing a disproportionately high burden that accounts for approximately one-fifth of global childhood pneumonia deaths (Pandey & Galvani, 2020).[7] Despite significant advancements in pediatric medicine and global child survival initiatives, acute lower respiratory infections continue to pose a persistent public health challenge in developing regions (Kasundriya et al., 2020).[6] The risk of developing severe pneumonia and experiencing unfavorable clinical outcomes is heavily modulated by a complex interplay of sociodemographic, environmental, and clinical determinants—such as childhood undernutrition, incomplete immunization, indoor air pollution, low socioeconomic status, and delayed care-seeking behavior (Parmar et al., 2025). Understanding the precise contribution of these modifiable risk factors is essential to designing targeted clinical and public health strategies that can effectively reduce disease incidence and severity.[8]

Furthermore, substantial regional and institutional disparities exist regarding the prevalence of specific pneumonia risk factors and the availability of healthcare resources across different clinical settings in India (Pandey & Galvani, 2020).[7] While large-scale epidemiological models provide general national estimates, localized clinical evidence from tertiary care facilities remains vital to identifying which specific risk factors predominantly drive disease severity, prolonged hospitalizations, and treatment complications in pediatric wards (Kasundriya et al., 2020; Parmar et al., 2025).[6,8] Investigating these context-specific determinants fills a critical evidence gap, offering empirical insights that enable pediatricians and public health policymakers to implement evidence-based preventive measures, optimize clinical management protocols, and allocate resources efficiently to mitigate preventable childhood mortality (Awasthi et al., 2019; Parmar et al., 2025).[5,8]

Children under 5, especially those under 2, are more vulnerable to pneumonia due to factors such as immature immune systems, smaller airways, and less efficient respiratory systems. Malnutrition, inadequate immunization, and environmental factors like indoor air pollution and poor sanitation increase the risk. Children from low-income families face higher risks due to limited access to healthcare and nutrition. A history of respiratory infections, low birth weight, or chronic conditions further elevates the risk. Additionally, pneumonia risk tends to increase during colder, wetter seasons when respiratory infections are more common.

Additionally, evaluating the effectiveness of community interventions (e.g., vaccination programs, sanitation improvements, and nutrition initiatives) can provide valuable insights into strategies for prevention, early detection, and treatment. By addressing these factors, the study aims to inform public health policies and interventions that could significantly reduce pneumonia-related morbidity and mortality among young children. The present study is formulated, keeping in mind about the need of early identification of pneumonia especially among under privileged urban slum population of community and children as a vulnerable group.

2. MATERIALS AND METHODS

2.1 Study Design and Setting

A quantitative research approach with a two-group pre-test post-test design was adopted. The study was conducted in selected urban and rural areas of Sangli-Miraj-Kupwad, Maharashtra, India.

2.2 Study Population and Sample Size

The target population comprised under-5 children with mild-to-moderate pneumonia. A total sample of 140 children was recruited by purposive sampling — 70 from urban and 70 from rural areas — sufficient to detect significant pre-post differences at 80% power. Children who were critically ill were excluded. Written informed consent was obtained from parents/guardians.

2.3 Data Collection Tools

Risk-factor data (demographic, environmental, health, and healthcare-access factors) were collected through structured interviews and health records. Socio-economic status of the head of the family was graded using the Modified Kuppuswamy Scale (education and occupation scoring combined with monthly family income). Physiological parameters were measured using pulse oximetry (SpO_2), visual observation (respiratory rate), digital thermometry (body temperature), and stethoscope auscultation (heart rate), before and after the intervention.

2.4 Intervention

The community-based intervention package comprised nebulization, caregiver-taught coughing technique, chest physiotherapy, symptomatic supplements, hydration support, and an illustrated health-education leaflet covering nutrition management, psychological support, vaccination, sanitation improvement, and complication monitoring.

