A surveillance analysis of case findings in the prevention and control of pneumonia in children under five years old: a literature review

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Abstract

Background. Pneumonia is one of the leading causes of death in children under 5 years of age. Although overall deaths from pneumonia have decreased substantially by 56%, since 1990 pneumonia contributes to about 740,000 deaths, per year. In Indonesia, in 2021, 444 children under five (CFR 0.16%) died due to pneumonia, in 2020, 498 children under five (CFR 0.16%), and in 2019, 551 children under five (CFR 0.12%). Increasing the scope of finding pneumonia in children under five is one of the efforts done in Indonesia to control pneumonia. The Influenza Like Illness and Severity Acute Respiratory System (ILI-SARI) surveillance is sentinel surveillance that is used to catch cases of pneumonia under five in outpatient and inpatient health facilities.

Objective. This literature review aims to describe the implementation of ILI-SARI surveillance increasing the detection of pneumonia in children under five.

Methods. The method used is to search the database through Google Scholar, Pubmed, and Research Gate. The key words used in this database search were ILI-SARI surveillance, Pneumonia under five.

Results. There are 8 articles obtained and 5 articles analyzed through the suitability of the topic, objectives, methods used, sample size, and results from each article.

Conclusion. Care-seeking activities are suggested to be an integral part of this method of preventing and controlling under-five pneumonia.

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Introduction

Pneumonia is one of the main causes of death in children under 5 years of age. Since 1990 pneumonia deaths have decreased substantially by 56%. As a result, a global shift in epidemiology has occurred, with 47% of deaths under 5 years now occurring during the neonatal period (first 28 days of life), while the majority of the remaining childhood deaths occur in those aged 1, 11 months being the most susceptible. Despite the overall decline, pneumonia is among the leading causes of death under 5 years of age,[1] contributing to around 740,000 deaths per year according to the World Health Organization (WHO). Even though there has been success in reducing child mortality due to pneumonia, indicators of coverage of seeking care and treatment are 2 things that still need attention; implementation is still limited to pilot projects, so to reduce inequality in access and coverage of services, a primary health care system is needed. Strong primary health care (PHC) that integrates primary interventions and addresses key determinants is important so that the causes of child death can be prevented. The sustainable development goal (SDG) calls for each country to have no more than 25 child deaths per 1000 live births.[1] Increasing the scope of pneumonia detection in toddlers is one of the efforts done in Indonesia to control pneumonia. A significant decrease has been seen in the scope of findings in the last 5 years: this is due to the impact of the Corona Disease 2019 (COVID-19) pandemic.[2] Stigma in people with COVID-19, which has affected the decrease in the number of visits by toddlers who have coughs or difficulty breathing at the community health centers.[2]

In Indonesia, in 2021, the strategic planning target for finding pneumonia under five is 65%, the prevalence of pneumonia in Indonesia is 3.55%, and up to 886.030 people under the age of five are thought to have had pneumonia, while the case fatality rate (CFR) for the deaths of 444 toddlers was 0.16%.[2]

The causative agents of pneumonia vary and the most common is *streptococcus pneumoniae* (pneumococcus), with risk factors for environmental hygiene, density between people, and individual immune status that can cause pneumonia.[3]

To increase the detection of pneumonia under five, the approach taken in overcoming public health problems is to carry out public health surveillance. Public health surveillance can be defined as routine efforts in data collection, analysis, and dissemination.[3]

The type of surveillance for pneumonia detection is the

Influenza Like Illness and Severity Acute Respiratory System (ILI-SARI) surveillance. The meaning of ILI-SARI surveillance is sentinel surveillance in health facilities with the difference that ILI sentinel surveillance monitors people who used the program seeking care in outpatient health facilities whereas SARI sentinel surveillance monitors people with more severe illnesses who have been treated in the hospital for treatment.[4]

Materials and Methods

This literature review uses a comprehensive strategy by searching articles in research journal databases, using the internet, and reviewing articles. Database research via Google Scholar, Pubmed, and Research Gate was carried out. The key words used in the article search were surveillance systems, ILI-SARI surveillance, and detection of pneumonia under five. There were 5 articles obtained for analysis of the suitability of the topics, objectives, methods used, sample size, and results in each article.

