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Bibliometric Analysis of Research Trends and Novelties for Pneumonia in Children

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Abstract

Pneumonia is the leading cause of death among children globally, with most cases occurring in low- and middle-income nations. Pneumonia in children has been thoroughly researched in numerous countries throughout the world. However, no research performed bibliometric analyses of pneumonia in children. This study aims to use a biometric analysis to determine trends in the number of publications, the number of citations, network visualization, overlay visualization, and density visualization concerning the issue of pneumonia in children. This research method employs a systematic review with stages adhering to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart. The highest publication increase occurred in 2020, with a rise of 2,739. The number of citations increases exponentially from year to year. The most cited article is "The Epidemiology and Pathogenesis of Coronavirus Disease (COVID-19) Outbreak," with 3,680 citations. Keywords and interest trends in pneumonia in children focus on viral pneumonia. The endeavor to perform a bibliometric analysis of pneumonia in children may be revisited in the next few years. Notably, this article only extracts data from scientific articles within the app.dimension.ai database. Further research may be conducted to add other databases and ensure a more comprehensive understanding of pneumonia in children.

Keywords: bibliometric analysis, children, novelty, pneumonia, risk factor, trend

Abstrak

Analisis Bibliometrik Tren dan Kebaharuan Penelitian terkait Pneumonia pada Anak. *Pneumonia adalah penyebab utama kematian di antara anak-anak di seluruh dunia, dengan sebagian besar kasus terjadi di negara-negara berpenghasilan rendah dan menengah. Pneumonia pada anak telah diteliti secara menyeluruh di berbagai negara di seluruh dunia. Namun, belum ada penelitian yang melakukan analisis bibliometrik terhadap pneumonia pada anak-anak. Penelitian ini menggunakan analisis bibliometrik untuk menentukan tren jumlah publikasi, jumlah kutipan, visualisasi jaringan,* overlay visualization*, dan visualisasi densitas terkait masalah pneumonia pada anak. Metode penelitian ini menggunakan tinjauan sistematis dengan tahapan yang mengikuti* Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart. *Peningkatan publikasi tertinggi terjadi pada tahun 2020, dengan peningkatan sebesar 2.739. Jumlah kutipan meningkat secara eksponensial dari tahun ke tahun. Artikel yang paling banyak dikutip adalah "Epidemiologi dan Patogenesis Wabah* Coronavirus Disease (COVID-19)*," dengan 3.680 kutipan. Kata kunci dan tren minat pada pneumonia pada anak berfokus pada pneumonia virus. Upaya untuk melakukan analisis bibliometrik pneumonia pada anak mungkin akan ditinjau kembali dalam beberapa tahun ke depan. Sebagai catatan, artikel ini hanya mengekstrak data dari artikel ilmiah dalam database app.dimension.ai. Penelitian lebih lanjut dapat dilakukan untuk menambahkan database lain dan memastikan pemahaman yang lebih komprehensif tentang pneumonia pada anak-anak.*

Kata Kunci: *anak-anak, analisis bibliometrik, faktor risiko, kebaharuan, pneumonia, tren*

Introduction

Pneumonia is the leading cause of death among children around the world. The incidence of clinical pneumonia in children under five is about 152 million, mostly occurring in low- and middle-income countries (Nasrin et al., 2022). Pneumonia is a common acute respiratory infection that attacks the alveoli and distal airways (Torres et al., 2021). The leading bacterial cause of pneumonia in children is Streptococcus pneumonia; the leading viral cause is

syncytial virus; lastly, the main fungal cause is Pneumocystis for children born with human immunodeficiency virus (HIV) (Adawe et al., 2023). Pneumonia is the most prevalent cause of child mortality, accounting for around 6.0% of the 5.9 million deaths in the under-five age group in 2015, killing approximately 900,000 children. Pneumonia claims more than 2,500 children's lives every day, or more than 100 every hour (Keleb et al., 2020).

Lack of exclusive breastfeeding during the first six months after birth, start time of giving exclusive breastfeeding and variation of improper composition of complementary foods, anemia, malnutrition, child age, sex, birth order, low birth weight, prematurity, low educational attainment by the mother, low socioeconomic status, and indoor pollution due to cigarette smoking are all significant risk factors for pneumonia in children (Adawe et al., 2023; Yadav & Awasthi, 2023). Malnutrition is a key risk factor for poor pneumonia outcomes and early mortality (King et al., 2022; Liapman et al., 2023). Individuals and communities must know the risk factors contributing to treatment failure and death to prevent, diagnose, and treat pediatric pneumonia (Mvalo et al., 2022). In terms of prevention, it helps health practitioners and community leaders identify and intervene with individuals and communities at risk of adverse consequences (e.g., malnutrition). Risk stratification is crucial in the diagnosis and therapy because it allows patients to be prioritized for appropriate treatment (e.g., who needs hospitalization and home care) and encourages the most efficient use of available resources (Wilkes et al., 2023). Many children hospitalized with pneumonia develop hypoxemia, and one in 10 children die. Young age and malnutrition are among the risk factors associated with pneumonia that necessitate hospital treatment (Hooli et al., 2023). Delays in seeking health care are also among the factors that contribute to pneumonia-related deaths (Temsesgen et al., 2023). B.K. et al. (2022) conducted a study on the prevalence of pneumonia in hospitalized children. Pneumonia is most commonly found in vulnerable age groups, namely children aged 2–59 months, with a higher prevalence in children aged 2–11 months and in men (B.K. et al., 2022).