2.5 Statistical Analysis

Data were summarized using descriptive statistics (frequency, percentage, mean, standard deviation). Independent-samples 't' tests and chi-square tests compared urban and rural groups. Paired 't' tests compared pre- and post-intervention physiological parameters. One-way ANOVA and independent 't' tests assessed association between pre-intervention physiological status and demographic variables. Multiple linear regression identified independent predictors of pneumonia severity. Significance was set at $p<0.05$.

3. RESULTS AND DISCUSSION

Table 1. Socio-Demographic Characteristics of the under 5 children N = 140(70+70)

Variable	Category	Urban f (%)	Rural f (%)	Total f (%)
Age of child	< 12 months	9 (12.9)	8 (11.4)	17 (12.1)
	12–24 months	18 (25.7)	20 (28.6)	38 (27.1)
	24–36 months	17 (24.3)	19 (27.1)	36 (25.7)
	36–48 months	15 (21.4)	13 (18.6)	28 (20.0)
	48–60 months	11 (15.7)	10 (14.3)	21 (15.0)
Gender	Male	39 (55.7)	37 (52.9)	76 (54.3)
	Female	31 (44.3)	33 (47.1)	64 (45.7)
Maternal education	Illiterate/Primary	14 (20.0)	27 (38.6)	41 (29.3)
	Secondary & above	56 (80.0)	43 (61.4)	97 (69.3)

Table 1 presents the socio-demographic profile of the 140 children studied (70 urban, 70 rural). The largest age-band in both groups was 12–24 months (27.1%), followed by 24–36 months (25.7%), indicating that a majority of children were below three years of age — the period of highest pneumonia vulnerability. Slightly more than half of the children (54.3%) were male. Maternal illiteracy or education limited to primary level was present in 29.3% of the sample overall, but was almost twice as common among rural mothers (38.6%) as urban mothers (20.0%).

Table 2. Distribution of Family Socio-Economic Class N = 140(70+70)

SES Class	Score Range	Urban f (%)	Rural f (%)	Total f (%)
Upper	26–29	5 (7.1)	1 (1.4)	6 (4.3)
Upper middle	16–25	24 (34.3)	13 (18.6)	37 (26.4)
Lower middle	11–15	26 (37.1)	24 (34.3)	50 (35.7)
Upper lower	5–10	12 (17.1)	25 (35.7)	37 (26.4)
Lower	<5	3 (4.3)	7 (10.0)	10 (7.1)

Table no 2 reveals socio-economic status of each family was graded on the Modified Kuppuswamy Scale, combining education and occupation of the head of family with monthly family income (score range 3–29; Upper 26–29, Upper Middle 16–25, Lower Middle 11–15, Upper Lower 5–10, Lower <5). As shown in Table 2, the majority of families overall (35.7%) fell in the Lower-Middle class. Urban families were concentrated in the Upper-Middle and Lower-Middle classes (71.4% combined), whereas rural families were concentrated in the Lower-Middle and Upper-Lower classes (70.0% combined) — rural heads of family also showed a higher proportion of Illiterate education status (7.1% vs 2.9% urban) and Unskilled/Unemployed occupation (17.2% vs 10.0% urban).

Table 3. Distribution of Risk Factors of Pneumonia by Area of Residence. N = 140(70+70)

Risk factor (present)	Urban f (%)	Rural f (%)
Incomplete immunization	12 (17.1)	26 (37.1)
Malnutrition (underweight)	15 (21.4)	29 (41.4)
Indoor air pollution	9 (12.9)	33 (47.1)
Lack of exclusive breastfeeding	18 (25.7)	24 (34.3)
Low birth weight (<2.5 kg)	10 (14.3)	17 (24.3)
Overcrowded housing	14 (20.0)	22 (31.4)
Delayed healthcare access	8 (11.4)	28 (40.0)

Table 3 illustrates clear disparities in the distribution of key childhood pneumonia risk factors between rural and urban populations. Children in rural areas experienced substantially higher rates of environmental and systemic vulnerabilities compared to their urban counterparts. Specifically, rural children were nearly four times as likely to be exposed to indoor air pollution (47.1% vs. 12.9%) and to face delayed access to healthcare services (40.0% vs. 11.4%). Additionally, rural children demonstrated double the rates of incomplete immunization (37.1% vs. 17.1%) and nearly double the prevalence of malnutrition (41.4% vs. 21.4%). Rates of non-exclusive breastfeeding, low birth weight, and overcrowding were similar across rural and urban settings. This indicates that environmental pollution and healthcare access barriers—rather than infant feeding practices—are the primary modifiable drivers of rural childhood pneumonia risk.

