

A BIBLIOMETRIC ANALYSIS OF RESPIRATORY TRACT INFECTION EDUCATION IN CHILDREN USING VOSVIEWER: RESEARCH TRENDS AND FUTURE DIRECTIONS

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Abstract

Acute Respiratory Tract Infection (ARTI) is one of the leading causes of morbidity and mortality among children, particularly in low- and middle-income countries. Although the number of studies related to ARTI continues to increase, comprehensive mapping of research trends on ARTI education in children remains limited. Therefore, this study aims to analyze publication trends, country contributions, citation impact, and thematic clusters in ARTI education research in children from 2020 to 2025. This study employed a bibliometric analysis using data from the Scopus database with the keywords “Acute Respiratory Tract Infection,” “Education,” and “Children.” The results indicate a consistent increase in publications during the observation period, with contributions dominated by high-income countries. Highly cited articles are generally published in high-impact journals. Network visualization identified major clusters dominated by clinical topics such as pneumonia prevention, hygiene practices, parental education, public health interventions, and rational antibiotic prescribing. Recent evidence shows that indoor air pollution significantly affects respiratory health outcomes in children (Springer, 2026). Furthermore, integrated interventions combining educational strategies with air filtration technology have been shown to reduce respiratory infections among children (KidsAIR Trial, 2022).

Keywords: *Acute Respiratory Tract Infection; Education; Children; Bibliometric Analysis; Scopus; VOSviewer.*

A. INTRODUCTION

Acute Respiratory Tract Infection (ARTI) remains a major cause of morbidity and mortality among children worldwide. The burden is particularly high in low- and middle-income countries due to limited healthcare access, poor environmental conditions, and inadequate preventive measures. Respiratory infections, including pneumonia, contribute significantly to child mortality, accounting for approximately 14% of deaths in children under five (World Health Organization, 2022). In addition, ARTI is largely preventable through appropriate promotive and preventive strategies (Merera, 2021).

Health education plays an important role in preventing ARTI, particularly through improving parental knowledge and caregiving practices. Educational interventions have been shown to enhance hygiene behavior, cough etiquette, and infection prevention (Apanga & Kumbeni, 2021). Education also improves immunization adherence and promotes early detection of respiratory symptoms (Kronman et al., 2020). Recent studies indicate that community-based education at primary healthcare facilities effectively increases awareness of ARTI risk factors, including environmental exposure and household conditions (Kesuma & Mailita, 2024).

Epidemiological studies highlight that socioeconomic and environmental factors are key determinants of ARTI incidence in children (Apanga & Kumbeni, 2021). Household conditions and regional disparities further increase vulnerability (Merera, 2021). Additional evidence shows that poor housing conditions, inadequate sanitation, and low maternal

education are strongly associated with increased ARTI incidence (Uganda Study, 2022). From a clinical perspective, improving ARTI management includes rational antibiotic prescribing (Kronman et al., 2020). Recent literature emphasizes the importance of antibiotic stewardship programs to reduce inappropriate antibiotic use (Nature Medicine, 2026).

Environmental exposure, particularly indoor air pollution, has also been identified as a major contributor to respiratory health problems in children (Springer, 2026). Public health interventions during the COVID-19 pandemic have influenced respiratory disease transmission (Lee et al., 2021), supported by systematic reviews (Dallmeyer et al., 2024). Recent studies also show that combining educational interventions with environmental approaches can reduce respiratory infections in children (KidsAIR Trial, 2022). Policy-focused research highlights the need to strengthen RSV prevention strategies in low- and middle-income countries (Frontiers in Pediatrics, 2022).

B. METHOD

This study employed a bibliometric analysis design to examine the development of research on Acute Respiratory Tract Infection (ARTI) education in children. Bibliometric analysis is a quantitative method used to evaluate patterns, trends, and relationships within scientific publications. The data were obtained from the Scopus database, which is recognized as one of the most comprehensive and reputable sources for peer-reviewed scientific literature. The search strategy was conducted using the TITLE-ABS-KEY fields to ensure that the selected publications were directly relevant to the research topic. The keywords used in this study were “Acute Respiratory Tract Infection,” “Education,” and “Children.”