Over time, interest in pneumonia among children worldwide has increased. As discussed by Fauzy et al. (2022) and Moral-muñoz et al. (2020), relevant data can be uncovered through Google Trends (https://trends.google.com/) by typing the following keywords: "pneumonia in

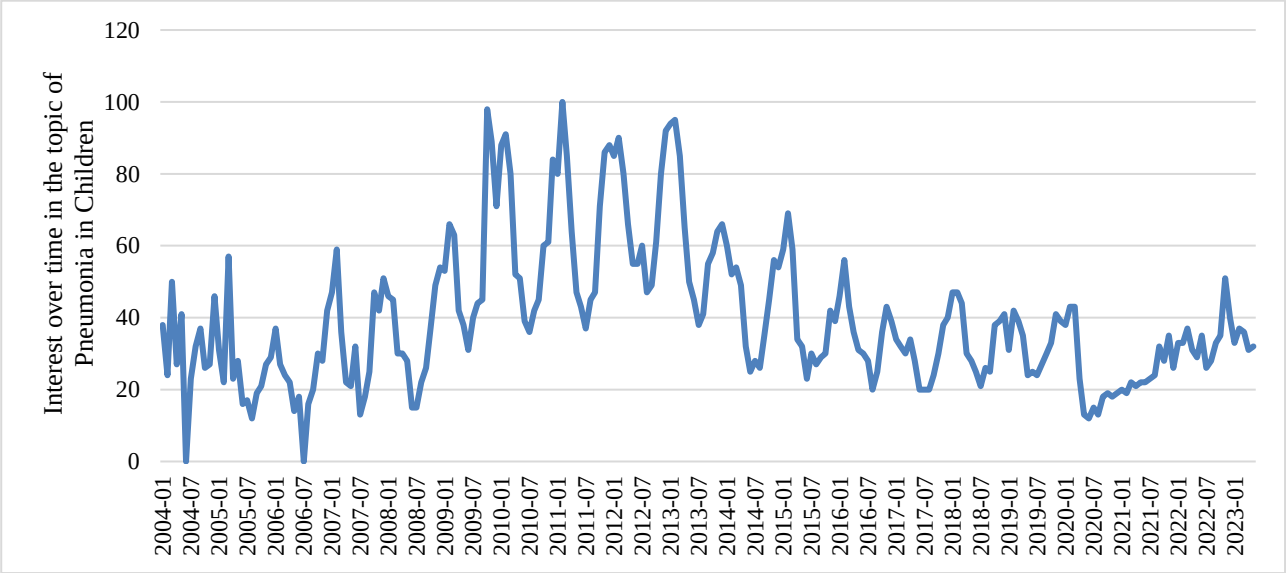

Figure 1. Interest Over Time in the Topic of Pneumonia in Children

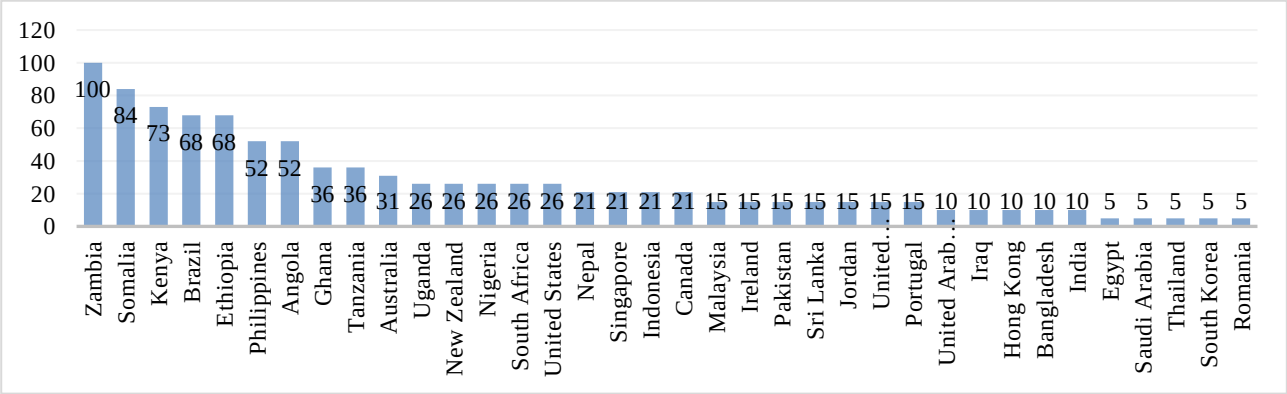

Figure 2. Diagram of Interest by Country in the Topic of Pneumonia in Children

children." For example, a search of data from January 2004 to December 2022 that involved selecting "web search" and "all categories" yielded the data presented in Figure 1. This data was collected on May 29, 2023. Interest in pneumonia in children can also be reviewed by country, as illustrated in Figure 2. Zambia has the highest interest in pneumonia in children, followed by Timor Leste.

