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EXPOSURE TO CIGARETTE SMOKE IN THE HOME AND THE RISK OF PNEUMONIA IN TODDLERS IN INDONESIA (SYSTEMATIC STUDY)

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ABSTRACT

Exposure to Cigarette Smoke in the Home and the Risk of Pneumonia in Toddlers in Indonesia: Systematic Study. Pneumonia is a respiratory disease that affects more than 287,000 children under five in Indonesia, with 444 deaths among those under five. One of the factors causing pneumonia is exposure to tobacco smoke in the home. This study aimed to describe the association between exposure to indoor tobacco smoke and the incidence of pneumonia among under-fives in Indonesia. This study method was a systematic review using articles from national and international journal databases. Databases used included Google Scholar, Garuda Portal, Scopus, Science Direct, ProQuest, and Springer Link. Articles in this study used the case-control method, published between 2013 and 2023, and focused on the association between indoor tobacco smoke exposure and under-five pneumonia incidence. There were 15 articles reviewed in this study. From the review of 15 articles, factors of exposure to secondhand smoke found in the home include the smoking habits of family members, the presence of family members who smoke, the number of family members who smoke, the location of smoking in the house, the presence of secondhand smoke exposure in the house, the number of cigarettes consumed by family members, the togetherness of infants with smokers, and the smoking status of the father. Most articles show a significant association between exposure to tobacco smoke in the home and the incidence of under-five pneumonia, so it can be concluded that exposure to tobacco smoke in the house is associated with pneumonia in under-fives.

INTRODUCTION

Pneumonia is an acute respiratory infection that causes the alveoli in the lungs to become submerged in fluid. (1) Until now, pneumonia has been the main cause of high morbidity and mortality rates in children under five, especially in developing countries. (2) According to WHO data, pneumonia was responsible for 14% of all deaths of children under five years, 22% of all deaths of children aged 1–5 years, and 740,180 deaths of children under five in the world in 2019. (3)

According to the 2021 Indonesian Health Profile, the prevalence of pneumonia among children under five in Indonesia is 3.55%, with a discovery coverage of 31.4%. The scope of pneumonia discovery is still below the Strategic Plan target. In Indonesia, pneumonia

accounts for 14% of deaths among children aged 29–11 months, 9.4% of deaths among children aged 12-59 months, and is the second leading cause of death among children under five after diarrhe(4) Toddlers, due to their imperfect immunity, are highly susceptible to developing pneumonia. w. [5]

Risk factors for pneumonia are divided into intrinsic factors and extrinsic factors. Intrinsic factors include gender, age, nutritional status, history of exclusive breastfeeding, birth weight, and immunization history. [6] Meanwhile, extrinsic factors include socio-economic conditions, residential density, physical factors of the house, use of cooking fuel, use of mosquito coils, and exposure to cigarette smoke. BAccording to these factors, exposure to cigarette smoke, or environmental tobacco smoke (ETS), is an important factor that can influence the incidence of pneumonia in toddlers. [7]

Globally, the number of smokers is still very high. In 2020, it is estimated that there will be 1.3 billion smokers worldwide, with over 80% of them residing in low- and middle-income countries.[9] BasAccording to the Global Adult Tobacco Survey (GATS) results, the number of smokers in Indonesia is estimated to reach 69.1 million in 2021. This figure has increased compared to the previous 10 years, when there were only 60.3 million smokers in Indonesia. GATS survey also explained that the prevalence of passive smoking in Indonesia will increase to 120 million people in 2021. [10]

High levels of cigarette consumption cause a large burden of disease due to smoking. This is because cigarettes contain thousands of chemical compounds, of which 200 can be harmful to health, such as nicotine, tar, carbon monoxide, and so on. The content of cigarettes and cigarette smoke can increase the risk of diseases such as heart disease, cancer, and respiratory infections for both active and passive smokers. [11]

Passive smokers inhale cigarette smoke that is as dangerous as or even more dangerous than active smokers. Cigarette smoke consists of main and side cigarette smoke. Main cigarette smoke contains 25% levels of hazardous substances, while side cigarette smoke contains 75% levels of hazardous substances. Passive smokers can inhale 75% of the harmful substances from side cigarettes and half the harmful substances exhaled by smokers. [12] Side smoke is also considered more dangerous because it is smaller than the main smoke, so it is easier to enter the body and cause pneumonia. [13]

Based on these problems, a literature review was conducted using various trusted sources and research references that had previously been conducted to determine the relationship between exposure to cigarette smoke and the incidence of pneumonia in Indonesian toddlers.