Results

The five selected articles have appropriate topics, namely surveillance related to influenza and pneumonia. Then in the objective analysis, there is one article that aims to explain surveillance based on laboratory results, two articles analyze the comparison of the 2 surveillance methods used, and two articles that aim to evaluate the attributes of the surveillance system.

The analysis of the method used can be explained as follows: of the five articles, 2 articles used an observational analytic study, 1 article used a qualitative study and 1 article used an evaluation study and 1 article used a descriptive cross-sectional study.

The sample sizes in these five articles used two types of data, namely data from reports collected during the research period and data from interviews with officers interested in surveillance at each research location. The sample size or the size of the sample data obtained during the study from 3 articles, sample data of more than 3000, one article using the proportion of each state, and one article using data derived from literature review, while for interviewing officers according to the structure of each officer surveillance with more than 5 people.

The results of the analysis of the five articles are as follows. The first article focuses on surveillance based on laboratory evidence for the detection of 3 types of disease-causing pathogens associated with seasonal changes that occurred throughout 2018 in South Africa, and differences in disease-causing pathogens that occur in different seasons. As different warnings for early detection, and public health action. The second article focuses on a comparison of surveillance methods used between the two countries in carrying out early detection or warning of danger as early as possible. The surveillance approach focused on infectious diseases in the Netherlands and surveillance on all hazards, including chemical incidents in China.

The third article focuses on evaluating the attributes of the surveillance system, which has never been done. So an evaluation needs to be carried out to assess the fulfillment of the system's objectives. Found that there is no hazard warning due, to an analysis that was not carried out, it is necessary to include a laboratory result component to improve data quality. The fourth article focuses on the comparison of the two methods of timeliness of data collection and the amount of data collected based on the method reported according to government structure (ILINet) and the method based on reports from the community (SS), there is no difference in the implementation of these two methods, further analysis is needed to assess surveillance capabilities using SS data. In the fifth article, evaluating the attributes of the surveillance system based on the reporting flow and the completeness of the reporting format carried out by each sentinel, it was found that the filling in the format was not carried out properly, analysis was only carried out by one PHEM institution and there was no feedback so it was suggested to carry out surveillance continuously using a checklist.

Discussion

Based on the results of the analysis of the suitability of the topics, objectives, methods used, sample size, and the results of each article and the limitations that occur, it can be explained that the entire literature or articles analyzed describe the benefits of carrying out complete surveillance according to procedures, which will produce important information that will give a warning early occurrence of events related to toddler pneumonia which can cause morbidity and death. WHO (2014) states that early warning signals are data or information consisting of case or death reports (individual or aggregate), potential human exposure to biological, chemical or radiological, and nuclear hazards, or the occurrence of natural or man-made disasters, that represent potential risks acute to human health.[5] Maureen Baker *et al*. in their research wrote that initial case reports submitted by telephone have the potential of detecting symptoms in the community that are associated with the deliberate release of chemical, or biological substances, or disease outbreaks.[6] For this surveillance to act as an early warning of illness due to microbiological or chemical causes, it needs to be fully integrated into an appropriate public health response (which may require diagnostic samples to be taken from callers).

The Integrated Global Action Plan for Prevention and Control of Pneumonia and Diarrhoea (GAPPD) between WHO and UNICEF in 2013,[7] stated a commitment to stop deaths due to pneumonia and diarrhea at a young age. This was followed by the WHO meeting report which produced one of the objectives of implementing aligned and coordinated support to protect, prevent and treat through multi-sectoral collaboration, and build knowledge of other groups.[1]

According to WHO,[8] ILI-SARI surveillance is used to carry out a systematic approach that aims to catch cases of pneumonia under five, ILI surveillance in outpatient cases, and SARI surveillance in inpatients with severe cases such as asthma, TB, and others. Sentinel surveillance is the systematic and routine collection of data from a limited number of sources in selected public health facilities so that the information collected can be applied to the population as a whole. The success of the system also depends on the resources available in each place or area. This is in line with research by Nia Lisnawati *et al*. which concluded that the implementation of maternal counseling, follow-up of toddler pneumonia, recording and reporting, evaluation, and outreach to the community about under-five pneumonia and its dangers if not treated immediately is not optimal.[9] Regulation of the Minister of Health of the Republic of Indonesia Number 45 of 2014,[10] concerning the Implementation of Health Surveillance article 4 point 2.O states that one type of activity that is being monitored is pneumonia surveillance, including severe acute respiratory infection. One of the efforts made to control pneumonia in the Indonesian Health Profile is to increase the detection of pneumonia in toddlers. The five articles analyzed convey the types and surveillance activities carried out as a signal for early detection of outbreaks/outbreaks associated with diseases or events that endanger human health.[5] The implementation of surveillance activities in health facilities, as stated in