The data illustrates general interest in the topic of pneumonia in children. Researchers who wish to investigate the topic of pneumonia in children require more detailed information, such as scholarly publications in the form of scientific journals. Researchers in this study require information concerning future trends and novelty concerning pediatric pneumonia. However, no publications have performed a bibliometric analysis of pneumonia in children to identify trends. This research was conducted to uncover answers to the following questions: 1) What trends can be identified in publications regarding pneumonia in children?; 2) What is the trend in the number of citations related to pneumonia in children?; 3) How is network visualization related to pneumonia in children?; 4) How is overlay visualization on pneumonia in children?; 5) What is density visualization on pneumonia in children?

Analyses of distribution literature genres, source journals, citations, co-authorship network analyses, and text mining can assist academics in better understanding relevant fields through bibliometric research (Zhang et al., 2021). Jackson et al. (2013) conducted studies regarding various risk factors for pneumonia in children. Still, there has been no review of bibliometric analyses of published literature assessing risk factors and pneumonia in children. A bibliometric analysis is a statistical research approach that visualizes academic institutions' contributions and changes in research hotspots (Fu et al., 2023). Bibliometric analysis, using visualization tools, assists researchers in identifying new regions and future directions concerning the study topic (Lam et al., 2022).

Methods

Bibliometric analysis is more suitable for quantitatively analyzing the distribution of research papers, terms, and keywords when determining research trends (Murugesu et al., 2022). In addition, it is a research method used in library and information science to evaluate research performance (Syros et al., 2022). Bibliometric analysis is essential in assessing the impact of research wherein studies are ranked based on citations received (Pahwa et al., 2022).

The data at the center of the bibliometric analysis is typically expansive (hundreds, if not thousands) and objective in nature (e.g., number of citations and publications, occurrences of key-

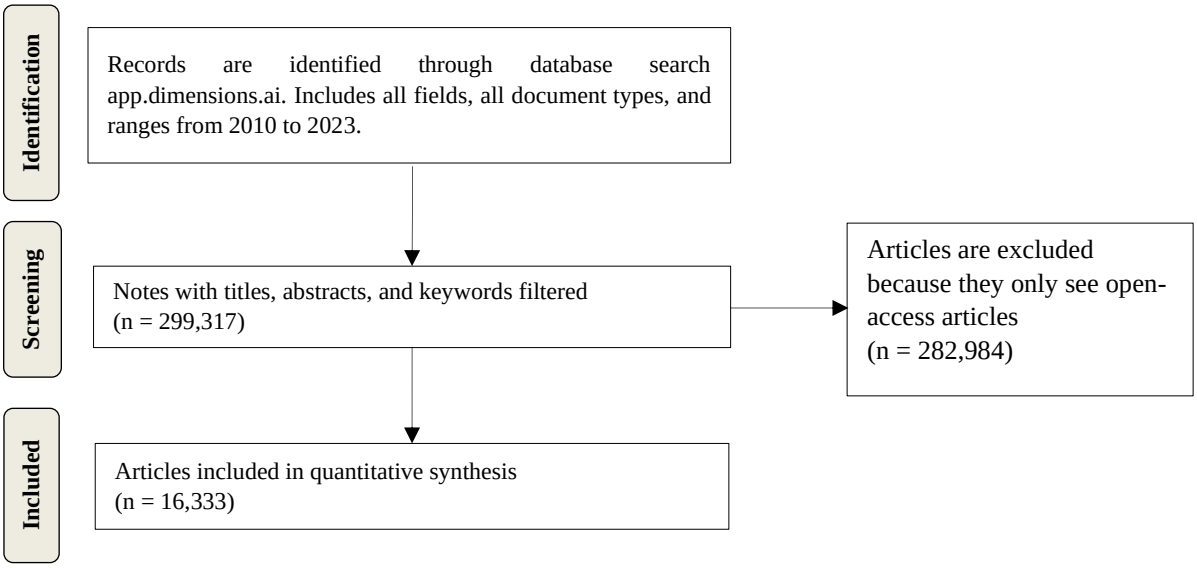

Figure 3. PRISMA Flowchart

words and topics), but its interpretations frequently rely on both objective (e.g., performance analysis) and subjective (e.g., thematic analysis) evaluations established through informed techniques and procedures (Donthu et al., 2021). However, other research approaches are also included so that the reader can get a primary picture and understand the basics of the leader on several factors. Notably, the researcher believed that the number of articles denotes production, whereas the total number of citations reflects the effect of the analysis (Sikandar & Kohar, 2022).

The data used in the study was based on online searches using https://app.dimensions.ai/. This database provides various scientific literature resources, such as journal articles, books, and conference records. Dimensions spans many fields and is well-known for its robust data analysis and visualization capabilities. This database intends to provide a comprehensive and integrated resource for academics in numerous areas. Data was retrieved on May 29, 2023.

