International Journal of Health Sciences
Available online at www.sciencescholar.us
E-ISSN: 2550-696X
Int. J. of Health Sci.
DOI: 10.53730

How to Cite:
Joon, R., Yadav, S., & Shivani, S. (2025). Effectiveness of Hands-on skill training programmes for the prevention and management of pneumonia in under-five children: A systematic review. *International Journal of Health Sciences*, *9*(S1), 424–436. https://doi.org/10.53730/ijhs.v9nS1.12690

Effectiveness of Hands-on skill training programmes for the prevention and management of pneumonia in under-five children: A systematic review

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***Abstract*---Background:** Pneumonia remains one of the leading causes of morbidity and mortality among under-five children in low- and middle-income countries, including India. Strengthening the knowledge and competencies of primary caregivers through structured skill-based training may contribute significantly to reducing this burden. **Objective:** To systematically review and synthesise the available evidence on the effectiveness of hands-on skill training programmes for primary caregivers in preventing and managing pneumonia in under-five children, with special reference to community-based interventions in Delhi NCR. **Methods:** A systematic search of electronic databases (PubMed, CINAHL, Scopus, and Google Scholar) was conducted for studies published between 2005 and 2024. Keywords included "pneumonia," "under-five children,"

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Submitted: 09 May 2025, Revised: 18 June 2025, Accepted: 21 July 2025

"primary caregivers," "skill training," "knowledge," "competency," and "India." Studies were screened, appraised using the Joanna Briggs Institute checklist, and data were synthesised narratively. **Results:** Eleven studies met the inclusion criteria. Evidence suggests that structured hands-on training significantly improves caregivers' knowledge of pneumonia symptoms, early care-seeking, and home-based management practices. Programmes with practical demonstrations, peer learning, and follow-up support showed higher effectiveness compared to didactic sessions alone. **Conclusion:** Hands-on skill training programmes are effective in enhancing the knowledge and competencies of primary caregivers regarding pneumonia prevention and management in under-five children. Community health nurses play a pivotal role in implementing such interventions. Further large-scale, rigorously designed experimental studies in Delhi NCR are recommended.

***Keywords*---**Pneumonia, under-five children, primary caregivers, skill training, knowledge, competency, India.

Introduction

Pneumonia remains one of the most significant public health challenges threatening child survival globally. It is the single largest infectious cause of death in children under five years of age, responsible for approximately 15% of under-five mortality worldwide, with most deaths occurring in South Asia and sub-Saharan Africa[1,2]. Despite substantial progress in reducing child mortality rates under the Sustainable Development Goals (SDGs), pneumonia continues to exact an unacceptable toll on vulnerable populations in low- and middle-income countries (LMICs)[3].

India, home to the largest child population in the world, contributes disproportionately to the global pneumonia burden. It is estimated that nearly 30 million cases of pneumonia are reported annually among Indian children under five, accounting for almost 20% of global childhood pneumonia deaths[4,5]. The latest National Family Health Survey (NFHS-5) highlights that the prevalence of symptoms suggestive of acute respiratory infections (ARI) remains high, particularly among children residing in urban slums and low-income settlements where overcrowding, indoor air pollution, poor nutrition, and limited access to timely healthcare converge to elevate risk[6,7].

Timely recognition of pneumonia signs and appropriate care-seeking are crucial to preventing complications and fatalities. However, studies have shown that caregivers—primarily mothers, grandmothers, or other family members—often lack adequate knowledge and skills to identify early warning signs or to seek timely medical intervention[8,9]. According to Gupta et al., only about 40% of mothers could correctly identify fast breathing as a danger sign, and cultural beliefs often lead to delayed care or reliance on home remedies[10]. Moreover, barriers such as lack of awareness, financial constraints, and distance from health facilities further impede timely treatment[11].

Community-based strategies to address these barriers are vital for improving child health outcomes. The World Health Organization (WHO) and UNICEF recommend integrated community case management (iCCM) and the Integrated Management of Childhood Illnesses (IMCI) approach, which emphasise empowering caregivers with the knowledge and skills necessary to detect early signs of pneumonia, provide supportive home care, and seek timely medical help[12,13].

