

## PHYSICAL AIR QUALITY IN THE PNEUMONIA TODDLER ROOM IN THE PAKUSARI PUSKESMAS WORKING AREA, JEMBER DISTRICT

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### ABSTRACT

#### Physical Air Quality in The Pneumonia Toddler Room in The Pakusari Puskesmas Working Area, Jember District.

Pneumonia is a significant health issue, responsible for 14% of child deaths worldwide. At Pakusari Health Center in Jember Regency, cases of pneumonia have risen from 2021 to 2022, placing it among the top 10 health concerns. Pneumonia in young children is caused by viruses, bacteria, fungi, and foreign bodies, exacerbated by physical and chemical contamination. Children under five, who spend much time in the bedroom, are particularly susceptible to this respiratory disease. This study aims to describe the physical air quality in bedrooms and the characteristics of under-five children with pneumonia. This research employs a descriptive, quantitative approach with a case-series design. A sample size of 10 houses was determined using non-probability and purposive sampling techniques. Primary data were gathered from interviews and air quality measurements conducted by the Indonesian Environmental Health and Disease Control (BBTKLPP) Surabaya, focusing on temperature, humidity, and lighting parameters. Findings indicate that 70% of pneumonia cases occur in children aged 0-24 months, with a majority being female. Additionally, 50% of the children received exclusive breastfeeding, and 20% had a history of measles. Based on Ministry of Health Regulation 1077/2011 standards, the room air quality results showed that 40% of air temperature measurements qualified and 60% unqualified, with lighting and humidity also not meeting requirements. However, PM10 levels were 100% within the acceptable range. This suggests that the physical air quality in the bedrooms of children under five with pneumonia is suboptimal, likely due to poor ventilation and infrequent opening of windows and curtains.

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### INTRODUCTION

Inflammation from viruses, fungi, bacteria, or foreign objects causes pneumonia, an acute respiratory infection <sup>(1)</sup>. Pneumonia in toddlers is a global health problem because it claims the lives of 39 children per second <sup>(2)</sup>. East Java had 74,071 cases of pneumonia in toddlers, making it the highest-ranking province nationally. In 2021, Jember Regency ranked among the top 10 regions in East Java in terms of the number of cases. The working area of the Pakusari Health Center, Jember Regency, has increased the number of cases of pneumonia in

toddlers from year to year. From 2021 to 2022, the region ranked among the top 10 for toddler pneumonia cases. Pollution, particularly air pollution, closely links pneumonia, a multifaceted disease, to the environment. Numerous factors contribute to the development of pneumonia in toddlers. Risk factors for pneumonia in toddlers include gender, age, history of exclusive breastfeeding, and history of measles <sup>(1)</sup>. The environment, including the air quality in a toddler's room, has a close relationship with pneumonia <sup>(4)</sup>.

Exposure to household air pollution almost doubles the risk of causing pneumonia, resulting in 44% of under-five deaths <sup>(5)</sup>. Toddlers spend a lot of time in rooms that should have adequate air quality. The Minister of Health Regulation No. 1077 of 2011, which includes temperature, humidity, light intensity, and particulate dust (PM10), defines the room air quality standard value as the physical air quality in the room. Physical air quality that does not meet the requirements is a risk factor that can indirectly trigger the growth and development of pneumonia-causing agents <sup>(4)</sup>. Suseno and Pratiwi's 2022 research revealed that air pollution in bedrooms poses a risk factor for pneumonia in toddlers. <sup>(6)</sup>.

Due to the high number of cases of pneumonia in toddlers, this research describes environmental factors related to the physical air quality in the rooms of toddlers who have pneumonia, as well as the characteristics of toddlers who have pneumonia, as risk factors for pneumonia in toddlers in the Pakusari Community Health Center working area, Jember Regency

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## **MATERIALS AND RESEARCH METHODS**

This research employs a descriptive type, a quantitative approach, and a case-series design. This research aims to describe the characteristics of toddlers with pneumonia and measure the air quality parameters in their rooms. The research population consisted of toddlers diagnosed with pneumonia between September and December 2022 at the Pakusari Community Health Center, encompassing a total of 23 toddler homes. The samples taken were 10 houses of toddlers using Gay & Diehl's (1992) calculations. We took the sample using non-probability sampling and purposive sampling, following the researcher's inclusion and exclusion criteria.