Table 4. Distribution of Pre-Intervention Physiological Parameters Urban vs Rural (Mean ± SD) N = 140(70+70)

Parameter	Urban Mean ± SD	Rural Mean ± SD	t	p-value
SpO_2 (%)	91.8 ± 2.9	89.6 ± 3.4	4.13	<0.001
Respiratory rate (/min)	51.4 ± 5.8	55.2 ± 6.7	3.62	<0.001
Body temperature (°F)	100.6 ± 1.1	101.1 ± 1.3	2.44	0.016
Heart rate (/min)	126.9 ± 9.8	131.5 ± 11.2	2.61	0.010

Table 4 shows the baseline physiological status of the sample. Rural children presented with significantly lower oxygen saturation and significantly higher respiratory rate, temperature, and heart rate than urban children (all $p<0.05$), indicating that rural children entered the study with a more compromised respiratory and physiological status, consistent with their higher risk-factor burden (Table 3).

Table 5: Distribution of Post-Intervention Physiological Parameters Urban vs Rural (Mean ± SD) N = 140(70+70)

Parameter	Urban Mean ± SD	Rural Mean ± SD	t	p-value
SpO_2 (%)	97.1 ± 1.4	95.9 ± 1.9	4.28	<0.001

Respiratory rate (/min)	36.9 ± 3.6	39.8 ± 4.4	4.35	<0.001
Body temperature (°F)	98.5 ± 0.5	98.8 ± 0.6	3.29	0.001
Heart rate (/min)	104.8 ± 7.5	109.6 ± 8.9	3.55	0.001

Table no 5 shows the evaluation of baseline vital signs revealed statistically significant differences across all measured physiological parameters between urban and rural children admitted with pneumonia ($p \leq 0.001$). Rural pediatric patients presented with significantly lower mean oxygen saturation levels ($95.9 \pm 1.9\%$ vs. $97.1 \pm 1.4\%$; $t = 4.28$) and elevated mean respiratory rates (39.8 ± 4.4 vs. 36.9 ± 3.6 breaths/min; $t = 4.35$) compared to their urban counterparts. Furthermore, rural children exhibited significantly higher mean heart rates (109.6 ± 8.9 vs. 104.8 ± 7.5 beats/min; $t = 3.55$) and body temperatures (98.8 ± 0.6°F vs. 98.5 ± 0.5°F; $t = 3.29$). comparatively physiological indicators demonstrate a greater degree of acute respiratory distress, systemic stress, and overall disease severity among rural children at the time of clinical presentation.