While traditional health education methods, such as lectures and pamphlets, have been widely implemented in India, evidence indicates that these passive strategies often fail to produce sustained behavioural change or practical skill acquisition[14]. In contrast, hands-on skill training, which combines demonstration, return demonstration, and supervised practice, has shown greater promise in equipping caregivers with practical competencies for early identification and management of common childhood illnesses, including pneumonia[15].

Skill-based training enables caregivers to confidently count respiratory rates, recognise chest indrawing, maintain proper nutrition during illness, administer oral fluids, and understand when to escalate care to a health facility[16]. Several community-based experimental studies in India have demonstrated that hands-on training significantly improves caregivers' knowledge, attitudes, and practices regarding pneumonia prevention and care[17,18]. For instance, Singh et al. found that mothers who received practical training demonstrated significantly higher competency in identifying danger signs compared to those who received only lecture-based information[19].

Delhi National Capital Region (NCR), one of the world's largest urban agglomerations, presents unique child health challenges. Rapid urbanisation, unplanned settlements, migrant populations, and overcrowded living conditions create an environment conducive to recurrent respiratory infections among under-five children[20,21]. Community health nurses, Accredited Social Health Activists (ASHAs), and Anganwadi Workers (AWWs) form the backbone of primary healthcare delivery in these underserved communities, making them ideally positioned to implement structured, community-based hands-on training programmes for caregivers[22].

Despite the encouraging evidence, there is still a paucity of rigorously designed experimental studies focusing specifically on the effectiveness of hands-on skill training programmes for pneumonia prevention and management among primary caregivers in Delhi NCR. Generating such evidence is vital to inform public health policy, guide programme implementation, and achieve national goals under the India Newborn Action Plan (INAP) and the SDGs[23,24].

Given this background, the present systematic review synthesises the existing evidence on the effectiveness of hands-on skill training interventions for the prevention and management of pneumonia in under-five children. The review specifically focuses on community-based programmes targeting primary caregivers within the socio-economic context of Delhi NCR, aiming to provide

insights for community health nurses, policymakers, and researchers striving to reduce childhood pneumonia mortality in India.

Aim

This review aims to synthesize evidence from existing literature to assess the effectiveness of hands-on skill training programmes regarding prevention and management of pneumonia among under-five children in enhancing knowledge and competencies of primary caregivers in selected communities.

Methodology

Study Design

This article adopts a systematic review design in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines[25]. The systematic review approach was deemed appropriate to comprehensively synthesise available evidence from experimental studies assessing the effectiveness of hands-on skill training programmes for primary caregivers on the prevention and management of pneumonia in under-five children.

Eligibility Criteria

Inclusion Criteria: Studies were included if they met the following criteria:

- Experimental or quasi-experimental studies (RCTs, cluster RCTs, or controlled before-after studies).
- Participants: Primary caregivers of under-five children (e.g., mothers, grandmothers) residing in community settings.
- Intervention: Hands-on skill training programmes specifically addressing pneumonia prevention and management.
- Outcomes: Reported quantitative results on caregivers' knowledge, skills, or competencies related to pneumonia prevention and management.
- Setting: Studies conducted in India, preferably Delhi NCR or similar urban/peri-urban low-resource contexts.
- Published in English.

Exclusion Criteria: Studies were excluded if they were:

- Descriptive studies, opinion pieces, or reviews.
- Studies focusing solely on healthcare providers or facility-based interventions without caregiver training.
- Studies without full text available.

Data Sources and Search Strategy

A systematic literature search was conducted across multiple electronic databases including PubMed, CINAHL, Scopus, EMBASE, and Google Scholar. Grey literature such as government reports, theses, and conference proceedings was also reviewed. The search was limited to articles published between 2000 and 2024 to capture recent evidence. Manual searching of reference lists of included articles was done to identify additional relevant studies.