MATERIALS AND RESEARCH METHODS

This type of research involves a systematic review or study to identify and analyse factors associated with exposure to cigarette smoke in the home and the incidence of pneumonia in toddlers. This research utilizes secondary data from journal articles published in accredited national journals with at least a Sinta 4 accreditation and reputable international publications. The keywords used in this research are "pneumonia AND exposure to cigarette smoke OR passive smoking AND children under five years old OR toddlers." Meanwhile, the keywords used to search for international journals were "pneumonia and smoke exposure OR environmental tobacco smoke OR secondhand smoke OR thirdhand smoke AND children under five OR toddlers." Articles were searched online using the Google Scholar database, Garuda Portal, Scopus, Science Direct, ProQuest, and Springer Link.

The research criteria for this study include the use of either Indonesian or English in the article, open access, a research location in Indonesia, a time span of the last 10 years (2013–2023), a case-control research design, a population and sample of toddlers, and the inclusion of research data results.

The article selection process starts with entering keywords into the databases used. A total of 1,390 articles were identified at this stage. All articles that have been identified are then checked for duplicates. After duplicate articles were removed, the number of articles that

entered the screening stage was 1,380. Out of the 1,380 articles, 1,277 were excluded because they did not have titles and abstracts that were appropriate to the research topic and/or could not be accessed, so the number of articles that entered the next stage was 103. A total of 103 articles were reviewed in full text, and then 88 articles were found that did not comply with the predetermined inclusion and exclusion criteria, resulting in 15 articles that were then assessed for quality. The Critical Appraisal Checklist for Case Control Studies, developed by the Joanna Briggs Institute (JBI), was used to assess the quality of articles. This study will include articles that pass the article quality assessment.