The initial search identified a total of 744 documents. After removing duplicates and screening previously included records, 146 articles met the inclusion criteria and were selected for further analysis. The inclusion criteria consisted of publications published between 2020 and 2025, written in English, and categorized as research articles. Further screening was conducted based on subject areas to maintain the focus of the study. Only publications within the fields of medicine and nursing were included. Articles categorized under immunology and microbiology, dentistry, environmental science, agriculture and biological sciences, biochemistry, genetics and molecular biology, as well as pharmacology, toxicology, and pharmaceuticals were excluded.

This selection process ensured that the analysis remained relevant to the scope of health education and pediatric care. The bibliographic data from the selected articles were exported in CSV format, including citation information, abstracts, keywords, and other relevant metadata. The data were then analyzed using VOSviewer software to visualize publication trends, country contributions, keyword co-occurrence networks, and citation patterns. The analysis focused on identifying thematic clusters, research evolution over time, and gaps in the literature related to ARTI education in children. This approach allowed for a comprehensive understanding of the research landscape and provided insights into future research directions.

This section outlines the research design, utilizing various figures and diagrams to provide a clear visualization of the methodological framework and the systematic data selection process employed in this study.

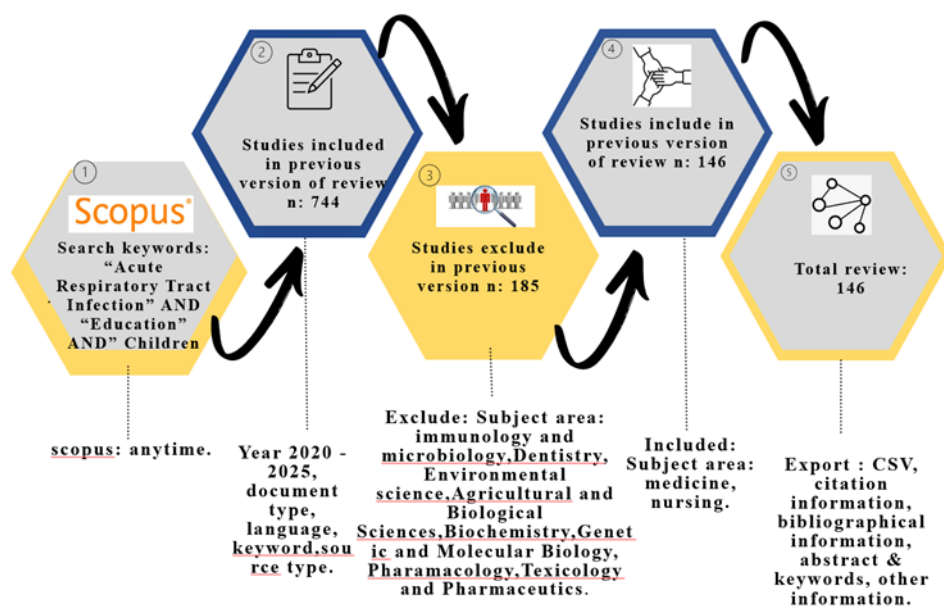


Figure. 1 Illustrates the Systematic Process of Data Collection and Article Selection Conducted in this Study

Bibliometric analysis in this study represents an analytical approach that focuses on quantifiable scientific publication data. This method enables the generation of objective and reproducible results while providing an overview of the relationships among documents analyzed in the context of Acute Respiratory Tract Infection (ARTI) education in children. The main indicators used include the number of publications as a measure of research productivity and citation counts as an indicator of the impact or influence of publications.

The analysis was focused on publication productivity and impact based on year of publication, country, journal, and authors. Frequency distributions and percentages were calculated based on publication year, number of documents, and global citation scores, while country contributions were determined based on author affiliations. In addition, keyword analysis was conducted to identify co-occurrence patterns and emerging research themes by selecting the 20 most relevant keywords. All bibliometric data were processed using BibExcel and VOSviewer software to map research networks, identify influential contributors, and project future research trends.

The article selection process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework. Articles retrieved from the Scopus database were filtered based on publication year, document type, and subject area. After removing duplicate records, the remaining articles were evaluated using predefined inclusion and exclusion criteria. Articles that met all criteria were included in the final dataset for bibliometric analysis.

C. RESULTS AND DISCUSSION

1. Publication Trends

The following figure illustrates the annual trend of publications on ARTI education in children.

