



## Systematic Review



## The Impact of Integrated Community-Based Management of Respiratory Infections in Reducing Child Mortality

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## ABSTRACT

Pneumonia alone is reported to be the leading reason for child death especially within developing countries which have inadequate health care facilities. So, it is necessary to assess the effect of Integrated Community Based Management interventions in reducing the child mortality rate caused by respiratory diseases. **Objectives:** To assess the effectiveness of early intervention to raise public awareness, ensure that individuals adhere to their treatments and use community health workers to decrease mortality in Low- and middle-income countries and to identify the key factors that contribute to success. **Methods:** The articles which are purely research articles were retrieved from databases including PubMed, Science Direct, Nature Journal and Google Scholar from January 2013 to April 2024. Peer-reviewed papers published on the management of respiratory diseases in the communities including youngsters below the age of 5 years were included from Africa, South Asia, America and Europe. Only those studies that met the identified criteria for methodological quality, and reporting on the outcomes of interventions and decrease in mortality were considered for inclusion. **Results:** The findings showed that community health workers played a significant role in the early diagnosis and prevention of respiratory tract disorders and other harmful diseases. There was a significant reduction of 30% in mortalities of infants and preschoolers in communities where the implementation of interventions was made necessary. **Conclusions:** It was concluded that the implementation of integrated community-based management of respiratory infection is a viable approach used to address child mortality in low-income areas and raise public awareness.

## INTRODUCTION

Lower respiratory diseases, mainly pneumonia, are some of the major reasons for mortality and morbidity in infants and preschoolers, and most of these incidences are being observed in poor or middle-income countries. Pneumonia incidences in newborns and children younger than five years old persist to be the ruling cause of mortality in developing and under-developed countries. For example, pneumonia contributes to about 15% of all under-five years' children's deaths worldwide this is about 800,000 children's deaths every year. [1]. The main risk factors are delaying

seeking medical help, poor access to health care, weak immunization programs and lack of oxygen supply systems [2]. Bronchiectasis and chronic bronchitis are a major underlying reason for pneumonia [3]. The 7% of the population in low-income countries, suffers from chronic obstructive pulmonary disease (COPD). Out of these pulmonary diseases, 2% have affected the physical function, quality of life as well as economic productivity of the patients [4]. Respiratory infections and pneumonia are culprits for more than 50% of the incident rate being



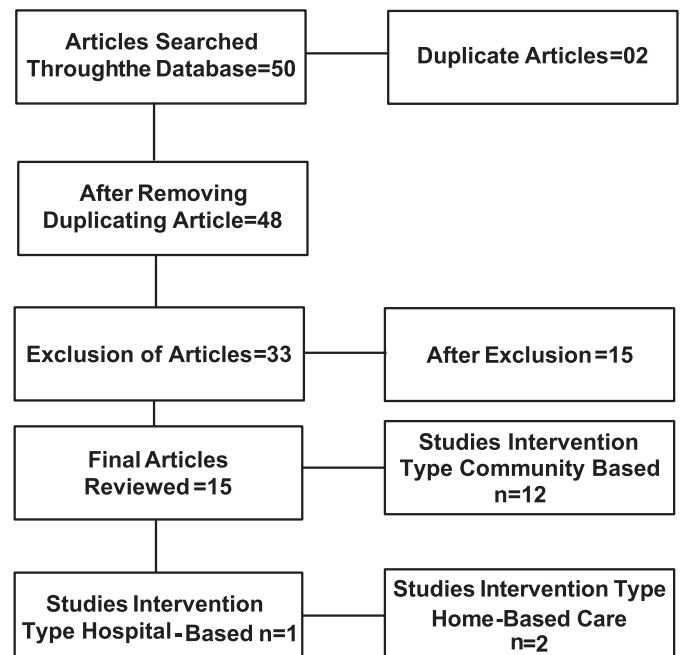
recorded in children aged below five, whereas South Asian individuals have been said to have a higher prevalence of asthma, dyspnea and chronic cough. [5, 6]. In an African study, an autopsy identified that bacterial pneumonia is more prevalent among children and low-immunity patients [7]. These respiratory conditions are significantly associated with poor health status and are one of the leading reasons for death in studied regions. Encouraging outcomes of lowering the mortality rate of pediatric pneumonia in underdeveloped nations have been shown by Interventions which used Integrated Community Case Management (ICCM). Community-based case management with the use of antibiotics might potentially decrease pneumonia mortality in children under 5 by 70% [8]. A significant reduction of 76% was demonstrated in one study, while other studies have also shown a greater decrease in mortality among kids living within ICCM program regions than in control areas. For example, in ICCM programs, there was a 57% reduction in under-five mortality rates observed in several countries, including Nepal, Ethiopia, and Uganda [9]. Focusing on providing high-demand and high-quality healthcare services and monitoring new infections from time to time is essential for the successful execution of ICCM in lower to middle-income countries like Sub-Saharan Africa [10]. Cost-effectiveness analyses bring to a focus that, in low- and middle-income nations, community-based therapies, encouraging breastfeeding, use of zinc supplementation, and vaccination against *Streptococcus pneumoniae* and Hemophilic influenza type B are highly successful approaches towards the cure [11]. These combined strategies may reduce total child mortality by 17% [11].