The study approach is a literature review (Nursalam et al., 2020) with steps that follow the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow chart (Page et al., 2021). The stages in PRISMA include identification, screening, and inclusion, as shown in Figure 3. Phase 1, identification, detected 299,317 records from dimensions.ai, accounting for each significant search term, including "pneumonia in children," "article document type and proceedings," and "all published data in the data range from 2010 to 2023". In phase 2, screening, the option "article title, abstract" was selected for each search term, so 282,984 notes were issued. In phase 3, inclusion, the final sample produced 16,333 articles, both open and non-open access.

The data was analyzed using VOSviewer version 1.6.18. VOSviewer is a computer program for creating and viewing bibliometric maps (Westby, 2021). Similarity Matrix was used to apply the visualization of similarities (VOS) mapping approach to produce a map reflecting the similarity measure between items, and translation, rotation, and reflection were used to rectify the optimization problem outlined in the literature. Regarding visualization capabilities, this software offers three options: overlay, network, and density (Moral-muñoz et al., 2020).

In this study, the analysis was reviewed based on co-occurrence and co-author. The following

is the process for analyzing co-occurrence. The data source that was chosen reads data from the references within the manager files. The title and abstract fields have been selected as the fields from which terms will be retrieved. Complete counting was used as the counting method. The threshold specified for the minimum number of term occurrences is ten. The number of phrases selected is 291.

Results

Analysis of the Number of Article Publications. Searches from 2010 to 2023 yielded 16,333 scientific article publications. The number of publications on pneumonia in children per year from 2010 to 2023 is presented in Figure 4. The highest increase occurred in 2020, with a rise of 2,739 publications. The lowest increase occurred in 2023, with an increase of 564.

Citation Analysis. The number of citations regarding pneumonia in children per year from 2010 to 2023 is presented in Figure 5. The highest increase occurred in 2021, with an increase of 86,719. The lowest increase occurred in 2010, with an increase of 474.