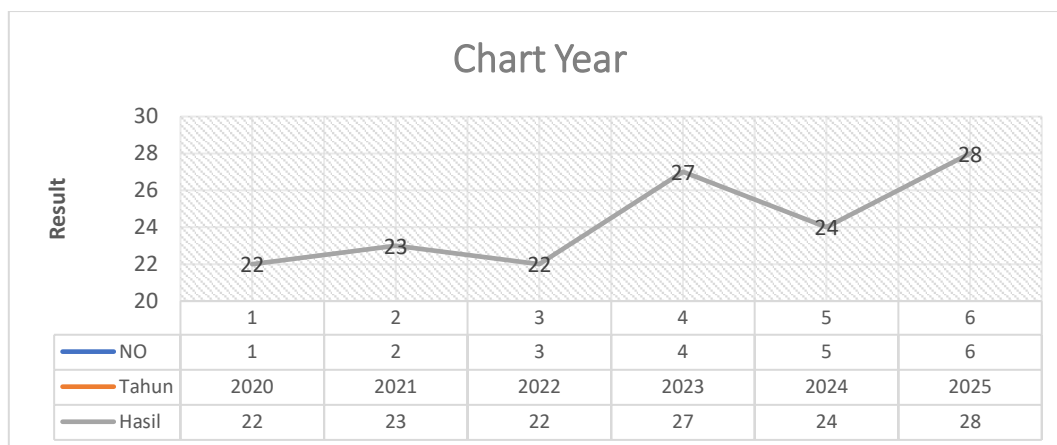


Figure 2. Annual Publication Trend, Which Reached Its Peak in 2025

Based on the analyzed publications, research on Acute Respiratory Tract Infection (ARTI) in children has progressed through several phases of focus. In the initial stage, studies primarily concentrated on clinical and epidemiological aspects, including disease characteristics, identification of individual risk factors, and the clinical management of ARTI cases in children. Over time, the focus gradually expanded to include preventive aspects, such as the role of immunization, nutritional status, and household environmental conditions in influencing ARTI incidence. This shift reflects an increasing emphasis on preventive strategies aimed at reducing disease burden.

In more recent years, research has increasingly adopted a broader public health perspective. Studies have not only explored community-based promotive and preventive interventions but have also examined social determinants of health, healthcare accessibility, hospitalization burden, and the economic impact of ARTI. This progression indicates a transition from a predominantly descriptive clinical approach toward a more comprehensive, prevention-oriented, and policy-driven research framework.

2. Distribution by Country

The following figure presents the distribution of publications on Acute Respiratory Tract Infection (ARTI) in children across different countries.

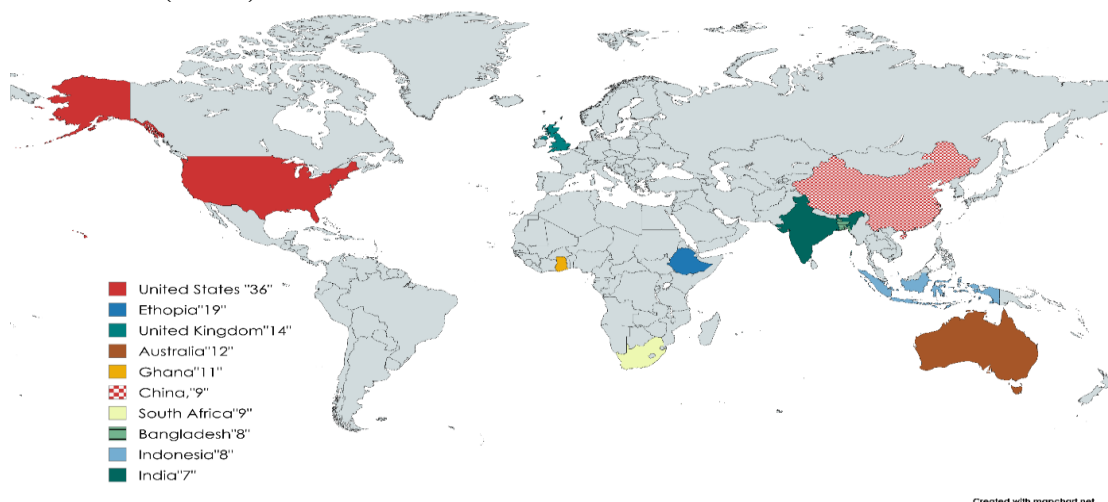


Figure 3. Distribution of Publications by Country

Source: From Data Bases Scopus, Process by Author Using Mapchart

(<https://www.mapchart.net/>)