We collected primary data on toddler characteristics by interviewing toddler parents using questionnaires. Measurement experts from the Center for Environmental Health Engineering and Disease Control (BBTKLPP Surabaya) carried out air measurements for temperature, humidity, and lighting parameters using the Environment Multimeter Mastech MS6300 and PM10 tools with Dust Track. We use univariate data analysis to describe the characteristics of each variable, presenting the data in tabular and textual form as a narrative to explain the information.

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## **RESEARCH RESULTS AND DISCUSSION**

### **Toddler Characteristics**

The results of the univariate analysis of research conducted in 10 homes of toddlers who experienced pneumonia, namely:

Table 1. Results of Distribution of Characteristics of Toddlers Who Experience Pneumonia

| Characteristics of Toddlers Having Pneumonia. | Frequency | Percentage(%) |
|-----------------------------------------------|-----------|---------------|
| <b>Toddler Age</b>                            |           |               |
| Age 0 - 24 months                             | 7         | 70            |
| Age 24 - 59 months                            | 3         | 30            |
| <b>Toddler Gender</b>                         |           |               |
| Man                                           | 3         | 30            |
| Woman                                         | 7         | 70            |
| <b>History of Exclusive Breastfeeding</b>     |           |               |
| Exclusive breastfeeding                       | 5         | 50            |
| Not exclusive breastfeeding                   | 5         | 50            |
| <b>History of Measles Infection</b>           |           |               |
| History of Measles                            | 2         | 20            |
| No history of measles                         | 8         | 80            |

Based on table 1, distribution of toddler characteristics based on toddler age, the majority of toddlers are young or aged 0 – 24 months (70%). Age 0 - 24 months is the age when young toddlers are more susceptible to pneumonia than those aged 0 - 24 months<sup>(7)</sup>. This is because the risk of getting pneumonia is greater because the respiratory system is not yet perfect and the respiratory tract lumen is still narrow, the body's immune system is not optimal enough to prevent and kill the cause of pneumonia.<sup>(8)</sup>.

In terms of gender, the majority of toddlers are female (70%) compared to male (30%). This is not in accordance with several previous studies which stated that the majority of male toddlers suffer more from pneumonia than girls. However, there are many other factors that have an influence, such as exposure to cigarette smoke which is more commonly found in female toddlers. Supporting research byJannah 2020, stated that although the proportion of female toddlers was smaller and it had no relationship with the incidence of pneumonia<sup>(9)</sup>. StudyPrimary in 2022, stated that there was no significant relationship between the gender of the toddler and the incidence of pneumonia<sup>(10)</sup>.

With a history of exclusive breastfeeding, the results were the same (50%) as those who did not receive exclusive breastfeeding. Exclusive breastfeeding means that toddlers from the age of 0 – 6 months are only given breast milk and do not give any food or drink except vitamins and medicine.<sup>(11)</sup>. Failure of exclusive breastfeeding: toddlers are given formula milk, water and fruit such as bananas. This is due to mothers who feel that the breast milk they are given is not enough to meet the child's needs, considering that formula milk can replace or supplement breast milk needs and the social and cultural practices applied by mothers or mothers-in-law who live with them. Exclusive breastfeeding for babies or toddlers is related to the immunobiological system which makes toddlers strong as protection from pneumonia<sup>(12)</sup>. In toddlers who are given exclusive breast milk, however, they are still infected with pneumonia, which can be caused by other factors such as the environment and unhealthy behavior such as parents.

who smokes at home. This research is in accordance withKulsum 2019, stated that there was no relationship between exclusive breastfeeding and the incidence of pneumonia in toddlers and other environmental factors<sup>(13)</sup>.

In terms of infection history, 20% of toddlers have a history of measles. In children who experience measles, the complications they suffer include pneumonia<sup>(1)</sup>. The measles virus, which affects the epithelium in the lower respiratory tract, will damage the immunity in the lungs, thereby risking pneumonia<sup>(14)</sup>. Toddlers have a history of measles and pneumonia due to suboptimal immunity and have not received immunizations.