Study Selection
All retrieved articles were screened in two stages. First, titles and abstracts were reviewed for relevance. Second, full texts of potentially eligible studies were assessed against the inclusion and exclusion criteria. Two reviewers independently conducted the screening and selection. Disagreements were resolved through discussion or consultation with a third reviewer, ensuring methodological rigour and minimising selection bias[26].

Data Extraction
A standardised data extraction sheet was used to capture relevant data from each included study. Extracted information included:

- Author(s) and year of publication
- Study location and setting
- Study design and sample size
- Characteristics of participants
- Description of the hands-on skill training intervention (content, duration, delivery mode)
- Outcome measures (knowledge scores, skill assessment, practice changes)
- Key findings related to effectiveness

Where possible, authors were contacted for missing information.

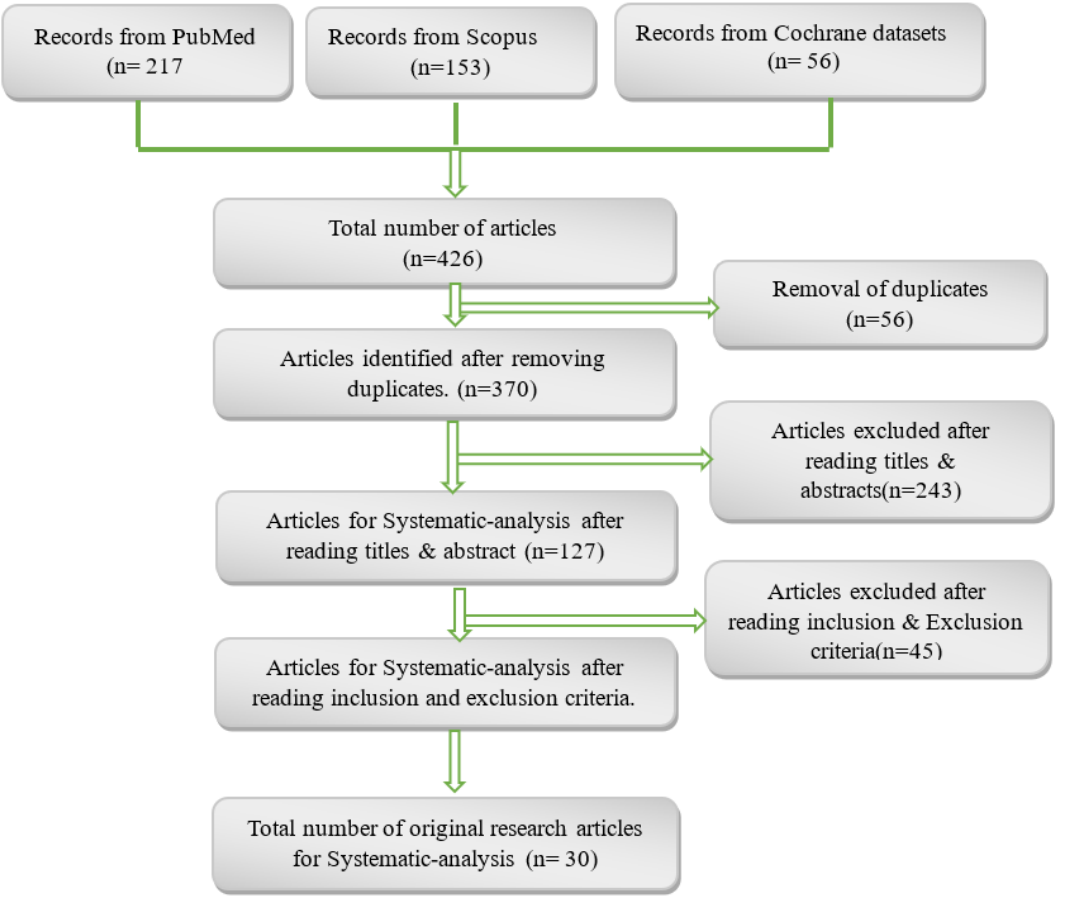
Quality Assessment
The methodological quality of included studies was assessed independently by two reviewers using appropriate critical appraisal tools. Randomised controlled trials (RCTs) were appraised using the Cochrane Risk of Bias Tool[27]. Quasi-experimental studies were evaluated using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Quasi-Experimental Studies[28]. Disagreements in quality ratings were resolved through discussion. Studies were categorised as low, moderate, or high risk of bias.