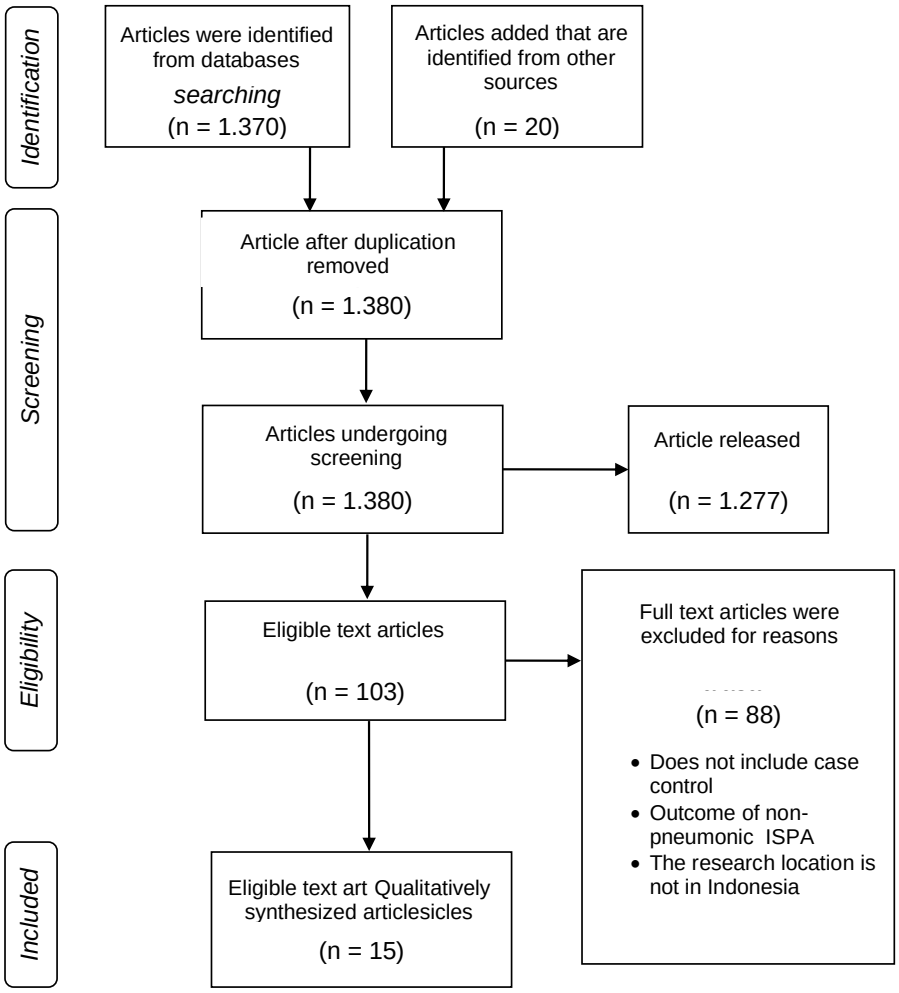

Figure 1. Article Selection Flow Diagram

RESEARCH RESULTS AND DISCUSSION

According to the entire article's results, 11 different research areas were identified. The most research locations were Surabaya with 3 studies, Semarang and Klaten with 2 studies each, and Jakarta, Central Lampung, Bantul, Kediri, Kulon Progo, Jambi, Banjarbaru, and Bengkulu with 1 study each. All the research subjects in the article are toddlers under five years of age. The samples used ranged from 50 to 278, which were divided into case groups and control groups. All research articles use structured questionnaires and interviews to obtain data regarding exposure to cigarette smoke among toddlers. The article's results can be found in Table 1.

Table 1. Article Findings

Writer	Research sites	Samples (n)	Variable	Results		
				p-value	OR	95%CI
Stephanie (2021)[11]	Jakarta	67 toddlers aged less than 5 years	The presence of smokers at home	0,000	28,952	6,447-130,020
			Number of smokers at home (1 person)	0,000	26,190	6,029-113,778
			Number of smokers in the house(≥2 persons)	0,000	75,000	6,889-816,858
			Parental smoking behavior at home	0.001	28,000	3,810-205,791
			Number of cigarettes consumed by parents	0.402	2,444	0.499-11.965
Larasati (2019)[14]	Surabaya	50 toddlers aged 0-4 years	The presence of family members who smoke	0.030	6,667	1,247-36,954
			Number of family members who smoke	1,000	2	0.108-36.954
			Family member's smoking area	0.039	8.25	1,154-59,003
Jannah (2019)[15]	Semarang	84 toddlers aged less than 5 years	Smoking behavior at home	0.029	2.94	1.21-7.16
Pratiwi (2018)[16]	central Lampung	100 toddlers aged 12-59 months	Family members' smoking habits	0.033	4,041	1,215-13,433
			Family member's smoking area	0.042	1,527	2,889-4,981
Alnur (2017)(17)	Bantul	160 toddlers aged less than 5 years	Family smoking habits	0.020	2,185	1,068-4,505
Mahalastri (2014)(18)	Surabaya	60 toddlers aged 12-59 months	Exposure to cigarette smoke in the house	-	4.00	1.21-13.64
Dwimawati (2021)(19)	Klaten	278 toddlers aged less than 5 years	Exposure to cigarette smoke in the house	0.017	2,053	1,137-3,705
Ula (2019)(20)	Surabaya	70 toddlers aged 12-59 months	Exposure to cigarette smoke in the house	0.528	0.667	0.190-2.345
Almeida (2020)(21)	Kediri	60 toddlers aged less than 2 years	Having family members who smoke	-	0.61	0.15-2.45
			Number of family members who smoke	-	2.27	0.19-26.81
			Smoking location	-	2.03	0.65-6.30
Winarsih (2019)(22)	Kulon Progo	174 toddlers aged under five years	Family members' smoking habits	0,000	7,725	3,442-17,334
			Father's smoking status	0.186	2,154	0.677-6.857
			Smoking location	0.003	3,046	1,429-6,492
			Togetherness between toddlers and smokers	0,000	-	-
			Number of cigarettes consumed by family members	0,000	7,105	3,079-16,394
Hariyanto (2020)(23)	Semarang	72 toddlers aged 12-59 months	There is a smoker in the family	0.79	-	-
Armina (2020)(24)	Jambi	110 toddlers aged 12-59 months	Smoking habit at home	0.405	1,598	0.527-4.842
Ardia (2019)(25)	Banjarbaru	96 toddlers aged under 5 years	Parental smoking behavior at home	0.018	3,935	-
Luthfiyana (2018)(26)	Klaten	200 toddlers under 5 years old	Exposure to cigarette smoke from family members at home	0.024	6.37	1.27-32.01
Suryani (2018)(27)	Bengkulu	134 children under five years old	The presence of smokers in the house	0.021	2.76	1.16-6.57