Based on the bibliometric analysis (Figure. 3), publications on Acute Respiratory Tract Infection (ARTI) in children from high-income countries, such as the United States and the United Kingdom, tend to emphasize clinical aspects and healthcare system performance (Kronman et al., 2020). Frequently discussed topics include the development of evidence-based clinical guidelines (Nolan et al., 2020), evaluation of medical intervention effectiveness (Dallmeyer et al., 2024), and strategies for controlling respiratory infections within formal healthcare settings (Lee et al., 2021). This pattern reflects a strong focus on case management and improving the quality of healthcare services for both prevention and treatment.

In contrast, publications from developing countries, particularly in regions such as Asia and Africa—including India, Ethiopia, Kenya, and Ghana—tend to focus more on underlying determinants of ARTI. Commonly studied factors include child nutritional status (Merera, 2021), housing conditions and environmental exposure such as air pollution (Mulatya & Mutuku, 2020), sanitation, and limited access to basic healthcare services (Apanga & Kumbeni, 2021).

Recent evidence further highlights that indoor air pollution remains a critical environmental determinant affecting respiratory health outcomes among children, especially in low- and middle-income countries (Springer, 2026). Additionally, community-based studies emphasize that household density and exposure to cigarette smoke significantly increase the risk of ARTI in children (Kesuma & Mailita, 2024).

Overall, these findings indicate that in developing countries, ARTI in children remains a major public health issue closely linked to environmental and socioeconomic conditions. This contrast highlights the need for context-specific interventions tailored to the socioeconomic and environmental conditions of each region.

3. Most Influential Publications

The following table presents the most cited publications in ARTI research.

Table 1. Most cited articles

No	Document title	Authors/Year	Source	Cited by	Quartile
1.	European Resuscitation Council COVID-19 guidelines executive summary	(Nolan et al., 2020)	<i>Resuscitation</i>	255	Q1
2.	Impact of Public Health Interventions on Seasonal Influenza Activity during the COVID-19 Outbreak in Korea	(Lee et al., 2021)	<i>Clinical Infectious</i>	134	Q1
3.	Postnatal depression and its association with adverse infant health outcomes in low-and middle-income countries: A systematic review and meta-analysis	(Dadi et al., 2020)	<i>BMC Pregnancy and Childbirth</i>	113	Q1
4.	Reducing antibiotic prescribing in primary care for respiratory illness	(Kronman et al., 2020)	<i>Pediatrics</i>	83	Q1

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5.	Housing and child health in sub-Saharan Africa: A cross-sectional analysis	(Tustingi et al., 2020)	<i>Plos Medicine</i>	83	Q1
6.	Prevalence and determinants of fever, ARI and diarrhea among children aged 6–59 months in B	(Rahman & Hossain, 2022)	<i>BMC Pediatrics</i>	38	Q2
7.	Assessing Comorbidity of Diarrhea and Acute Respiratory Infections in Children Under 5 Years: Evidence From Kenya’s Demographic Health Survey 2014	(Mulatya & Mutuku, 2020)	<i>Journal of Primary Care and Community Health</i>	36	Q1
8.	Determinants of acute respiratory infection among under-five children in rural Ethiopia	(Merera, 2021)	<i>BMC Infectious</i>	35	Q1
9.	Factors associated with diarrhoea and acute respiratory infection in children under-5 years old in Ghana: an analysis of a national cross-sectional survey	(Apanga & Kumbeni, 2021)	<i>BMC Pediatrics</i>	34	Q2
10.	Epidemiology of respiratory viruses among children during the SARS-CoV-2 pandemic: A Systematic review and meta-analysis	(Dallmeyer et al., 2024)	<i>International Journal of Infectious</i>	25	Q1

Source: From Data Bases Scopus

Based on the bibliometric analysis of citation counts, highly influential publications in ARTI research are predominantly published in high-impact journals (Q1 and Q2) and address key issues related to child health and respiratory infections. Citation count serves as a primary indicator for assessing the influence of a publication in shaping research directions and advancements in ARTI studies.