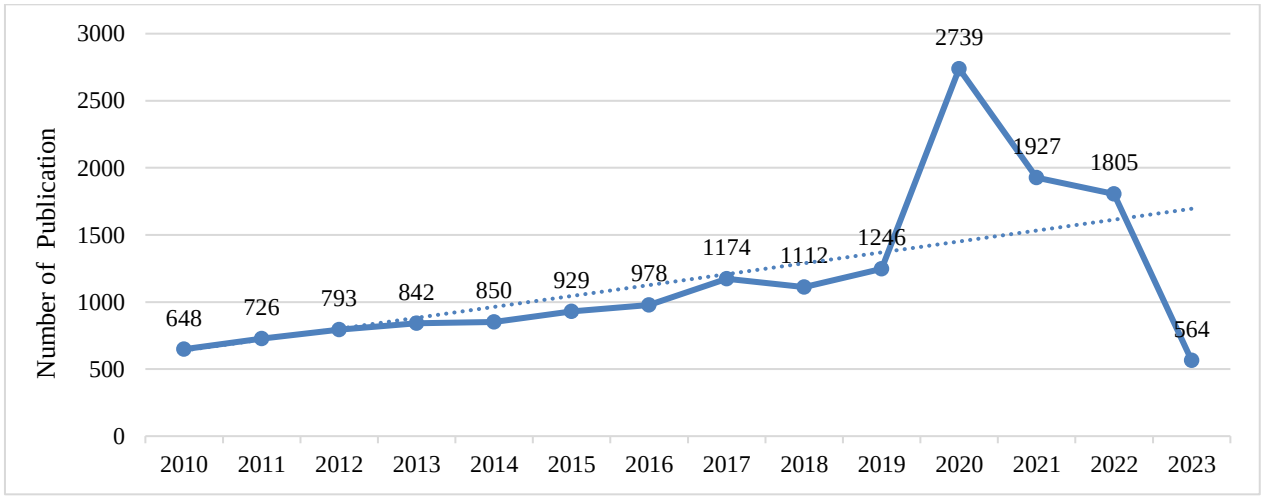

Figure 4. Number of Publications on Pneumonia in Children from 2010 to 2023

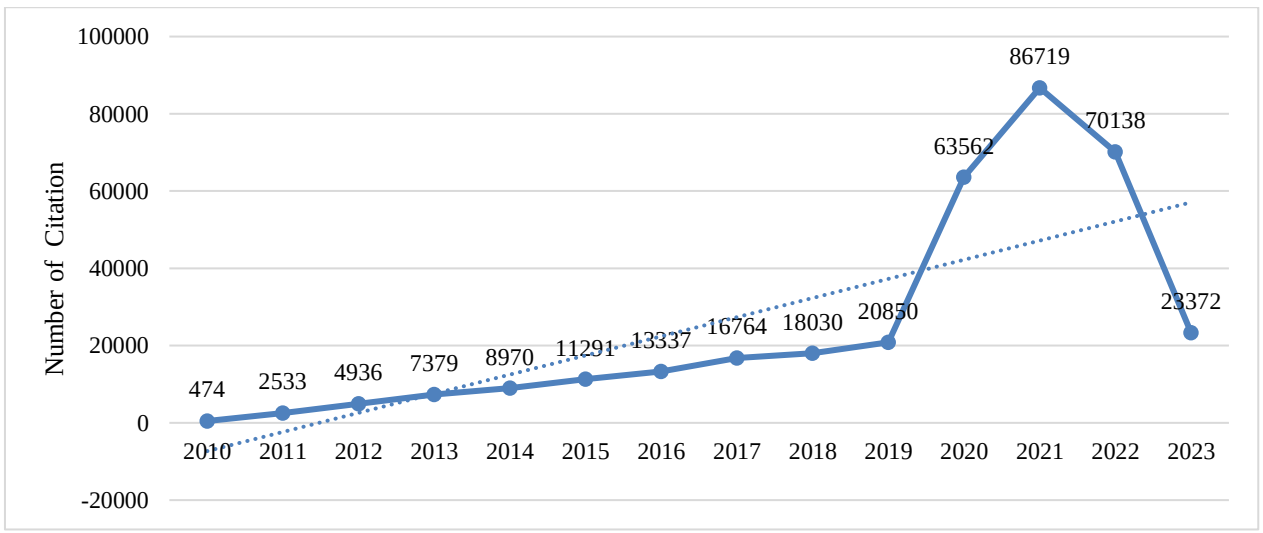

Figure 5. Number of Citations for the Topic of Pneumonia in Children from 2010 to 2023

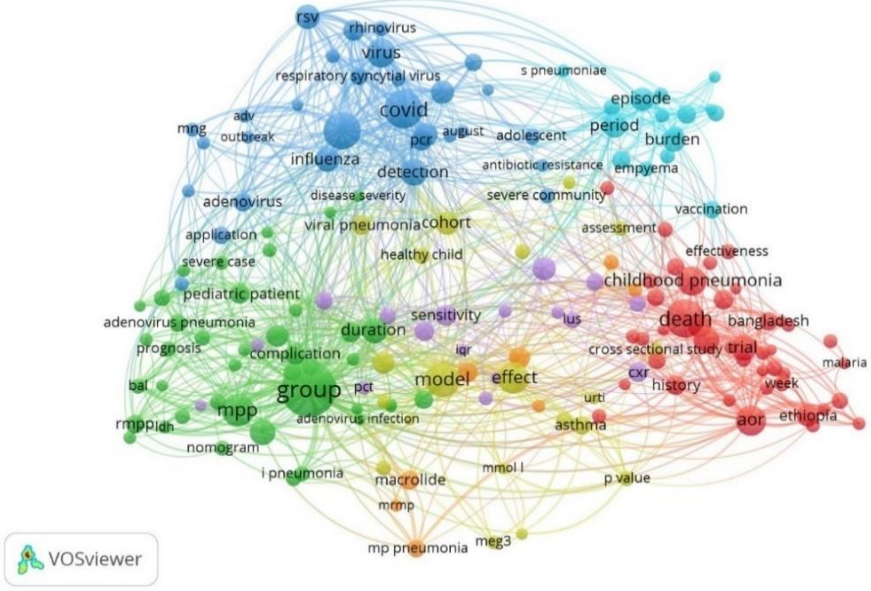

Figure 6. Network Visualization

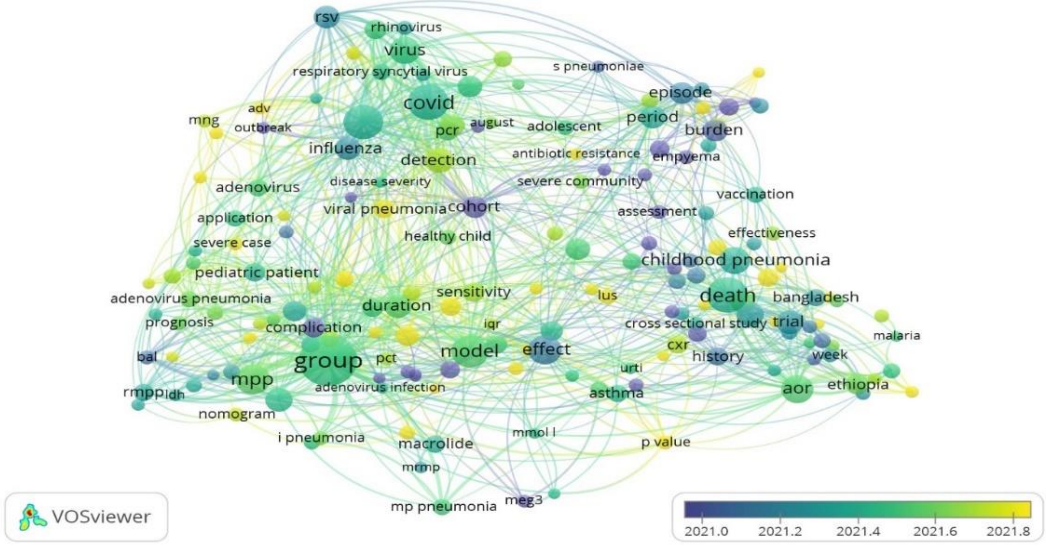

Figure 7. Overlay Visualization

Network Analytics. The selection of the number of terms was 291. The network visualization of these 291 terms is presented in Figure 6. Two items connected by a line indicate they appear together in a title and abstract. Conversely, two items not connected by a line indicate that they do not appear together in the title and abstract. Figure 6 shows 175 items, 7 clusters, 483 links, and a link strength 33,216.