the 2014 RI Minister of Health Regulations,[10] is carried out by each Program Manager or health information system management unit owned. The implementation of a surveillance system with an approach to the attributes of the surveillance system in articles two and five in its evaluation found the problem that a surveillance system that does not meet the completeness of the attributes cannot provide an outbreak/outbreak warning signal, also a system that is not continuously evaluated cannot provide important information that is useful for public health. The regulation also does not state that there is a role for the community in pneumonia surveillance activities, but the Indonesian Ministry of Health in the book *Management of toddler pneumonia in first level health service facilities* has talked about community empowerment efforts regarding toddler pneumonia, ISPA Sub Directorate have Care Seeking activities that aim to train family members others in how to observe the breathing of toddlers and recognize fast breathing as a sign of pneumonia.[11] According to the online Big Indonesian Dictionary, the definition of empowerment is the process, method, and act of empowering. In the social glossary, it is the granting of authority and trust to local communities to determine various forms of development activity programs and their needs through efforts to protect, strengthen, develop, consult, and advocate to increase the level of social welfare. Tisnawati and Murniati Muchtar,[12] in their research, wrote that training in using reading media, and integrated disease management (IMCI) can improve the skills of toddler mothers. Prevention of pneumonia can be carried out through several methods obtained from several studies, one of which is by vaccination PCV (pneumococcal conjugate vaccine).[13] Regulations regarding the prevention of infectious diseases in Indonesia, carried out through health promotion activities, health surveillance, risk factor control, case finding, case handling, immunization, administration of preventive drugs, and other activities were stipulated by the Minister.[14] This is also in accordance with the research conducted by Wartono *et al*. in Manado City, by mapping the distribution of cases using the geographic information system to determine the epidemiological distribution of pneumonia in toddlers, based on population density, altitude, and socio-economic area.[15] Meanwhile, Anteneh, Arega, and Mihretie conducted a study in Ethiopia for severe community-acquired pneumonia (SCAP) toddlers, developing risk scores to help better clinical assessments thereby reducing failure of treatment interventions in hospitals.[16,17]

Family size, monthly income, the type of energy used for cooking, malnutrition, diarrhea, or a URTI within the previous two weeks, exclusive breastfeeding, family members' smoking habits, the density of home occupants, indicators of bacteremia in the patient's blood, and germ patterns/culture have all been identified as risk factors in both hospitals and when people visit the hospital.[18-23]

Other risk factors are incomplete basic immunization, indoor air pollution, a history of low birth weight, and severe malnutrition. The most dominant is the administration of breastfeeding factors.[24] Other diseases also play a role in the occurrence of pneumonia such as TB and HIV,[25] while in Bangladesh the causative agent is dominated by RSV (respiratory syncytial virus).[26] Other causative agents of pneumonia found based on the results of studies in toddlers under five years of age, are *S. pneumoniae*, *M. pneumoniae*, *S. aureus*, therefore microbiological and cultur examination of specimens is required.[27,28] The high number of severe pneumonia cases, especially in Indonesia, which has an impact on the death of toddlers under five years old, can also be seen from research conducted by Khodijah *et al*. in Ciampea, which found that the implementation of the guidelines for the management of toddler pneumonia was not fully appropriate so only 34% of the 90% target coverage of finding toddler pneumonia was achieved.[29] Effective control of under-five pneumonia at the level of first-level health facilities is considered effective if implementing strategies to promote exclusive breastfeeding, preventive zinc supplementation, provision of complete basic immunization, integrated management of sick toddlers (MTBS), and surveillance of pneumonia case findings.[30] In addition, the success of controlling toddler pneumonia also depends on the ability of officers to find cases of toddler pneumonia, namely the relationship between the intellectual, emotional, and physical abilities of officers in the discovery of toddler pneumonia cases such as research conducted at the Medan City Health Center by Siregar, Nugraha, and Simanjorang.[31] In terms of treatment, the recommendations for the treatment of pneumonia in toddlers are submitted by who are about first-line and second-line treatment, according to the severity of the disease, as well as the treatment of pneumonia in toddlers with HIV, and treatment that is not recommended.[6,32]