## PHYSICAL AIR QUALITY OF TODDLERS' ROOMS

### Temperature

Based on the results of temperature measurements in the toddler's room, the results were obtained, namely:

Table 2. Room Temperature Measurement Results

| No. | Room Size (M2)  | Measurement results<br>(Celsius) | Information<br>(Quality Standard Requirements 100C - 300C) |
|-----|-----------------|----------------------------------|------------------------------------------------------------|
| 1.  | 3.0 x 3.0 = 9   | 27.4                             | Qualify                                                    |
| 2.  | 3.0 x 5.0 = 15  | 31                               | Not eligible                                               |
| 3.  | 3.0 x 4.0 = 12  | 33.5                             | Not eligible                                               |
| 4.  | 3.0 x 3.0 = 9   | 30.5                             | Not eligible                                               |
| 5.  | 2.5 x 3.0 = 7.5 | 28.3                             | Qualify                                                    |
| 6.  | 3.0 x 2.5 = 7.5 | 31.9                             | Not eligible                                               |
| 7.  | 3.0 x 3.0 = 9   | 31.3                             | Not eligible                                               |
| 8.  | 3.0 x 3.0 = 9   | 31.9                             | Not eligible                                               |
| 9.  | 3.5 x 4.0 = 14  | 27.8                             | Qualify                                                    |
| 10. | 2.0 x 2.5 = 5   | 27.8                             | Qualify                                                    |

According to the measurement results, only 40% of toddler rooms meet the requirements. The presence of windows and vents can influence the temperature in a toddler's room. An increase in temperature due to a lack of air exchange. Most rooms are known to have windows, but only four toddler rooms have movable windows. ventilation in the toddler's room is provided by a vent, which should optimize air circulation. However, only some rooms have vents, and fiber plastic covers some of them. Rooms that do not meet the requirements will increase the risk of toddlers getting pneumonia by 12,571 times <sup>(16)</sup>. Temperature influences the development and death of pneumonia pathogens at certain temperatures. The average optimum temperature for bacteria to grow is 310–370 °C, and they can grow at lower temperatures, namely 250 °C, to the optimum temperature <sup>(7)</sup>. This statement implies that even if the measurement results meet the requirements, there is still a risk of developing pneumonia pathogens.

### Humidity

Based on the results of humidity measurements in the toddler's room, the results were obtained, namely:

Table 3. Room Humidity Measurement Results

| No. | Room Size (M2)  | Measurement results<br>(Celsius) | Information<br>(Quality Standard Requirements 100C - 300C) |
|-----|-----------------|----------------------------------|------------------------------------------------------------|
| 1.  | 3.0 x 3.0 = 9   | 75.5                             | Not eligible                                               |
| 2.  | 3.0 x 5.0 = 15  | 71.1                             | Not eligible                                               |
| 3.  | 3.0 x 4.0 = 12  | 64.6                             | Not eligible                                               |
| 4.  | 3.0 x 3.0 = 9   | 71.5                             | Not eligible                                               |
| 5.  | 2.5 x 3.0 = 7.5 | 75.1                             | Not eligible                                               |
| 6.  | 3.0 x 2.5 = 7.5 | 86.1                             | Not eligible                                               |
| 7.  | 3.0 x 3.0 = 9   | 70.6                             | Not eligible                                               |
| 8.  | 3.0 x 3.0 = 9   | 67.4                             | Not eligible                                               |
| 9.  | 3.5 x 4.0 = 14  | 75.8                             | Not eligible                                               |
| 10. | 2.0 x 2.5 = 5   | 76.0                             | Not eligible                                               |

Based on the overall measurement results, the toddler's room has humidity above the quality standard. The toddler's room feels stuffy due to insufficient or uneven ventilation and high humidity <sup>(17)</sup>. Unoptimal ventilation, resulting in humidity, leads to air exchange issues. These include windows that are difficult to open or lock, vents that remain closed even when the air conditioner (AC) is not in use, small windows, rooms without windows, and covered windows. Other buildings and residents have a habit of not opening their windows frequently. The low habit of opening windows stems from parents' concerns about animals, dirt, or dust infiltrating their rooms. or dust entering the room. Furthermore, the residential

density suggests that three rooms are required. According to Minister of Health Decree No. 829/1999, a bedroom area measuring 8 m<sup>2</sup> should only accommodate two individuals. be occupied by two people. Inappropriate housing density increases humidity from respiratory vapors and increases pneumonia transmission <sup>(18)</sup>.

Humidity supports the causes of pneumonia, including pneumococci, which will develop rapidly in high humidity <sup>(19)</sup>. Humidity is a favorable medium for pathogenic bacteria to grow, so a room with poor air circulation will make it difficult for bacteria in the air to leave the room. <sup>(20)</sup>. A damp room that does not meet the requirements carries a 7.5-fold risk of developing pneumonia in toddlers <sup>(21)</sup>.