This study aims to explore how effectively integrated community-based methods are controlling the child mortality rate due to pneumonia and other respiratory disorders, particularly in middle to low-income countries where steady treatments and other healthcare facilities are deficient. It will help researchers in future to streamline exploratory and therapeutic protocol keeping the needs of Asian and African cultures aligned to establish an understanding of respiratory disorders and their effective treatments.

## METHODS

According to the recommendations by PRISMA for reporting, this systematic review was conducted on data published during January 2013 to April 2024. It included 50 articles which were sorted out based on inclusion criteria as recommended by PRISMA and reported the details including author, title, year, demographics, intervention type, variables, sample, age range, references and outcome. Several search engines were employed; Google Scholar, PubMed and Springer Link. Google Scholar was used for (80%) of the articles. Search phrases included South Asia, Africa and Sub-Saharan Africa. It assisted in providing more relevant papers for scrutinizing research

and its evaluation. Research conducted in peripheral countries was also represented in the pool of articles. The articles were chosen about the subjects and according to the inclusion criteria. Cross-sectional, controlled, and randomized trial studies, published in internationally indexed scientific journals, describing community-based management interventions in children under five years with respiratory infections were selected. Further, sample size justification was done using the articles that fulfilled quality criteria recommended within PRISMA checklists; moreover, the minimum sample size criterion of the study's representative population was also considered. The process of statistical analysis was developed to integrate mortality data obtained from different research. Information on changes in mortality was then combined and the outcomes were presented as per cent reductions in child mortality. Where needed, risk ratios (RR) were applied, while the confidence intervals (CI) of 95% were determined to establish the specificity of the outlined results. Article searches were done using keywords: Integrated Community-Based Management, respiratory infections, children's health, pneumonia, and child mortality rate. The articles that, did not fulfil our inclusion criterion were eliminated. 50 articles in total were downloaded from databases. There were two duplicate articles, which were removed, leaving 48 items to analyze. The total sum of 33 articles was eliminated from this systematic review. After eliminating them, 15 papers were sorted for systematic review, which met the inclusion criteria (Figure 1).



**Figure 1:** Review Model

## RESULTS

The majority of the children in all the studies were under 5 years old. Few studies showed a variety of age ranges. One

study comprises a survey of community health workers. In this review, (93%) of the articles came from Asian and African regions, with the remaining (7%) from the USA and Europe. The findings imply that such community-based initiatives tremendously contribute to early identification and appropriate treatment of the illness, reducing child mortality. For instance, mortality was reduced by 30 percent in the studies applying Integrated Community-Based Management (ICBM) interventions. The articles taken from Google Scholar were (80%), Springer Link (15%) and other databases (5%). The research showed community-based intervention type for 85% of studies, hospital-based management for one study and home-based care for the rest of the studies (Table 1).