Overlay Analysis. The VOS viewer also provides overlay visualization maps. The overlay visualization of these 291 terms is presented in Figure 7. Overlay visualization offers an analysis based on "pneumonia in children" from 2010 to 2023 to observe trends in research titles related to pneumonia in children. The yellow node on the map overlay representation in Figure 7 indicates that the keyword is of current research

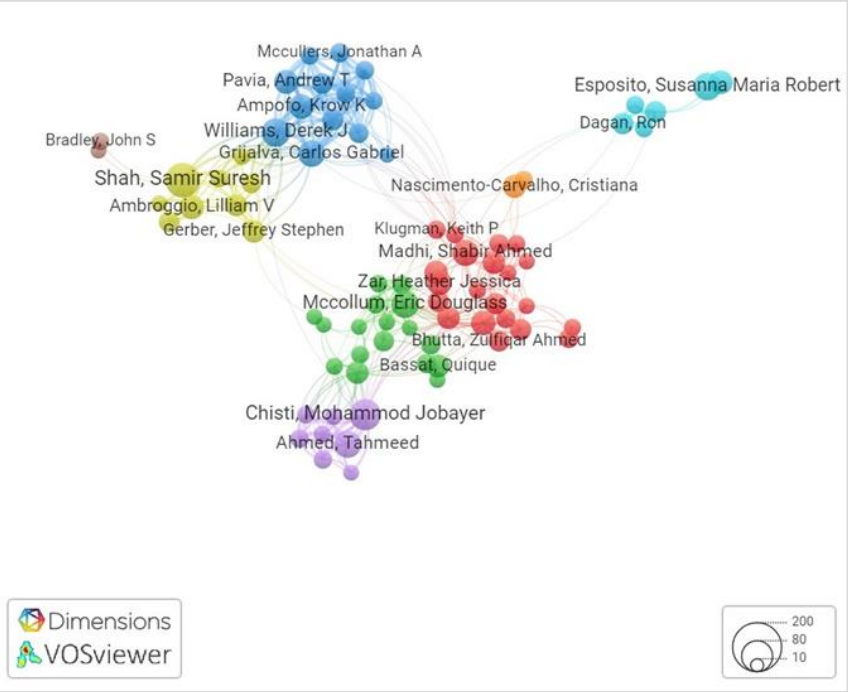

Figure 8. Density Visualization

interest. For example, current research trends in childhood pneumonia are centered on viral pneumonia.

Density Visualization Analysis. The density visualization of these 291 terms is presented in Figure 8. Figure 8 provides a density visualization, with many items widely contained in several items, including COVID-19. Some items with yellow knots mean that they have been widely discussed in previous journal publications. Thus, the recommended research topics related to pneumonia in children are topics that have density visualization in the low category, such as viral pneumonia.

Network Visualization Analysis for Co-Authors. Network visualization for co-authors is presented in Figure 9. Based on co-authorship data, Figure 9 depicts a collaboration map among lead authors. During the investigated period (2010-2023), the writers driving this theme are associated with the visualization network group, indicating a specific dispersion in author affiliations based on co-authorship approaches. There are 78 researchers, 388 link co-authorships, 3,853 total co-authorships, and 7 clusters in network visualization.

A bibliometric analysis has been applied to examine the topic of pneumonia in children. The study shows that from 2010 to 2023, the lowest number of publications about pneumonia in children was in 2023, with 564 publications, and the highest number of publications about pneumonia in children was in 2020, with 2,739 publications, indicating an average of 1,167 (Figure 10). Meanwhile, the lowest increase in the number of citations concerning pneumonia in children occurred in 2010, with 474 citations, and the most significant number of citations occurred in 2021, with 86,719 and an average of 24,882.5 (Figure 11). The number of publications and citations has increased exponentially year by year.

There are 175 items, 7 clusters, 483 links, and a link strength 33,216. Cluster 1 (42 items), cluster 2 (42 items), cluster 3 (30 items), cluster 4 (20 items), cluster 5 (27 items), cluster 6 (16 items), cluster 7 (8 items). In more detail, these clusters are presented in Table 1.