The most highly cited article is the *European Resuscitation Council COVID-19 Guidelines Executive Summary* (Nolan et al., 2020), published in *Resuscitation*, with a total of 255 citations. The high citation count indicates that this clinical guideline has become a major global reference in managing respiratory conditions, particularly during the COVID-19 pandemic, including its implications for pediatric populations.

Another highly influential publication is the study by Lee et al. (2021) in *Clinical Infectious Diseases*, which examines the impact of public health interventions on the reduction

Another cluster highlights the interconnection between keywords such as *risk factors*, *malnutrition*, *environmental factors*, and *socioeconomic status*. This suggests that ARTI in children is also widely studied from the perspective of social and environmental determinants. The interlinked nature of these clusters demonstrates that ARTI research is inherently multidimensional, encompassing clinical, epidemiological, and public health perspectives.

Recent evidence further supports the importance of environmental determinants, particularly indoor air pollution, as a key factor influencing respiratory health outcomes in children (Springer, 2026). The following figure shows the evolution of research topics over time.

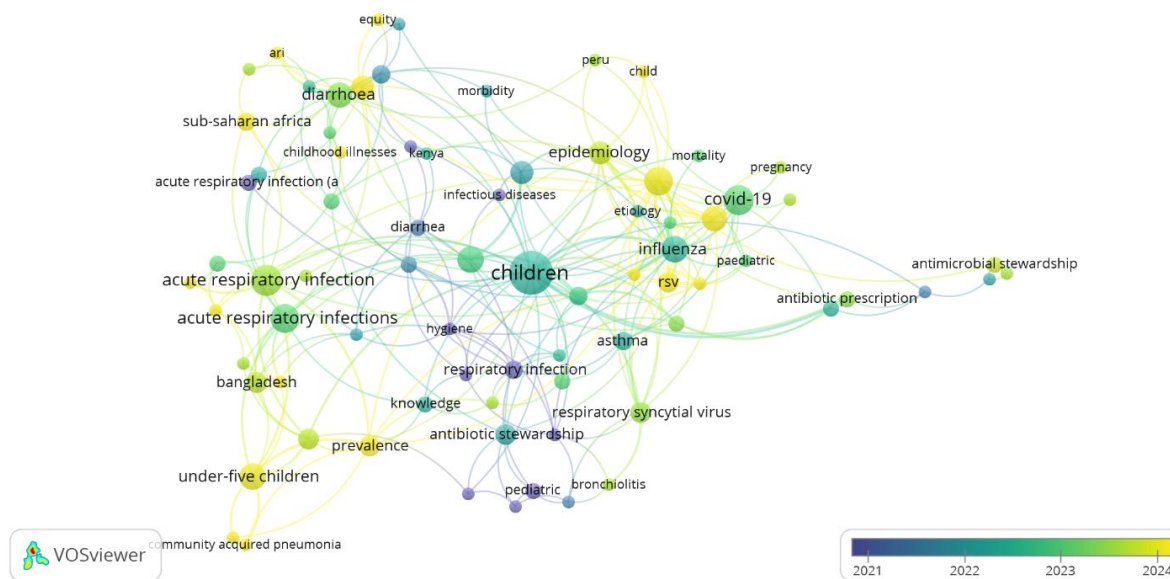


Figure 5. Overlay visualization

Source: Processed by Author Using VOSviewer

Figure 5 displays the overlay visualization generated from VOSviewer, showing the temporal progression of keywords in ARTI research in children. In this visualization, blue colors represent topics that were explored in earlier years, while yellow colors indicate more recently emerging research themes.

The overlay analysis demonstrates that earlier studies on ARTI in children primarily focused on topics such as *pneumonia*, *mortality*, and *child survival*. Over time, there has been a noticeable shift toward more preventive and promotive approaches, including *health education*, *prevention*, *antibiotic prescribing*, and *public health interventions*. This transition reflects an increasing emphasis on reducing disease burden through preventive strategies rather than solely focusing on clinical management.