**Table 1:** Systematic Scheme of Studies Included in Review Along with Their Findings and Outcomes

Sample Size (Age range)	Intervention Type	Variables	Key Outcomes	Main Findings	References
230,000 children (7 days to 59 months). Women of childbearing age (16 to 49 years)	WSS whole systems strengthening approach: Community men's and women's groups	Primary variable: Under-five mortality rate. Secondary variables: Mortality from suspected pneumonia, care-seeking breast feeding rates, vaccine	30% reduction in under-five mortality. Contingent on the success of the interventions	Reduction of mortality rate in under-five. Improvements in care-seeking, knowledge of pneumonia, and healthcare system quality	[12]
62,363 children including 4013 children with pneumonia (2-59 months)	Community-level health workers (CLHWs) assessed and treated children with a 5-day oral amoxicillin course	Pulse oximetry performance treatment. Clinical deterioration	Intervention clusters (4.3% (90/2081) failed treatment with five deaths). Control clusters (4.4% (79/1816) with five deaths). Risk difference calculated (-0.01, 95% CI, 1.5% to 1.5%, which satisfied the pre-specified non-inferiority criterion)	The community-based treatment of chest-in-drawing pneumonia using oral amoxicillin was non-inferior to the standard facility-based treatment CLHWs can effectively manage such cases in the community	[13]
Children under 5 years old	Integrated Management of Childhood Illness (IMCI) program under ICCM	Under-5 mortality rate (U5M) Medical assistance for pneumonial	MCI reduced under-5 mortalities by 57% Neonatal mortality by 46%	Improvement in under-5 mortality, reduction in pneumonia mortality, and Increase in care-seeking behaviours were observed	[14]
Children under 5 years old	Integrated community case management (ICCM)	Care-seeking behavior. Treatment failure rates.	Mortality rate Care-seeking behavior for pneumonia increased by 13%. Pneumonia treatment failure rates decreased by 40%. There was a 32% reduction in pneumonia-specific mortality	Community-based interventions have the potential to scale up care-seeking. Use of essential commodities and significantly decreased morbidity and mortality burden due to pneumonia	[15]
165 PPMVs trained, children aged 2 to 59 months	Integrated Community Case Management (ICCM) focused on improving PPMVs' ability	Assessing cough, respiratory rate, fever	1.8% of PPMVs could not appropriately treat malaria, down from 21.8% in the first segment. The number of PPMVs who could not treat cough and fast breathing dropped from 28.5% to 8.5%	Significant improvement in the quality of services provided by PPMVs across the three disease areas. PPMVs' ability to assess the respiratory rate and diagnose fast breathing improved significantly	[16]
10,022 household survey, children under 5 years old	Integrated community case management (ICCM). The Integrated Community-Based Health Systems Strengthening (ICBHSS)	Under-5 mortalities, Health service coverages. Care-seeking behaviour for child illness. Timeliness of treatment and successful referrals	Under-5 mortality decreased from 51.1 per 1,000 live births in 2015 to 35.8 in 2020. Antenatal care in the first trimester rose from 37.5% to 50.1%	The intervention was associated with a 30% reduction in under-5 mortalities over 5 years	[17]
1524 health. 5400 healthcare providers were interviewed	Integrated Management of Childhood Illness (IMCI) services under ICCM	Availability of staff trained in IMCI, essential equipment. Necessary medicines	Only 18% of facilities had high readiness for managing pneumonia. 20% had low readiness. Substantial gaps in the availability of trained staff and essential items	IMCI-based pneumonia management services were lacking. There were gaps in the availability of IMCI services and essential items	[18]
3690 children aged 2-59 months	Integrated community case management (ICCM)	The availability of ICCM medicines. Diagnostic supplies. Supportive supervision coverage	65.9% of children received appropriate care. 63.3% in the control group. The intervention was associated with improved supervision and supply management	No significant effect of applied ICCM on the appropriate diagnosis and treatment of patients. Need longitudinal studies	[19]