Based on the results of a review of 15 articles, we can identify the variable factors for exposure to cigarette smoke. These factors include the smoking habits of family members, the presence of smokers in the family, exposure to cigarette smoke in the house, the location of smoking in the house, the number of cigarettes consumed by family members, the presence of toddlers with smokers, and the father's smoking status.

The smoking habits and the presence of family members who smoke are significant factors.

Most articles that discuss smoking habits and the presence of family members who smoke state that there is a significant relationship between smoking habits, the presence of family members who smoke, and the incidence of pneumonia in toddlers. Having family members who smoke can increase the risk of toddlers suffering from respiratory diseases like pneumonia. Toddlers whose family members smoke have a 0.61-28.952 times higher risk of developing pneumonia than toddlers whose family members do not smoke. (11,14,16,17,21–23,27)

Smoking not only poses a risk to the smoker's health, but also poses a significant risk to those around them, particularly children with weakened immune systems. Typically, the fathers, uncles, and grandfathers of toddlers carry on the smoking habit within their family. - The presence of family members with a smoking habit, particularly in the house, can increase the risk of toddlers being exposed to cigarette smoke. This exposure can persist even after active smokers have quit. his is because there are dangerous substances that are invisible but can stick to the surface of objects (thirdhand smoke). TThis substance can stick around for days or even months, and toddlers can inhale it. (28)

Having family members who smoke causes toddlers to be continuously exposed to cigarette smoke. Toxic substances in cigarette smoke can cause inflammation, which indicates an immune response to antibodies in the body. Inflammation of the lungs is characterised by increased production of inflammatory cytokines and leukocytes from the blood to the lungs. Leukocytosis is a sign of systemic immune changes that will lead to the destruction of pathogens by neutrophils, followed by the destruction of the neutrophils themselves. The formation of pus will signal the destruction of pathogen cells and neutrophils will be marked by the formation of pus. Continuous exposure to cigarette smoke will cause the lungs to become inflamed, leading to the filling of the lungs with pus and the occurrence of lung inflammation or pneumonia. (29)

Number of Family Members Who Smoke

Three articles discuss the relationship between the number of family members who smoke and the incidence of pneumonia in toddlers. on research conducted by Stefani (2021), the number of smokers in the house influences the incidence of pneumonia in toddlers. Toddlers with 1 smoker in the house have a 26.19 times higher risk of suffering from pneumonia, while toddlers with ≥2 smokers in the house have a 75 times higher risk of suffering from pneumpneumonia.This research is inversely proportional to researthatcted by Larasati (2019) and Almeida (2020). In these two studies, the number of smokers in the house householdo effect on the incidence of pneumonia in toddlers.(14.21)