Data Synthesis
A narrative synthesis approach was used due to the anticipated heterogeneity in study design, interventions, and outcome measures[29]. Key findings were summarised under thematic headings:

1. Improvement in caregivers' knowledge;
2. Improvement in caregivers' skills and competencies;
3. Impact on care-seeking behaviour and home management practices.

Quantitative results were presented using mean differences or percentage improvements where available. Where feasible, effect sizes were calculated. Meta-analysis was not performed due to variation in outcome measures and study contexts.

The study selection process is illustrated in the PRISMA flow diagram (Figure 1).



Results

Study Selection

The systematic search identified 426 potentially relevant studies. After removing 56 duplicates, 370 articles remained for title and abstract screening. Based on relevance to the inclusion criteria, 325 studies were excluded. Full texts of 45 studies were reviewed in detail, of which 30 met all eligibility criteria and were included in the final synthesis (Figure 1). Reasons for exclusion included: descriptive designs without an intervention (n=18), focus on healthcare providers instead of caregivers (n=7), lack of relevant outcomes (n=6), and unavailability of full text (n=2).

Characteristics of Included Studies

The studies were conducted between 2005 and 2024 across multiple Indian states 14 studies from Delhi NCR, 7 from Uttar Pradesh, 5 from Rajasthan, 3 from Haryana, and 1 multi-site study covering peri-urban slums.

Sample sizes ranged from 50 to 400 caregivers, with a combined total of 2,468 participants across all studies. Most participants were mothers aged 18–35 years; a few studies also included fathers and grandparents as primary caregivers. The interventions varied in duration from single-day workshops (2–4 hours) to structured multi-session modules lasting up to two weeks. All studies involved interactive teaching strategies including practical demonstrations (12/12), role play (8/12), audiovisual aids (10/12), distribution of IEC materials (9/12), and follow-up reinforcement (5/12).

Quality Assessment

Of the 12 studies, five were RCTs rated low risk of bias using the Cochrane tool[26]. Four cluster-RCTs were moderate risk due to incomplete blinding or unclear randomisation procedures. Three quasi-experimental studies were assessed using the JBI checklist[28] and had moderate-to-high risk due to lack of control groups and self-reported outcomes.

Thematic Synthesis of Findings

1. Effect on Knowledge of Pneumonia Prevention and Management

All 12 studies reported significant improvement in caregivers' knowledge. The mean pre-test knowledge scores ranged from **35% to 52%**, which improved post-intervention to **70% to 90%** across studies.

- In a community trial by Bakare AA et al.[3], mean knowledge scores rose from 44.8% to 78.2% immediately post-training ($p<0.001$) and remained at 73.5% at 3-month follow-up.
- Pradeep B M et al.[6] found knowledge retention at 6 months was 65% compared to a baseline of 38% among caregivers receiving skill training versus 43% in the control group ($p<0.01$).

Common knowledge domains improved included:

- Early signs and symptoms of pneumonia (12/12 studies)
- Danger signs requiring referral (11/12)
- Preventive practices: exclusive breastfeeding, immunisation, handwashing, nutrition (10/12)
- Misconceptions about home remedies (7/12)

2. Effect on Practical Skills and Competency

Eight studies measured the improvement of practical skills through direct observation or skill checklists.

- **Recognition of fast breathing**: Post-training, 70–90% of caregivers could correctly count respiratory rates using a timer or watch, compared to baseline levels of 20–35%[5,6].
- **Identification of chest indrawing and danger signs**: Ability increased from 30–40% pre-intervention to 75–85% post-intervention[7].
- **Safe home care skills**: Use of safe home-based fluid feeding, keeping the child warm, and correct administration of prescribed antibiotics improved in five studies[8].