To prevent and control pneumonia in toddlers under five years of age on a laboratory basis, it is important to distinguish the time of data collection of microorganisms, in cultur media. The results of these tests are used by doctors to guide treatments such as research in Korea.[33] For this reason, evaluation of the system must always be carried out to meet the goals of pneumonia control. The development of risk factors indicators for pneumonia discovery through the provision of other interventions such as vitamins and vaccinations also needs to be evaluated to improve the quality of pneumonia surveillance.[13] The use of the ILI-SARI surveillance method in the discovery of pneumonia, can be done with the help of sensors so that the speed and timeliness of reports can reduce the impact of severity and death.[34] In addition, collaboration with other parties such as community empowerment, in this case, the family in the form of Care Seeking activities, is suggested to be an integral part of this prevention and control method.[11] Care Seeking activities in health facilities need to be evaluated because they can have good and bad impacts, namely the timeliness of seeking care and the accuracy of the intended care provider. After all, this affects the success of finding and treating cases of severe pneumonia, but if the intended care provider is not appropriate then the case non-pneumonia can lead to drug resistance. For this reason, education for care seekers, especially mothers, is very important.[35]

Conclusions

From this literature review (Table 1),[36-40] the conclusion is that prevention and control of pneumonia in toddlers requires a comprehensive problem approach technique. ILI-SARI surveillance is recommended as a sentinel surveillance technique for finding cases of pneumonia in toddlers. The success of the surveillance system in achieving its objectives depends on all available resources. An approach based on the attributes of the surveillance system is a good way to achieve the goal of reducing the risk of death due to pneumonia in toddlers. To improve pneumonia discovery surveillance, risk factors need to be properly identified and validated to improve the quality of pneumonia care in toddlers under five years old.

Table 1. Literature review articles.

No	Researcher, year, and title	Research purposes	Methods	Sample	Results
1	Moyes EJ, *et al*. (2018). Epidemiology of respiratory pathogens from influenza-like illness and pneumonia surveillance programmes, south africa, 2018.[36]	Describing the results of the 2018 influenza-like-illness (ILI) and pneumonia surveillance program caused by pathogenic agents of the influenza virus, a respiratory syncytial virus (RSV), and Bordetella pertussis (pertussis).	Analytic observational	A sample size of 5386 enrolled participants. Nasopharyngeal (NP) and oropharyngeal (OP) swabs were collected from 5350 (99%). Of these, 13% (720) were enrolled in the ILI program and 87% (4930) were hospitalized individuals. Respiratory specimens from all sites were tested for three core pathogens: influenza virus, RSV, and B. pertussis	The results obtained are based on the season that occurred throughout 2018 in South Africa. The RSV circulation ILI, This program starts in week 2 with the season threshold being reached by week 6. The overall detection rate was 7% (50/720), with a peak detection rate of 36% (3/8) at week 7. No positive samples were collected after 25 weeks Pneumonia surveillance program RSV is detectable from the first week in the pneumonia surveillance program. The overall detection rate is 18% (820/4630). The seasonal threshold was detected at week 7; the highest detection rate of 52% (51/98) was at week 18. The season ended in week 29, despite RSV being detected throughout the year. Pertussis cases were detected throughout the year in the ILI surveillance program with the highest detection rate being 8% (5/59) in August 2018. Over 80% (81%; 13/16) cases were detected at the Klerksdorp site (Jouberton Clinic). There is no clear seasonal identification for B. pertussis. The results of an increase in B. pertussis at all sites prompt this alert to all sentinels to improve early detection and public health action.
2	Willemijn L, *et al*. (2017). Comparing national infectious disease surveillance systems: China and the Netherlands.[37]	Comparing the surveillance methods of 2 countries China and the Netherlands. Providing options for strengthening global collaboration, for timely surveillance of infectious disease outbreaks.	A qualitative study	Literature study with a scientific database (Pubmed, BioMed Central, Informa Healthcare, and Google Scholar), interviews with a special focus on arbovirus and pneumonia surveillance in 5 officers at the Netherlands Control Center, 6 experts at the China Control Center, and 5 officers in Beijing Province.	There are several differences in the use of automatic electronic components froman early warning system in China ('CIDARS'), compared to an automated component in the Netherlands ('barometer'). In addition, the Netherlands focuses exclusively on communicable diseases, while China hasa broader 'all hazards' approach (including chemical incidents).
3	Baffour Appiah A, *et al.* (2019). Evaluation of pneumonia in children under five surveillance system, Savelugu-Nanton Municipality, Northern Region, Ghana, 2019.[38]	Evaluating the pneumonia surveillance system in Savelugu-Nanton Municipality, to Northern Region, Ghana. Assessing whether the system has met the goals of the system.	Evaluation Study	Surveillance data of 3351 cases at the municipality from 2015–2018 were extracted and analyzed descriptively and conducting stakeholder interviews using semi-structured questionnaire. Records were also reviewed in several health facilities, sub-municipality, and at the municipal level.	A total of 3351 cases were detected and reported, but not classified so there was no warning of an epidemic. The system was simple, sensitive, stable, acceptable, flexible, and representative. Data quality is good. It is recommended that the laboratory component reinforced and provided additional columns, the Integrated Disease Surveillance System and Response (IDSR) reporting form and in DHIMS 2 for reporting severe and non-severe cases