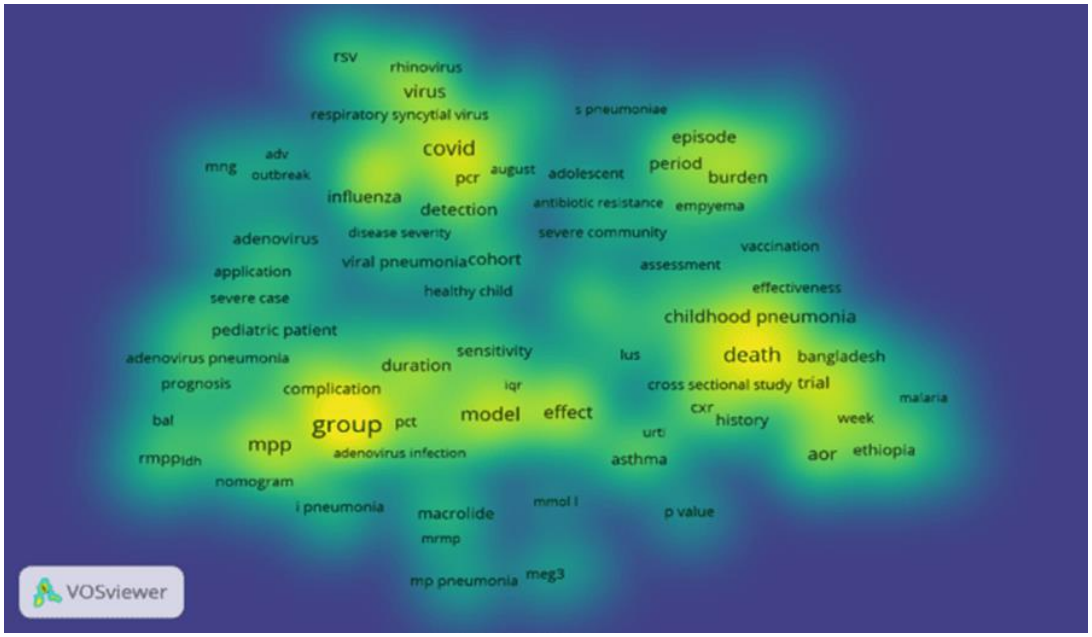

Figure 9. Network Visualization for Co-Authors

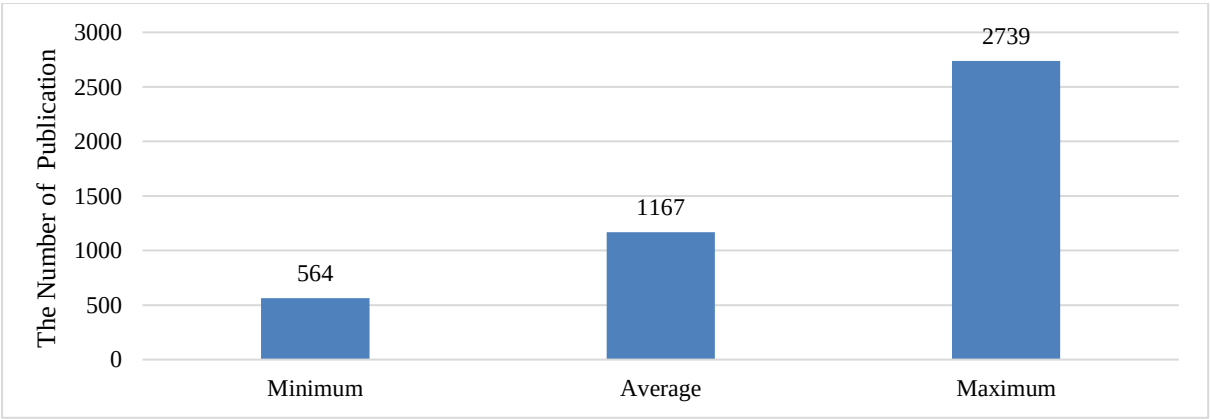

Figure 10. Histogram of the Smallest, Average, and Highest Increase in the Number of Publications on the Topic of Pneumonia in Children (2010-2023)

Discussion

The number of articles about pneumonia in children reached 1,167 in 2020, with an average of 1,167 (Figure 10). The number of publications increased significantly each year due to the COVID-19 pandemic in 2020. Amid the COVID-19 outbreak, the number of youths suffering from severe and critical illnesses was low. However, younger children and children with comorbidities should be treated with caution.

According to Chaiyakulsil et al. (2022), children under the age of one year, as well as children with comorbidities, had a higher risk of pneumonia (adjusted odds ratio 2.99; 95% confidence interval [CI]: 1.56-5.74 and 2.32; 95% CI: 1.15-4.67), respectively. In children with COVID-19, younger age, increased High Sensitivity C-Reactive Protein (hs-CRP), and pneumonia are independent risk factors for symptomatic infection (Lu et al., 2020). Since 2012, the World Health Organization (WHO) has recommended that pneumococcal conjugate vac-

cines (PCV) be included in pediatric immunization programs worldwide to prevent streptococcus pneumoniae infection. Currently, three PCVs are approved for use: 7-valent PCV (PCV7), conjugate protein D conjugate vaccination Haemophilus influenzae protein D (PHiD) pneumococcal 10-valent-CV, and 13-valent PCV (PCV 13) (Bhavsar et al., 2022).