Similar research results were found in research conducted by Ahn (2015) conducted research that yielded similar results. In this study, it was found that children with ≥2 smokers in the house had a longer hospital stay and needed more intensive care than children who did not have family members who smoked in the house. This demonstrates that the number of smokers in the house influences the severity of pneumonia. (30)

The greater the number of active smokers in a family, the greater the number of cigarettes smoked, so that the exposure to cigarette smoke received by toddlers is also greater. According to research results, a house with two smokers has 200% higher air nicotine levels than a house without smokers. In addition, children's hair and blood cotinine levels (CCR) were >150% higher in children who lived in a house with 2 smokers compared to children who lived in a house with 1 smoker. (30)

Locations of Smoking and Exposure to Cigarette Smoke within the House

Smoking location is one factor that can cause pneumonia in toddlers. Most articles state that there is a significant relationship between smoking at home and the incidence of pneumonia in toddlers. Toddlers who are exposed to cigarette smoke at home are 1,527–28.00 times more likely to suffer from pneumonia compared to toddlers who are not exposed to cigarette smoke at home.

According to Jannah's (2019) research, some parents who smoke disregard the presence of toddlers around them and fail to open doors and windows when smoking indoors, resulting in poor air circulation and potentially leading to pneumonia in toddlers. (15) Meanwhile, based on research conducted by Ula (2019), no relationship was found between smoking habits at home and the incidence of pneumonia. This is because only a small proportion of respondents (17.7%) have family members with smoking habits. Most family members who smoke have a habit of smoking outside the home and away from toddlers, so that toddlers are not directly exposed to cigarette smoke. (20)

Smoking activities carried out at home or indoors can cause air quality to become polluted. Indoor air pollution is more dangerous than outdoor air pollution caused by smoking. This is because some people, especially toddlers, spend more time indoors.(7) Cigarette smoke is the most dominant cause of indoor pollution. Cigarette smoke produces gases and particles such as NO2, SO2, CO, CO2, PM2.5, PM10, and other dangerous substances that can cause respiratory problems, one of which is pneumonia. In a closed room, cigarette smoke collects in concentrations that vary according to the type of cigarette, the number of smokers in the room, the number of cigarettes smoked, and room characteristics such as adequate ventilation, temperature, and humidity (18)

How many cigarettes do family members consume?

Family members, such as parents, have a significant influence on the amount of cigarette smoke exposure toddlers receive. In Indonesia, active smokers consume an average of 12 cigarettes per day, with their smoking time varying between 5 and 10 minutes. he numb The number of cigarettes smoked by parents indicates the amount of nicotine that adheres to both the lung lining and the mucosal lining of the larynx. Nicotine adhering to the lungs narrows the respiratory tract, irritates mucous membranes, and increases mucus production, all of which increase the risk of pneumonia. The number of smokers in the house is also correlated with the house's humidity levThe house also influences the number of smokers present, particularly if family members have a smoking habit, which heightens the risk of pneumonia in toddlers. rs. (11)

Based on research conducted by Winarsih (2019), toddlers whose parents smoke more than 10 cigarettes per day are at 7.105 times greater risk of developing pneumonia than toddlers whose parents are non-smokers. (22) Similar research was also conducted by Eyuboglu (2019), who found that exposure to cigarette smoke can worsen the incidence of pneumonia and affect urine CCR levels in toddlers. Oddlers who are exposed to cigarette smoke for more than 10 cigarettes per day have a higher urine CCR compared to toddlers who are not exposed. These findings suggest that higher exposure to cigarette smoke can increase the severity of pneumonia. (32)

Toddlers and Smokers Together

According to research conducted by Winarsih et al. (2019), the association of toddlers with smokers was linked to the incidence of toddler pneumonia. According to this research, 78% of toddlers who contract pneumonia live with smokers every day. (22)