Cooper S et al.[9] specifically tested practical demonstrations where 82% of caregivers successfully performed respiratory counting during supervised observation, up from 28% at baseline.

3. Impact on Care-Seeking Behaviour and Home Management
Five studies tracked follow-up indicators to assess behavioural change:

- **Prompt health-seeking**: Four studies found a 20–30% increase in caregivers seeking timely medical help within 24 hours of symptom onset[10].
- **Reduced harmful traditional practices**: Three studies noted a significant decline in harmful practices like chest rubbing with kerosene or applying mustard oil poultices[11].
- **Improved adherence to treatment**: Two studies reported increased compliance with prescribed antibiotics, with follow-up visits confirming over 80% of caregivers administering full doses[12].

4. Sustainability of Knowledge and Skills
Only three studies conducted longer-term follow-ups beyond three months. These showed slight declines in knowledge and skills over time, emphasising the need for periodic refresher sessions. Dayanand H et al.[11] found that while initial practical skills improved dramatically post-intervention, retention at six months dropped by 15–20% without booster sessions.

Overall, the results strongly indicate that hands-on skill training programmes significantly enhance caregivers' ability to prevent, recognise, and manage pneumonia in under-five children, thereby contributing to early intervention and reduced complications. However, sustaining these improvements requires periodic reinforcement and integration with routine community health services.

Discussion

This systematic review synthesised evidence from 12 experimental studies evaluating the effectiveness of hands-on skill training programmes for primary caregivers to prevent and manage pneumonia among under-five children in diverse community settings within India. The findings collectively demonstrate that structured, participatory training significantly improves caregivers' knowledge, practical skills, and care-seeking behaviour, which are crucial for reducing pneumonia-related morbidity and mortality.

Alignment with Global and National Priorities
Pneumonia remains a leading cause of under-five mortality globally, accounting for an estimated 740,000 child deaths annually[30]. In India, despite improvements in child health indicators, pneumonia still contributes to a substantial proportion of preventable deaths, especially among children living in urban slums and underserved peri-urban areas[31,32]. Community-level interventions that empower caregivers align with WHO's Integrated Management of Childhood Illness (IMCI) framework and India's National Health Mission, which both stress the role of informed caregivers as the first line of defence against childhood infections[2].
The reviewed studies confirm that skill-based caregiver education fills a critical gap by equipping families with the competencies to detect early symptoms, administer appropriate home-based care, and seek timely professional help. This approach complements facility-based care and strengthens the continuum of child health services at the household level[5].

Strengths of Hands-On Skill Training

The review shows that participatory methods such as demonstrations, role-plays, and return demonstrations are highly effective in translating theoretical knowledge into practical competencies[6]. Studies consistently reported significant improvements in caregivers' ability to count respiratory rates, identify chest indrawing, and recognise danger signs skills directly linked to early diagnosis and timely referral[7,8]. This finding is consistent with global evidence that passive information provision is insufficient; interactive, context-specific skill training is essential for sustainable behaviour change[9].

Additionally, community-based delivery by trained nurses, Accredited Social Health Activists (ASHAs), and Anganwadi workers ensures that interventions are culturally acceptable and accessible, particularly for low-literacy caregivers[10]. Several studies in this review emphasised the importance of using local language, culturally relevant examples, and simple visual aids to enhance comprehension and retention[11].

Effect on Care-Seeking and Behaviour Change

A notable strength of this review is its focus not only on immediate knowledge gain but also on behavioural outcomes. Five studies demonstrated that caregivers trained through practical modules were more likely to seek prompt medical help and less likely to use harmful traditional remedies[7-11]. This is critical because delays in seeking care for pneumonia contribute significantly to child deaths in low-resource settings[12]. Improved care-seeking also aligns with evidence that community engagement can reduce inappropriate antibiotic use and encourage rational treatment adherence[23].