380 children aged 0-48 months	Integrated community case management (ICCM)	Incidences of pneumonia, diarrhea, fever, malaria. Overall child morbidity. Severe childhood illnesses.	Reduced intervention of child morbidity by 83%. The incidence of pneumonia, diarrhea, fever, and malaria was reduced by 79%, 80%, 91%, and 73%, respectively	Reduction in child morbidity across multiple diseases, including pneumonia, diarrhea, fever, and malaria	[20]
Children under five years old and adults over 70 years old	Vaccination coverage and public health interventions	Household air pollution. Geographic location.	Lower respiratory infections (LRI) were reported to account for 2.4 million deaths in 2019. The burden was highest in low Socio-Demographic Index (SDI) countries	Globally, the burden of LRI has declined significantly over the last 30 years. The disease burden remains high in low SDI countries like Sub-Saharan Africa.	[21]
18,430 encounters, children aged 2 months to 5 years	Integrated community case management (ICCM)	Clinical presentation. Correct use of rapid diagnostic tests (RDTs).	74% of patients received correct care. Quality improved for about 3 years post-training for one cohort. For the second cohort, the quality of care was essentially constant over time.	Quality of care was relatively constant over time, though the trend towards decreasing quality of care after 3 years of providing ICCM care.	[22]
3,101 children aged 2-23 months	Hospital-based management with WHO guidelines	Children's nutritional status, mortality during hospital admission, and mortality within 180 days of discharge	The study found that 11.3% of children died two-thirds of these deaths occur within 30 days of admission. There is a need for improved community-based interventions	There was a high mortality rate, despite adherence to current WHO guidelines. Most deaths were attributed to preventable conditions like sepsis, pneumonia	[23]
4426 in control areas and 3230 in intervention areas. Children under 5 years old	Home-based child care (HBCC)	Under-five mortality rate (U5MR), Infant mortality rate (IMR)	U5MR reduced from 147.21 to 50.38 in intervention areas (65.78% reduction). IMR reduced from 106.60 to 32.75 in intervention areas (69.28% reduction). NMR was reduced by 55.34% and PMR by 66.77% in intervention areas.	Reduction in U5MR, IMR, NMR, and PMR in intervention areas.	[24]
Several studies with patients from 72 to over 17,000. Children from 1 month to teenagers 18 years	Point-of-care tests (POCTs) and rapid diagnostic tests	Antibiotic prescription rate. Duration of therapy. Antiviral (oseltamivir) prescriptions.	Significant reduction in antibiotic prescription rates, Reduction in length of hospital stay, and duration of antibiotic therapy. Improved accuracy in diagnosing viral versus bacterial infections	Rapid tests led to a substantial increase in appropriate oseltamivir use, particularly in influenza patients. Rapid tests shortened the duration of hospital stays.	[25]
1356 interviews, children under 5 years old	Home-based Care (HBC) and Community-based Health Planning and Services (CHPS)	Care-seeking behavior. Appropriate treatment for diseases. Socio-demographic factors.	33.0% of suspected pneumonia cases in Northern. Region CHPS received amoxicillin. 97.7% satisfaction in Volta CHPS	User satisfaction rate was 97.7%. treatment rate was low in the studied regions.	[26]

## DISCUSSION

To examine the impact of Integrated Community-Based Management (ICBM) interventions in reducing child mortality caused by respiratory infections, especially pneumonia, in low- and middle-income countries (LMICs), this study was conducted. Due to poor healthcare access, prophylaxis, and delayed treatment, pneumonia remains a leading cause of child mortality globally, disproportionately affecting children in the regions of low income-and poverty [27]. According to the World Health Organization (WHO), 15% of all deaths of children under five years old are caused by pneumonia globally, especially in LMICs where proper preventive measures can't be taken [28]. This study synthesizes that there are three key strategies for improvement, early diagnosis, adequate treatment and community involvement in combating pneumonia-related child mortality. Community health workers are involved extensively in these intervention programs because they give healthcare to the targeted populations in hard-to-

reach areas. These findings further underscore the importance of implementing community-based intervention within the context of the formal health system in LMICs [29]. In lower- and middle-income countries several factors assist the burden of respiratory tract infections mainly pneumonia. Children's exposure to respiratory illnesses is increased when environmental factors such as crowded living quarters, inadequate nutrition, and indoor air pollution caused by biomass fuels come in contact with children. [30]. More than half of all pneumonia fatalities in children under five in low-income countries (LMICs) are caused when indoor air is polluted. This is because biomass combustion such as wood, dung, and agricultural wastes releases dangerous pollutants into the air [31]. Furthermore, malnourished children have compromised immune systems already, which leaves them more prone to harmful diseases. Research done in sub-Saharan Africa and Southeast Asia found that