Meanwhile, the increase in the number of citations of pneumonia in minor children occurred in 2010 and was the highest in 2021, with an average of 24,882.5 (Figure 11). The number of citations has also increased exponentially from year to year. The most cited article was entitled "The Epidemiology and Pathogenesis of COVID-19 Outbreak" (Rothan & Byrareddy, 2020), followed by an article entitled "Epidemiology of COVID-19 Among Children in China" (Dong et al., 2020), with 3,161 citations. It is commonly cited because this article comprehensively highlights the symptoms of COVID-19, epidemiology, transmission, pathogenesis, phylogenetic analysis, and future recommend-dations to control the spread of this deadly COVID-19 disease (Rothan & Byrareddy, 2020).

In low- and middle-income countries, paramedic health workers play a significant role in detecting and treating pneumonia in children. Inward

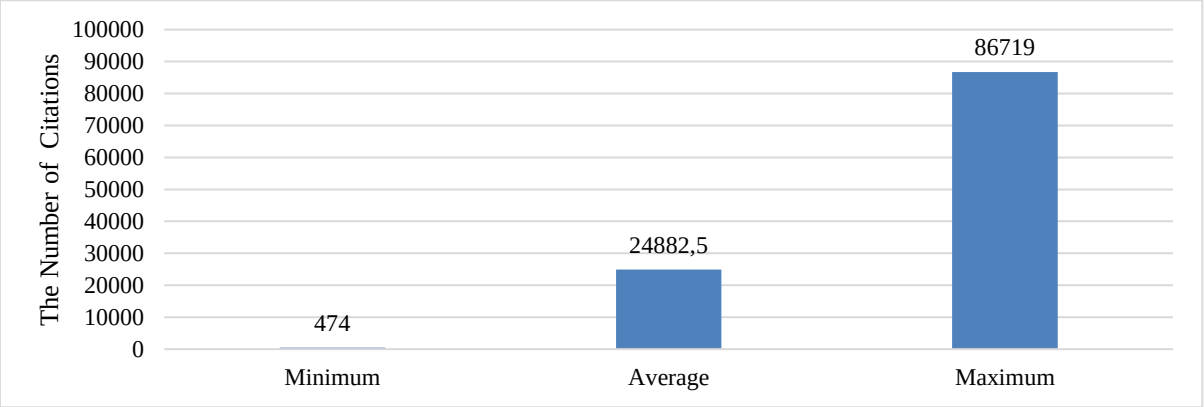

Figure 11. Histogram of the Smallest, Average, and Highest Increase in the Number of Citations for the Topic of Pneumonia in Children (2010-2023)

Table 1. Clusters for the Topic Pneumonia in Children

Cluster	The Number of Items	Cluster Member Items
1	42	Ten items include **anemia, childhood pneumonia**, comorbidity, health, meta-analysis, a **middle-income country**, sepsis, **pulse oximeter**, prevention, and hypoxemia.
2	42	Five items include HAdV pneumonia, **pneumonia, independent risk factor,** pediatric patient, refractory mycoplasma pneumoniae pneumonia (RMPP)
3	30	Five items include **COVID-19, influenza, pediatric population, streptococcus pneumonia**, and virus.
4	20	Five items include **clinical symptoms, healthy child, viral pneumonia,** inflammation, and subject.
5	27	Five items include **bacterial pneumonia**, clinician, oxygen saturation, pct, and sensitivity.
6	16	Five items include **cause pneumonia**, empyema, **invasive pneumococcal, s pneumoniae,** and vaccination.
7	8	Five items include **efficacy, M.P. pneumonia, mycoplasma pneumoniae**, MRMP, and hospital admission.

chest withdrawal is a critical diagnostic for pneumonia diagnosis, as it indicates the severity of the disease (Khan et al., 2023). Pneumonia is the leading killer of toddlers compared to other diseases known to affect children. Pneumonia in children causes substantial mortality and morbidity among children under five, with developing countries carrying the highest burden of pneumonia (Seramo et al., 2022). Exclusive breastfeeding, increased vitamin A supplementation, early control of respiratory infections through effective hygiene promotion, ventilation strategies in healthy homes, and the promotion of methods to reduce indoor air pollution through affordable clean stoves will all be relevant interventions to reduce pneumonia in toddlers (Yadate et al., 2023).

Due to the research limitations, the database app.dimensional.ai is experiencing periodic updates with new publications. As a result, the bibliometric analysis of pneumonia in children can be performed at various points during the year. This study focuses solely on analyzing data from app.dimension.ai articles. More research must be conducted to use a database to acquire more detailed information on pneumonia in children. Bibliometric analysis will uncover trends and novelties in childhood pneumonia research. This analysis will help researchers focus their research on understudied or critical topics.

Even though it has contributed to providing insight into the growth of pneumonia in children publications from 2010 to 2023 via app.dimension.ai, new publications are added to the app.dimension.ai database regularly. Further research should add other databases for a more comprehensive understanding of pneumonia in children.

Conclusion

The study used app.dimension.ai to conduct a bibliometric analysis of pneumonia in children's publications from 2010 to 2023. This study examines pneumonia in children and global research trends during the last 13 years (2010–2023). The most remarkable publication rise happened in 2020, with a 2,739-publication increase. Citations increased the most in 2021, with an increase of 86,719. With 3,680 citations, the article 'The epidemiology and pathogenesis of COVID-19 epidemic' is the most cited.

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