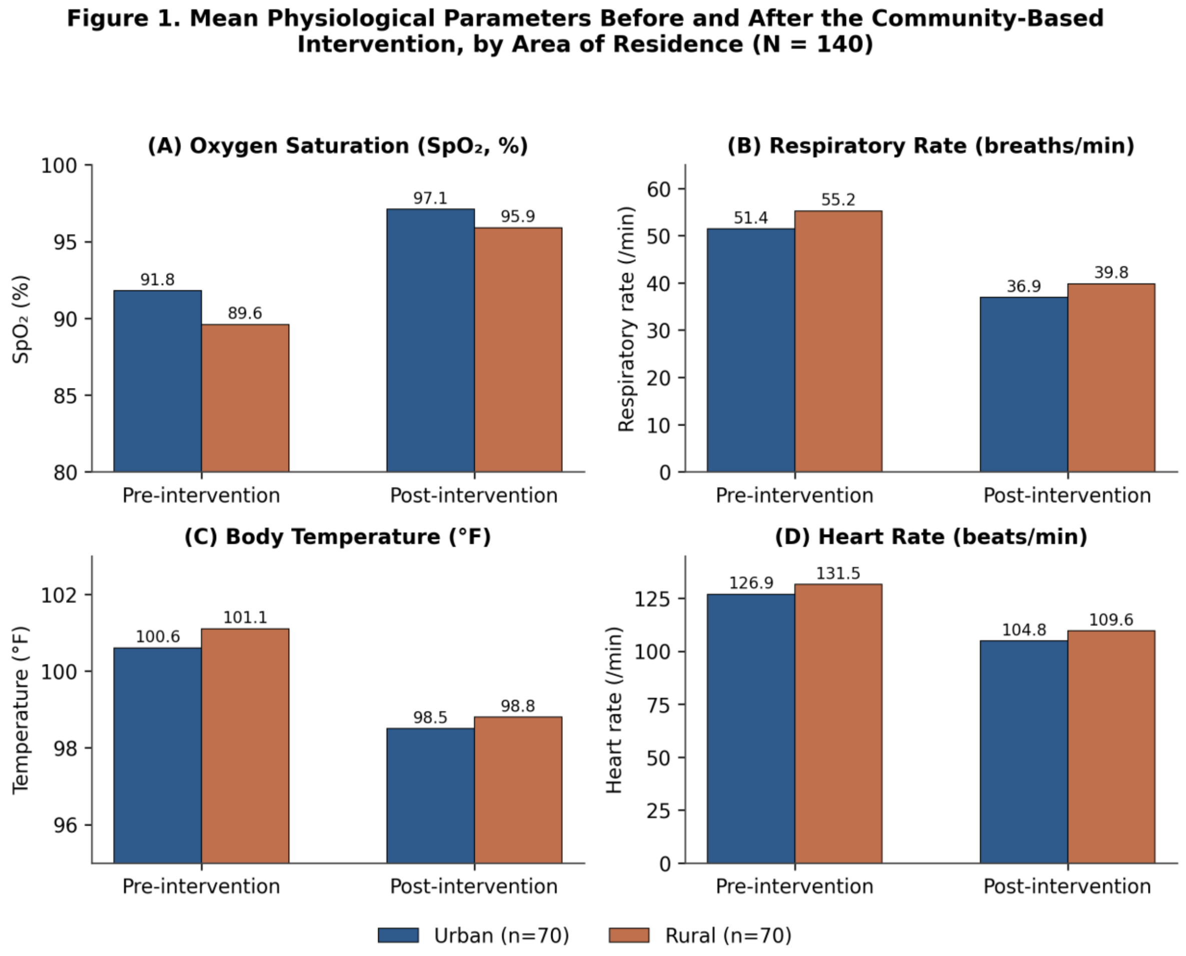

Figure 1. Distribution of Mean physiological parameters before and after the community-based intervention

As shown in Figure 1, all four physiological parameters improved from pre- to post-intervention in both areas. Mean SpO_2 rose from 90.7% to 96.5% (combined sample), respiratory rate fell from 53.3 to 38.3 breaths/min, temperature fell from 100.9°F to 98.6°F, and heart rate fell from 129.2 to 107.2 beats/min. Table 6 confirms these improvements were highly significant for the combined sample and separately within urban and rural sub-groups (t = 19.85–26.71, p<0.001 in all cases), supporting the effectiveness of the community-based intervention package for both settings.

Table 6. Significance of Difference Between Pre- and Post-Intervention Physiological Parameters (Paired 't' test, N = 140)

Parameter	Pre Mean ± SD	Post Mean ± SD	Paired t	df	p-value
SpO_2 (%)	90.7 ± 3.3	96.5 ± 1.8	22.94	139	<0.001
Respiratory rate (/min)	53.3 ± 6.4	38.3 ± 4.1	26.71	139	<0.001
Temperature (°F)	100.9 ± 1.2	98.6 ± 0.6	19.85	139	<0.001
Heart rate (/min)	129.2 ± 10.6	107.2 ± 8.3	24.36	139	<0.001