The association of toddlers with smokers allows them to be exposed to cigarette smoke either directly or indirectly. Toddlers will be exposed to cigarette smoke directly if family members smoke around them. However, toddlers can still be exposed to cigarette smoke, even if family

members do not smoke around them. This is because the toxic materials contained in cigarettes can stick to the smoker's clothes and hair, so if family members do not clean themselves before handling the toddler, the toxic materials will be inhaled by the toddler. ([14]) Cigarette smoke, especially side smoke, has been proven to contain 5 times more carbon monoxide; nicotine, tar, and nickel are 3 times greater; ammonia is 46 times greater; and nitrosamine (a cancer-causing substance) is 50 times greater than main smoke. The chemical content in side-cigarette smoke is greater because tobacco burns at a lower temperature when it is smoked, so the combustion is less complete and releases more chemicals. [(33)] If toddlers are exposed to cigarette smoke continuously, lung function will be affected. This reduces lung function, making toddlers more susceptible to pneumonia. [(12)]

Dad's Smoking Status

According to Winarsih's (2019) research, there was no relationship between a father's smoking status and the incidence of pneumonia because the majority of the toddlers in the case group and control group had fathers who smoked. However, in this study, it was concluded that toddlers whose fathers had a smoking habit had a 2.154 times greater risk of developing pneumonia compared to toddlers whose fathers were non-smokers. [(22)]

The results of Winarsih's (2019) research contradict those of Candra (2014) and Permatasari (2023). In research conducted byCandra's (2014) research concluded that a father's smoking status was related to the incidence of pneumonia in toddlers aged 1-2 years, with a p value of less than 0.011 anMeanwhile, according to Permatasari's (2023) research findings, the father's smoking status was linked to the incidence of pThere is a correlation between a father's smoking history and the severity of pneumonia in toddlers, with toddlers with smoking parents experiencing a more severe case of pneumonia compared to those without a smoking history. [(34)]

The father is one of the closest family members to the toddler. Toddlers who live with smoking fathers are at high risk of being exposed to smoking smoke continuously, especially if the smoking activity is carried out at home or in a closed room. [(2)]

CONCLUSIONS AND RECOMMENDATIONS

After reviewing 15 articles, it was concluded that exposure to cigarette smoke in the home is related and can increase the risk of pneumonia in toddlers. Factors related to the incidence of pneumonia in toddlers include family members' smoking habits, the presence of family members who smoke, exposure to cigarette smoke in the house, smoking location in the house, the number of cigarettes consumed by family members, and the toddler's association with smokers. Meanwhile, the father's smoking status was not linked to toddler pneumonia.

In future research, it is hoped that there will be objective use of biomarkers for exposure to cigarette smoke, so that the interpretation of the health effects obtained is more precise. Apart from that, awareness is needed for family members, especially parents, not to smoke in the house, especially around toddlers, and to always open windows, doors, and ventilation so that the air quality in the house is maintained.

REFERENCES

1. Aulina M, Rahardjo M, Nurjazuli. Pola Sebaran Kejadian Penyakit Pneumonia pada Balita di Kecamatan Bergas, Kabupaten Semarang. Jurnal Kesehatan Masyarakat. 2017;5(5):744–52.
2. Efni Y, Machmud R, Pertiwi D. Faktor Risiko yang Berhubungan dengan Kejadian Pneumonia pada Balita di Kelurahan Air Tawar Barat Padang. Jurnal Kesehatan Andalas. 2016;5(2):365–70.