Additionally, the emergence of keywords related to COVID-19 and respiratory viruses indicates that the global pandemic has significantly influenced the direction of ARTI research in children. This shift highlights an evolution in research paradigms, moving from a predominantly curative approach toward prevention-oriented strategies grounded in health education and community-based interventions.

Recent studies also emphasize the growing importance of integrating antibiotic stewardship programs and preventive strategies in response to evolving respiratory health challenges (Nature Medicine, 2026). The following figure presents the density of research topics.

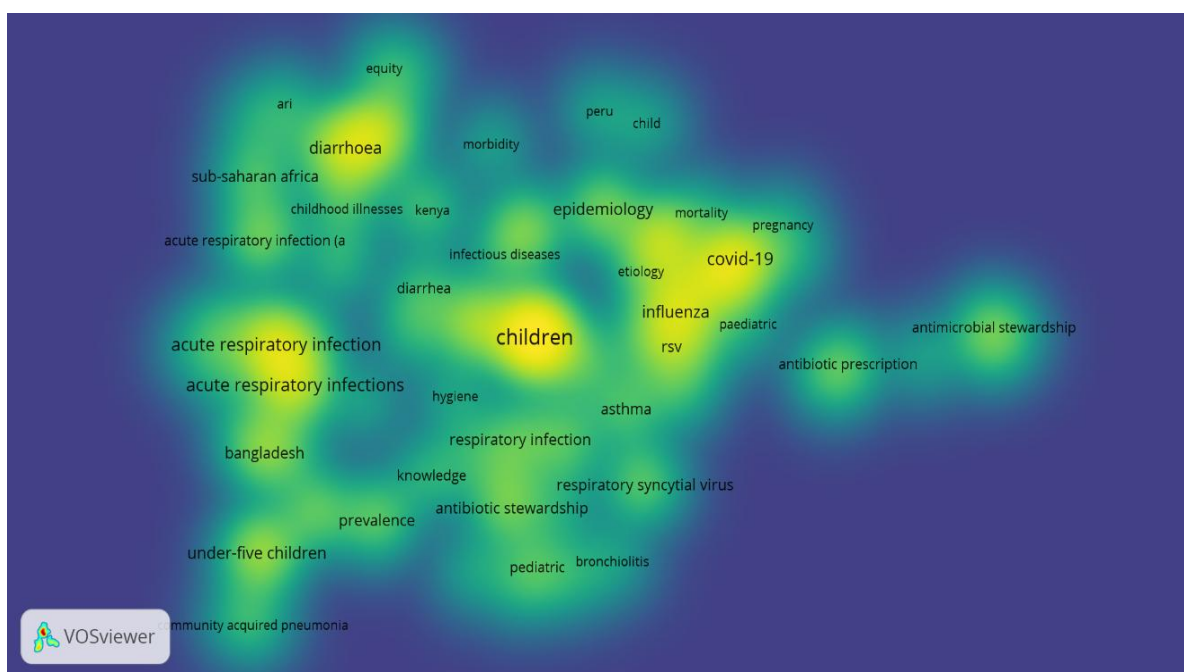


Figure 6. Density Visualization

Source: Processed by Author Using VOSviewer

Figure 6 illustrates the density visualization generated using VOSviewer, representing the concentration of research topics in ARTI studies in children. Areas highlighted in bright yellow indicate topics with high research intensity, while green to blue areas represent topics that have received comparatively less attention.

The visualization shows that topics such as *acute respiratory infection*, *children*, and *pneumonia* are located in high-density areas, indicating that these topics have been extensively studied and are relatively well-established within the literature. In contrast, topics such as *health education*, *parental knowledge*, and *preventive behavior* appear in lower-density areas, suggesting that they remain underexplored.

These findings indicate the presence of a research gap, particularly in studies focusing on health education, the role of parents, and preventive interventions in ARTI among children. This gap highlights significant opportunities for future research to develop and strengthen promotive and preventive approaches, especially those based on family and community engagement. Recent evidence supports the importance of strengthening community-based education and environmental interventions to reduce ARTI risk factors in children (Kesuma & Mailita, 2024).