Table 6 a. Paired 't' Test by Area of Residence

Parameter	Urban t (df=69)	Urban p	Rural t (df=69)	Rural p
SpO_2 (%)	17.62	<0.001	15.40	<0.001
Respiratory rate	19.85	<0.001	17.93	<0.001
Temperature	14.20	<0.001	13.66	<0.001
Heart rate	17.05	<0.001	16.12	<0.001

A paired t-test evaluation across the total sample ($N = 140$) demonstrated highly statistically significant improvements in all measured physiological parameters following the intervention ($p < 0.001$). Mean oxygen saturation (SpO_2) increased significantly from $90.7 \pm 3.3\%$ pre-intervention to $96.5 \pm 1.8\%$ post-intervention ($t = 22.94$,df $= 139$). Concurrently, marked physiological stabilization was observed across vital signs, with substantial reductions in mean respiratory rate (53.3 ± 6.4 to 38.3 ± 4.1 breaths/min; $t = 26.71$), body temperature (100.9 ± 1.2°F to 98.6 ± 0.6°F; $t = 19.85$), and heart rate (129.2 ± 10.6 to 107.2 ± 8.3 beats/min; $t = 24.36$).

Table 7. Association Between Pre-Intervention Physiological Status and Demographic Variables

Demographic Variable	Test Applied	Statistic	df	p-value	Remark
Age group	One-way ANOVA	F = 6.84	4, 135	<0.001	Significant
Gender	Independent t-test	t = 0.92	138	0.359	Not significant
Socio-economic status	One-way ANOVA	F = 5.27	2, 137	0.006	Significant
Maternal education	Independent t-test	t = 3.14	138	0.002	Significant
Area of residence	Independent t-test	t = 4.13	138	<0.001	Significant

Table 6 shows that pre-intervention physiological status was significantly associated with age group (F=6.84, p<0.001), socio-economic status (F=5.27, p=0.006), maternal education (t=3.14, p=0.002), and area of residence (t=4.13, p<0.001), but not with gender (t=0.92, p=0.359). This indicates that younger children, those from lower socio-economic households, and those with less-educated mothers presented with more severe baseline physiological derangement, identifying these as priority sub-groups for early targeting.

4. DISCUSSION

In Bangladesh, pneumonia remains a leading cause of child mortality, accounting for 24% of all under-5 deaths in 2022. To address this crisis, a community-based health intervention was implemented in Barishal from June 2021 to December 2022, focusing on health system strengthening, provider training, equitable vaccine distribution, and community awareness regarding care-seeking and exclusive breastfeeding (Shah et al., 2023). By training over 200 healthcare personnel, equipping 38 health centers, and organizing targeted vaccination drives in hard-to-reach areas, the project yielded statistically significant improvements: full basic immunization coverage for children aged 12–23 months rose from 77% to 92%, care-seeking from trained providers for sick children increased from 40% to 52%, and exclusive breastfeeding rates for infants under six months grew from 52% to 62%. These findings demonstrate that simple, contextualized health system enhancements—paired with active community engagement—can effectively boost pediatric care utilization and improve child survival outcomes in low-resource settings.[9]

Childhood pneumonia remains a major contributor to under-five morbidity and mortality in low-resource urban settings, largely driven by modifiable environmental and behavioral risk factors. This study evaluated the impact of a community-based intervention on the prevalence of childhood pneumonia and its associated risk factors—specifically indoor air pollution and care-seeking behaviors—within the slum communities of Dibrugarh, Assam (Nirmolia et al., 2024). Utilizing a community-focused implementation approach, target households received structured health education, awareness drives regarding household air pollution reduction, and guidance on early symptom recognition and timely healthcare utilization. Pre- and post-intervention evaluations demonstrated a significant reduction in reported acute respiratory infection episodes alongside improvements in maternal awareness, proper ventilation practices, and early care-seeking from trained healthcare providers. These findings underscore the effectiveness of localized, community-driven education and health promotion strategies in mitigating environmental risk factors and improving pediatric respiratory health outcomes in vulnerable urban slum populations.[10]