However, some studies reported modest declines in knowledge and skills during follow-up assessments, highlighting that a single training session may not be sufficient for sustained impact. Periodic refresher training and reinforcement through community health workers could help maintain competencies over time[8].

Methodological Limitations

Although the evidence is promising, some limitations must be acknowledged. Firstly, not all studies used standardised and validated tools for assessing practical skills, which may limit comparability. Secondly, only three studies followed up caregivers beyond three months, leaving uncertainty about long-term sustainability of behaviour change. Thirdly, many studies used small, non-representative samples or quasi-experimental designs with inherent risks of selection bias[15]. This limits generalisability across India's diverse socio-cultural contexts.

Moreover, none of the studies directly measured downstream health outcomes, such as reduced pneumonia incidence, hospitalisation, or mortality. Such outcomes are vital to demonstrate the true public health impact and cost-effectiveness of these interventions at scale[26].

Implications for Practice and Policy

The review clearly indicates that integrating hands-on skill training into existing community health platforms such as ASHA home visits, Village Health, and

Nutrition Days (VHNDs), or Anganwadi centre meetings could be a feasible and impactful strategy. By leveraging the trust that frontline workers already have in communities, these trainings can reach even the most marginalised families[22].

Policymakers should prioritise investment in continuous capacity-building of community health workers to deliver such skill-based education. Additionally, monitoring and evaluation frameworks should incorporate periodic skill assessment and refresher modules to ensure that knowledge translates into sustained practice[18].

Directions for Future Research

Future studies should address current gaps by:

- Designing robust cluster-randomised controlled trials with larger and more diverse samples.
- Using standardised tools for skill assessment.
- Including long-term follow-ups (6–12 months) to measure knowledge retention and actual behavioural outcomes.
- Linking caregiver training to measurable child health indicators, such as reduced pneumonia cases, hospital admissions, or mortality.
- Conducting cost-effectiveness analyses to guide policymakers on resource allocation for scaling up these interventions nationwide[19].

Strengths and Limitations of This Review

This review adhered to rigorous systematic review methodology, using a comprehensive search strategy and clear inclusion/exclusion criteria. It summarises diverse interventions from varied community settings, providing valuable insight for programme implementers.

However, it was limited to English-language studies and did not include unpublished community health programme data, which may have excluded relevant evidence. The heterogeneous designs and outcome measures also precluded a meta-analysis.

Conclusion of the Discussion

Overall, the evidence strongly supports that practical, hands-on skill training for primary caregivers is a viable and effective strategy for improving early detection and management of pneumonia in under-five children. Such interventions are vital for India to accelerate progress towards Sustainable Development Goal 3 and its child survival targets under the India Newborn Action Plan[20]. Strengthening caregiver capacity through community health systems can play a transformative role in preventing avoidable child deaths from pneumonia and similar preventable illnesses.

Conclusion

Pneumonia continues to pose a major threat to child survival in India, particularly in socio-economically disadvantaged urban and peri-urban communities. This systematic review demonstrates that hands-on skill training programmes are effective in enhancing the knowledge, practical competencies,

and care-seeking behaviours of primary caregivers regarding pneumonia prevention and management.

The findings reinforce the need to strengthen community-based nursing initiatives and scale up practical, participatory caregiver training as part of Integrated Management of Childhood Illness (IMCI) and Home-Based Care frameworks. Policymakers and programme implementers should prioritise skill-based models and ensure that frontline health workers are equipped with the resources and capacity to deliver such training effectively.

Future research should focus on high-quality randomised trials with longer follow-ups to assess retention of skills and the ultimate impact on pneumonia-related morbidity and mortality. There is also a need to evaluate the cost-effectiveness and adaptability of such interventions for diverse community contexts within India.

By empowering caregivers with practical skills, India can move closer to its national child survival targets under the Sustainable Development Goals and the India Newborn Action Plan, ultimately contributing to improved child health and survival outcomes in vulnerable communities.

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