3. Lailiyah A, Kiptiyah N. Hubungan Faktor Pejamu dan Lingkungan dengan Pneumonia Balita di 5 Provinsi di Pulau Sulawesi. Jurnal Epidemiologi Kesehatan Indonesia. 2021;5(2):59–65.
4. Kementerian Kesehatan Republik Indonesia. Profil Kesehatan Indonesia Tahun 2021. Jakarta; 2022.
5. Nuretza JA, Suhartono, Winarni S. Hubungan Antara Perilaku Keluarga dan Kondisi Lingkungan dalam Rumah dengan Kejadian Pneumonia pada Anak Balita di Wilayah Kerja Puskesmas Halmahera Kota Semarang. Jurnal Kesehatan Masyarakat. 2017;5(5):696–705.
6. Hasanah U, Santik YDP. Faktor Intrinsik dan Extrinsik yang Berhubungan dengan Kejadian Pneumonia di Wilayah Puskesmas Rembang. Jurnal Kesehatan Masyarakat Indonesia. 2021;16(2):84–90.
7. Trisiyah CD, Umbul C. Hubungan Kondisi Lingkungan Rumah dengan Kejadian Pneumonia pada Balita di Wilayah Kerja Puskesmas Taman Kabupaten Sidoarjo. The Indonesian Journal of Public Health. 2018;13(1):119–29.
8. Salsabila NN, Indraswari N, Sujatmiko B. Gambaran Kebiasaan Merokok di Indonesia Berdasarkan Indonesia Family Life Survey 5 (IFLS 5). Jurnal Ekonomi Kesehatan Indonesia. 2022;7(1):13–22.
9. CNN Indonesia. WHO: Jumlah Perokok di Dunia Turun . In: CNN Indonesia [Internet]. 2021 [cited 2023 Apr 15]. Available from: https://www.cnnindonesia.com/gaya-hidup/20211118090958-255-722782/who-jumlah-perokok-di-dunia-turun.
10. Kementerian Kesehatan Republik Indonesia. Temuan Survei GATS: Perokok Dewasa di Indonesia Naik 10 Tahun Terakhir. In: Kemenkes [Internet]. 2022 [cited 2023 Jul 23]. Available from: https://www.kemkes.go.id/article/view/22060200005/temuan-survei-gats-perokok-dewasa-di-indonesia-naik-10-tahun-terakhir.html
11. Stefani M, Setiawan A. Hubungan Asap Rokok terhadap Derajat Keparahan Pneumonia Anak Usia di Bawah 5 Tahun. Sari Pediatri. 2021;23(4):235–41.
12. Nurjanah, Kresnowati L, Mufid A. . Gangguan Fungsi Paru dan Kadar Cotinine pada Urin Karyawan yang Terpapar Asap Rokok Orang Lain. Kemas: Jurnal Kesehatan Masyarakat. 2014;10(2):43–52.
13. Wardani NK, Winarsih S, Sukini T. Hubungan Antara Paparan Asap Rokok dengan Kejadian Infeksi Saluran Pernapasan Akut (ISPA) pada balita di Desa Pucung Rejo Kabupaten Magelang Tahun 2014. Jurnal Kebidanan. 2016;5(10):30–7.
14. Larasati F, Hargono A. Perbedaan Risiko Pneumonia Berdasarkan Pola Asuh dan Paparan Asap Rokok. Jurnal Promkes: The Indonesian Journal of Public Health Education. 2019;7(2):163–72.
15. Jannah M. Kejadian Pneumonia Balita di Wilayah Pengasapan Ikan. Higeia Journal of Public Health Research and Development. 2019;3(3):454–68.
16. Pratiwi D. Hubungan Komponen Rumah Sehat terhadap Kejadian Pneumonia pada Balita di Wilayah Kerja Puskesmas Simpang Agung Kabupaten Lampung Tengah Tahun 2018. Jurnal Ruwa Jurai. 2018;12(2):53–61.
17. Alnur RD, Ismail D, Padmawati RS. Kebiasaan Merokok Keluarga Serumah dengan Kejadian Pneumonia pada Balita di Kabupaten Bantul Tahun 2015. Berita Kedokteran Masyarakat. 2017;119–24.
18. Mahalastri NND. Hubungan Antara Pencemaran Udara dalam Ruang dengan Kejadian Pneumonia Balita. Jurnal Berkala Epidemiologi. 2014;2(3):392–403.
19. Dwimawati E, Yanuaringsih GP, Pangaribuan R, Olivia N, Gurning FP, Pratama MY. Smoke Exposure at Home to the Incidence of Pneumonia in Children Under 5 Years Old. Indian Journal of Forensic Medicine & Toxicology. 2021;5(1):1872–8.
20. Ula SR, Adriyani R. In-door Factors and Its Status Related to Pneumonia Risk in Children Under Five Years. In: IOP Conference Series: Earth and Environmental Science. 2019. p. 1–6.