malnourished kids were susceptible to pneumonia twice as compared to well-nourished youngsters [32]. Particularly in informal living communities and rural regions in combination with overcrowded living settings empowers the spread of respiratory diseases and causes recurrent outbreaks. Inadequate vaccination coverage, especially for diseases like pneumococcal pneumonia and Hemophilic influenza type b (Hib), also plays a significant role in the continued high rates of child mortality in LMICs. Vaccination has proven to be one of the most effective preventive measures against pneumonia, only 50% of children in LMICs had received the complete dosage of Hib and pneumococcal vaccines. The Global Alliance for Vaccines & Immunization (GAVI) has a major role in expanding access to vaccines in LMICs, but coverage gaps remain due to logistical challenges, vaccine hesitancy, and weak healthcare infrastructure. Further expansion of vaccination programs is essential, particularly in rural regions where there is a limited approach to healthcare facilities. Pneumonia, being a persistent and prolonged lower respiratory illness, primarily affects children under the age of five, with symptoms such as rapid breathing, chest in drawing, and fever. However, distinguishing pneumonia from other respiratory infections, such as bronchitis or bronchiolitis, can be challenging in low-resource settings without proper diagnostic tools. Many healthcare workers, especially in remote areas, rely on clinical signs alone, leading to underdiagnoses or misdiagnoses of pneumonia. This is further compounded by a lack of trained healthcare professionals and diagnostic equipment in many LMICs. Untreated pneumonia can lead to severe complications, including sepsis, respiratory failure, and long-term respiratory problems such as chronic bronchitis and bronchiectasis, which place a further burden on healthcare systems in LMICs [33]. The economic impact of pneumonia is significant, as families are often forced to cover out-of-pocket expenses for treatment, pushing many into poverties. In regions where formal healthcare is inaccessible, families may delay seeking treatment due to cost concerns, which exacerbates the disease's progression and increases the likelihood of death [34]. Community-based interventions, such as ICBM programs, have been crucial in addressing these challenges by bringing healthcare services closer to the community level [35]. To diagnose pneumonia, the use of clinical criteria that are understandable to the normal public, healthcare information, and first aid availability is necessary and community health workers (CHWs) are essential for such interventions. The usefulness of CHWs in lowering pneumonia-related mortality has been shown in various research. This study finds its limits as it does not fully address the potential challenges in scaling these interventions, such as financial sustainability and the reliance on CHWs. A key issue is the lack of financial incentives for CHWs, many of whom are volunteers and may

have limited motivation or time to commit to healthcare activities. In many cases, CHWs receive basic training, but without regular refresher courses or supervision, their ability to provide quality care diminishes over time [32]. There is also the challenge of integrating community-based programs into national healthcare systems to ensure their sustainability. Future research should focus on developing innovative models for sustaining CHW programs, such as providing stipends, integrating CHWs into formal healthcare systems, or using mobile health (mHealth) tools to support their work. The evidence presented in this study encourages policymakers to focus on scaling up the implementation of ICBM interventions in national health systems, particularly in LMICs. Training of CHWs and the financial remuneration of these personnel can go a long way in making the programs sustainable. Governments and NGOs should extend health education to increase awareness about vaccines, donate essential medical equipment like pulse oximeters, and reduce air pollution. Further, the deployment of mHealth tools is likely to complement the operation of CHWs to achieve timely treatment of respiratory infections. Mobile applications can also facilitate better tracking of vaccination coverage, helping to ensure that children receive the necessary doses of pneumococcal and Hib vaccines on time. This study underscores the critical importance of community-based healthcare interventions in improving child survival, particularly in regions where formal healthcare systems are underdeveloped or inaccessible. Expanding immunization coverage, improving sanitation, and reducing indoor air pollution through cleaner cooking technologies are vital areas for future interventions. In conclusion, ICBM interventions have proven effective in reducing child mortality due to pneumonia in LMICs, but several challenges remain in scaling and sustaining these programs. The subject of future study should extend the community-based approaches with policy support programs about sustainability, incorporate CHWs into formal health systems, and apply mobile health solutions to CHWs. Additionally, addressing the underlying environmental and healthcare infrastructure issues in LMICs, such as improving vaccination coverage, reducing indoor air pollution, and strengthening healthcare systems, will be crucial in further reducing pneumonia-related mortality in children.

## CONCLUSIONS

It was concluded that to effectively reduce child death rates and lower respiratory infections, comprehensive community-based approaches need to be scaled up in LMICs. Early diagnosis, treatment adherence, and public health education should be central to these strategies. Preventive measures such as promoting vaccination against pneumococcal and Hib diseases, improving indoor air quality, and addressing malnutrition are essential.

Policymakers should focus on long-term investment in healthcare infrastructure, capacity building for CHWs, and the integration of technological tools like pulse oximeters to enhance diagnostic accuracy [34]. In addition, future initiatives must emphasize prevention, education, and sustainable healthcare delivery models that can be designed to the specific requirements of per region.

### Authors Contribution

Conceptualization: BH, SP, ZK

Methodology: BH, SP, ZK, SHAZ, AM, SHS, AAK

Formal analysis: BH, SP, ZK

Writing review and editing: SHAZ, AM, SHS, AAK

All authors have read and agreed to the published version of the manuscript

### Conflicts of Interest

All the authors declare no conflict of interest.

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