The results of the bibliometric analysis indicate that research on Acute Respiratory Tract Infection (ARTI) education in children has shown a consistent increase over the period 2020–2025. This trend aligns with the growing global emphasis on promotive and preventive strategies in controlling infectious diseases among children (Lee et al., 2021). Similar patterns have been reported in previous studies highlighting the importance of integrated prevention approaches (Mulatya & Mutuku, 2020). At the local level, the urgency of ARTI education has become increasingly evident, as reflected in reports from Universitas Muhammadiyah Yogyakarta, which noted a significant increase in ARTI cases in early 2025 associated with air pollution and extreme weather changes (Pakar UMY, 2025).

Research contributions from Universitas Muhammadiyah Yogyakarta further strengthen the understanding of ARTI education in children. Yadi (2019) emphasized the role of antibiotic counseling in improving patient adherence, while Apri (2014) demonstrated the effectiveness of Integrated Management of Childhood Illness (IMCI)-based education packages for mothers of young children. Fakhurrozi (2017) highlighted the influence of indoor

air pollution on ARTI incidence. More recent innovations include the Motoga App (Pinasti et al., 2024), which enhances public knowledge of herbal medicine for respiratory conditions, and educational calendar media developed by Rahmasari et al. (2025), which has proven effective in improving children's health literacy. Overall, these contributions reflect a comprehensive approach encompassing curative, preventive, promotive, and digital innovation strategies, indicating that local research extends beyond clinical aspects to include environmental, behavioral, and technological factors.

The dominance of research from developing countries suggests that health education is considered an effective and relatively low-cost intervention for reducing ARTI incidence in children. Previous studies have demonstrated that improved parental knowledge is associated with a lower risk of respiratory infections among children (Merera, 2021). Furthermore, educational interventions targeting caregivers have been shown to promote better preventive behaviors (Apanga & Kumbeni, 2021). Recent community-based evidence also indicates that structured health education programs can significantly reduce environmental risk factors, such as household crowding and exposure to cigarette smoke, which are strongly associated with ARTI incidence (Kesuma & Mailita, 2024).

The emergence of topic clusters related to hygiene education, immunization, and community-based health promotion further underscores the central role of education in ARTI prevention. These findings are consistent with studies emphasizing the importance of education within primary healthcare services (Kronman et al., 2020). From a policy perspective, these results highlight the need to integrate structured health education programs into primary healthcare systems and school-based interventions. Improving parental health literacy and strengthening community-level prevention strategies may significantly reduce the burden of ARTI, particularly in low- and middle-income countries. In addition, environmental factors such as indoor air pollution remain a major contributor to poor respiratory health outcomes in children, reinforcing the need for integrated interventions that combine education with environmental risk control (Springer, 2026).

Innovative approaches that integrate health education with environmental technologies, such as indoor air filtration systems, have also been shown to effectively reduce respiratory infections in children (KidsAIR Trial, 2022). Moreover, strengthening antibiotic stewardship programs is essential to ensure appropriate antibiotic use and to prevent antimicrobial resistance in pediatric populations (Nature Medicine, 2026). At the policy level, strengthening prevention and management strategies for respiratory syncytial virus (RSV) is increasingly recognized as a critical priority in low- and middle-income countries (Frontiers in Pediatrics, 2022).

Despite these advancements, there remains a limited number of studies examining school-based educational interventions and the use of digital technologies in ARTI prevention among children. The limitations of this study include the use of a single database and language restrictions, which may affect the comprehensiveness of the findings. Therefore, future research is recommended to expand data sources and include a broader range of publication platforms to provide a more comprehensive understanding of ARTI education research.

D. CONCLUSION

This study demonstrates a consistent increase in scientific publications related to Acute Respiratory Tract Infection (ARTI) education in children during the period 2020–2025. The findings indicate that research topics are predominantly focused on pneumonia prevention, hygiene practices, parental education, and community-based health promotion. The bibliometric analysis highlights that health education plays a crucial role in reducing the burden of ARTI in children, particularly through improving parental knowledge and promoting

preventive behaviors. The study also identifies a shift in research trends from clinical and curative approaches toward more comprehensive preventive and promotive strategies.

Future research should emphasize the integration of health education, environmental risk control, and technology-based interventions to enhance the effectiveness of ARTI prevention strategies in children. In addition, strengthening antibiotic stewardship programs and policy-based interventions is essential to improve clinical outcomes and reduce the global burden of respiratory infections in pediatric populations.

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