21. Almeida DV, Syahrul F. Correlation of Exclusive Breastfeeding and Cigarette Smoke Exposure with Pneumonia in Children Under Two Years. Jurnal Berkala Epidemiologi . 2020;8(3):228–35.
22. Winarsih W, Kusumawati W, Anjarwati. The Correlation Between Family Smoking Habits and Mosquito Coils Use with Pneumonia Incidences in Toddlers. Journal of Health Technology Assessment in Midwifery. 2019;2(2):69–74.
23. Hariyanto H. Kejadian Pneumonia pada Anak Usia 12-59 Bulan. Higeia Journal of Public Health Research and Development. 2020;4(3):549–60.
24. Armina, Wulansari A. Korelasi Faktor yang Berhubungan dengan Kejadian Pneumonia Balita di Dua Puskesmas Kota Jambi. Jurnal Ilmiah Universitas Batanghari Jambi. 2020;20(1):272–6.
25. Ardia A, Noraida, Erminawati. Perilaku Merokok Orangtua dengan Kejadian ISPA Pneumonia pada Balita. Jurnal Kesehatan Lingkungan. 2019;16(1):707–14.
26. Luthfiyana NU, Rahardjo SS, Murti B. Multilevel Analysis on the Biological, Social Economic, and Environmental Factors on the Risk of Pneumonia in Children Under Five in Klaten, Central Java. Journal of Epidemiology and Public Health. 2018;3(2):128–42.
27. Suryani, Hadisaputro S, Zain S. Faktor Risiko Lingkungan yang Berhubungan dengan Kejadian Pneumonia pada Balita (Studi di Wilayah Kerja Dinas Kesehatan Kota Bengkulu). Jurnal Higiene. 2018;4(1):26–31.
28. Sari HTM. Hubungan Paparan Asap Rokok pada Masa Kehamilan dengan Kejadian Berat Badan Lahir Rendah (BBLR) di Wilayah Kerja Puskesmas Kedungmundu Kota Semarang [Undergraduate Thesis]. [Semarang]: Universitas Diponegoro; 2022.
29. Riyanto R, Herlina. Kejadian ISPA Pneumonia dan Faktor Risiko yang Meningkatkan pada Bayi dan Balita. Jurnal Kesehatan Metro Sai Wawai. 2021;14(1):77-86
30. Ahn A, Edwards KM, Grijalva C, Self WH, Zhu Y, Chappell JD, et al. Secondhand Smoke Exposure and Illness Severity among Children Hospitalized with Pneumonia. J Pediatr. 2015;167(4):869–74.
31. Lianzi I, Pitaloka E. Hubungan Pengetahuan Tentang Rokok dan Perilaku Merokok pada Staf Administrasi Universitas Esa Unggul. Jurnal Inohim. 2014;2(1):67–81.
32. Eyuboglu TS, Aslan AT, Kose M, Pekcan S, Hangul M, Gulbahar O, et al. Passive Smoking and Disease Severity in Chilhood Pneumonia Under 5 Years of Age. J Trop Pediatr. 2019;7(1):1–7.
33. Safitri RN, Syahrul F. Risiko Paparan Asap Rokok terhadap Kejadian Anemia pada Ibu Hamil. Jurnal Berkala Epidemiologi. 2015;3(3):327-39.
34. Candra A. Faktor Risiko Infeksi pada Anak 1-2 TH. Diponegoro Journal of Nutrition and Health. 2014;2(1):1–12.
35. Permatasari SI, Anditiarina D, Wiatma DS, Sahrun. Hubungan Tingkat Pengetahuan Ibu dan Riwayat Merokok Ayah dengan Tingkat Keparahan Pneumonia pada Balita di RSUD Kabupaten Klungkung. Jurnal Ilmiah Kesehatan Medika DRG Suherman. 2023;5(1):183–96.