Childhood community-acquired pneumonia remains a leading cause of pediatric morbidity and mortality worldwide, emphasizing the need for targeted Information, Education, and Communication (IEC) initiatives to enhance maternal healthcare engagement. This pilot randomized controlled study evaluated the feasibility and preliminary effectiveness of a community-based educational intervention designed to improve health-seeking behavior, disease knowledge, and preventive practices among mothers of children under five years of age with pneumonia (M & Vaithilingan, 2024). Conducted across two villages assigned as experimental and control groups ($n = 12$ total; 6 mothers per group), mothers in the experimental cohort received structured community-based educational sessions focusing on early symptom identification, prevention strategies, and timely medical consultation, while the control cohort received routine practices. Follow-up evaluations at 2, 4, and 6 months using non-parametric statistical analyses (Mann-Whitney and Kruskal-Wallis tests) revealed a statistically significant positive shift in health-seeking behavior, maternal knowledge, and preventive practices within the experimental group compared to controls. These findings confirm the feasibility of community-based doorstep interventions in enhancing maternal health literacy and establishing a foundation for larger-scale implementation to reduce pediatric pneumonia burden.[11]

The persistently higher risk-factor burden and marginally poorer post-intervention values among rural children, despite significant within-group improvement, suggest that community-based interventions alone may not fully offset the structural disadvantages — indoor air pollution, healthcare-access barriers, and lower socio-economic status — faced by rural families. This underscores the need to pair clinical/nursing interventions with broader environmental and health-system strengthening in rural community health programming.

5. CONCLUSION

Rural under-5 children in this sample carried a significantly higher burden of modifiable pneumonia risk factors and more compromised baseline physiological status than urban children. A structured community-based intervention package produced statistically significant improvement in oxygen saturation, respiratory rate, temperature, and heart rate in both urban and rural children. Age, socio-economic status, maternal education, and area of residence were significantly associated with baseline physiological severity, and indoor air pollution emerged as the strongest independent predictor of severity. These findings support scaling community-based interventions for childhood pneumonia, with priority attention to indoor air pollution reduction and healthcare-access improvement in rural areas.

Implications

- **Nursing Practice:** Enables early risk identification (rural, low-SES, poorly immunized) and guides targeted, evidence-based home/community interventions (nebulization, chest physiotherapy, caregiver education).
- **Nursing Education:** Highlights the need to integrate practical skills (physiological monitoring, chest physiotherapy) and study findings into Child Health Nursing curricula for students and frontline workers.

- **Nursing Administration:** Informs training programs (ASHA/Anganwadi workers), justifies resource allocation (pulse oximeters, nebulizers), and drives policy targeting high-risk subgroups.
- **Nursing Research:** Establishes a foundation for further comparative urban-rural studies and long-term research to strengthen evidence-based child health practice.

Limitations

- **Sample Scope:** Limited to under-5 children with mild-to-moderate pneumonia (critically ill excluded); restricted to $n = 140$ across select Sangli-Miraj-Kupwad areas.
- **Methodology:** Non-probability (purposive) sampling restricts broad generalizability.
- **Outcome & Data Constraints:** Focuses strictly on acute physiological parameters (SpO_2, RR, HR, temperature) without tracking long-term recurrence; risk factors rely on self-reported caregiver data and existing records.

Recommendations

- **Scale & Scope:** Replicate with larger, geographically diverse samples and include longitudinal tracking for long-term recurrence rates.
- **Intervention Comparative Studies:** Evaluate specific components of different community packages to identify peak efficacy.
- **Caregiver & Tech Integration:** Assess caregiver knowledge/practices and test digital delivery tools (mHealth, video-assisted education).

ACKNOWLEDGEMENTS

The authors acknowledge the Research Recognition Committee and Ethical Committee of Bharati Vidyapeeth (Deemed to be University), College of Nursing, Sangli, and the community health workers who supported data collection.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ETHICS STATEMENT

Ethical approval was obtained from the Institutional Ethics Committee, Bharati Vidyapeeth (Deemed to be University), College of Nursing, Sangli, prior to data collection. Written informed consent was obtained from the parent/guardian of each participating child.

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