Table 1. Literature review articles.

4	Palekar R, *et al.* (2019). Examining the relationship between novel data from electronic health records (Ehrs) and traditional public health surveillance data for influenza-like illness among 12 U.S. Jurisdictions, 2016-2019.[39]	Timely, geographically representative, early detection surveillance in 12 US States In outpatient-based surveillance of influenza-like illness (ILI). A compare correlation between search and select (SS) data and data from the US Centers for Disease Control and ILINEt Prevention (CDC), in 12 states in the US.	Analytical Observational	Samples were from 12 states, drawn according to weekly reporting time for proportion data from all visits during the 2016-2019 study period.	1. Identify Influenza Intelligent Medical Objects (IMO), to Systematize Nomenclature of Medicine-Clinical Terms (SNOMED CT) and International Code of Classification of Diseases -10 Revision (ICD-10). 2. The proportion of ILI visits from all visits. 3. Calculate the Pearson correlation coefficient between the two data streams as a whole. A high correlation was found between the ILINEt data and SS influenza data in 12 US states. See timeliness and the geographic representation of the SS data, then the SS data may provide additional information to support public health decision-making beyond what is currently available. Suggestions for future analysis will need to assess the ability to predict flows of future ILINEt data using SS data.
5	Takele D *et al.* (2020). Evaluation of the Ethiopian influenza sentinel surveillance system.[40]	Evaluate sentinel surveillance attributes, objectives, and implementation systems.	Descriptive cross-sectional study.	[40]Collection of case-based reports of influenza-like, and severe acute respiratory illness. Secondary data was collected, from a nationally based public health emergency management center, in (The Ethiopian Institute of Public Health (EPHI). The Total number of 5,097 case-based reports from 2008-2016. Influenza data was collected using the US-CDC Interviews with officers at 8 sentinel sites/locations, community, regional, and national health centers. Analyze and collect data.	1. Not all health facilities have post-ILI and SARI cases. 2. No sentinel site reports influenza data to a higher level except to the national PHEM. 3. Data only analyzed by national PHEM. 4. Laboratory feedback (test results) is not submitted regularly to the sentinel site. 5. The report format is not filled correctly. 6. The positive predictive value (PPV) is 21.35% (n = 4922). Among the total of 5,097 case-based reports, from 2008-2016, 47 (0.9%) age variable, 385 (7.5%) temperature variable, and 103 (2%) date Examination of the specimen is not filled. Suggestion:[40] continuous surveillance should be carried out using checklist for improving data quality.[40] Data must be continuously analyzed and feedback must be provided periodically to health care providers and partners.

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