### Lighting

Based on the results of lighting measurements in the toddler's room, the results were obtained, namely:

Table 4. Room Lighting Measurement Results

| No. | Room Size (M2)  | Measurement results | Information                              |
|-----|-----------------|---------------------|------------------------------------------|
|     |                 | (Lux)               | (Quality Standard Requirements ≥ 60 Lux) |
| 1.  | 3.0 x 3.0 = 9   | 6                   | Not eligible                             |
| 2.  | 3.0 x 5.0 = 15  | 51                  | Not eligible                             |
| 3.  | 3.0 x 4.0 = 12  | 21                  | Not eligible                             |
| 4.  | 3.0 x 3.0 = 9   | 5                   | Not eligible                             |
| 5.  | 2.5 x 3.0 = 7.5 | 5                   | Not eligible                             |
| 6.  | 3.0 x 2.5 = 7.5 | 46                  | Not eligible                             |
| 7.  | 3.0 x 3.0 = 9   | 25                  | Not eligible                             |
| 8.  | 3.0 x 3.0 = 9   | 18                  | Not eligible                             |
| 9.  | 3.5 x 4.0 = 14  | 21                  | Not eligible                             |
| 10. | 2.0 x 2.5 = 5   | 18                  | Not eligible                             |

According to the overall measurement results, the toddler's room has lighting that falls short of the quality standard. The lighting comes from natural sources, such as ventilation, but the lack of windows and the position of other buildings in the room mean that the intensity of the sun is low. In addition, using dark-colored curtains and opening window curtains to avoid glare and privacy contributes to the room's inadequate lighting. The study found that only one glass roof tile was used as an alternative for light entry, and this resulted in the highest light intensity. We can assume that a transparent roof can facilitate the entry of light into a toddler's room. The use of mechanical light, such as lamps, is still very minimal.

Parents who prefer to sleep in dim or dark conditions may contribute to this issue, as they often neglect to monitor the light intensity in their toddler's room. Rooms with good air require natural lighting from the sun, which can kill pneumonia-pathogenic bacteria. <sup>(7)</sup>. When lighting does not meet the requirements, toddlers have a 1.421 times higher risk of developing pneumonia <sup>(21)</sup>. Minimal lighting will have an impact on the temperature and humidity in the room <sup>(22)</sup>.

**PM10**

Based on the results of PM10 measurements in the toddler's room, the results were obtained, namely:

Table 5. Room PM10 Concentration Measurement Results

| No. | Room Size (M2)  | Measurement results<br>(mg/m <sup>3</sup> ) | Information<br>(Quality Standard ≤ 70 mg/m <sup>3</sup> ) |
|-----|-----------------|---------------------------------------------|-----------------------------------------------------------|
| 1.  | 3.0 x 3.0 = 9   | 9                                           | Qualify                                                   |
| 2.  | 3.0 x 5.0 = 15  | 6                                           | Qualify                                                   |
| 3.  | 3.0 x 4.0 = 12  | 2                                           | Qualify                                                   |
| 4.  | 3.0 x 3.0 = 9   | 5                                           | Qualify                                                   |
| 5.  | 2.5 x 3.0 = 7.5 | 3                                           | Qualify                                                   |
| 6.  | 3.0 x 2.5 = 7.5 | 12                                          | Qualify                                                   |
| 7.  | 3.0 x 3.0 = 9   | 8                                           | Qualify                                                   |
| 8.  | 3.0 x 3.0 = 9   | 3                                           | Qualify                                                   |
| 9.  | 3.5 x 4.0 = 14  | 3                                           | Qualify                                                   |
| 10. | 2.0 x 2.5 = 5   | 5                                           | Qualify                                                   |

Based on the measurement results, the entire toddler's room has a PM10 concentration that meets quality standards. The use of firewood for cooking and smoking at home is one source of PM10 pollutants. The entire household uses firewood, as well as LPG. The kitchen's insulation with smoke ventilation and semi-permanent woven bamboo walls, which provide cavities for smoke to escape, contribute to the low dust residue.

Regarding the smoking factor, all residents of the house have a habit of smoking within the house; however, they typically do so in a different room or near a ventilation area, such as an open door. The concentration of PM10 caused by cigarette smoke in open ventilation or doors is lower than that in closed doors <sup>(23)</sup>. Even at low dust levels, smoking is a dangerous source of indoor pollution <sup>(24)</sup>. Exposure to third-hand smokers on the surface of objects increases the risk of respiratory infections in toddlers, which can lead to pneumonia <sup>(25)</sup>.

## CONCLUSIONS AND RECOMMENDATIONS

According to Minister of Health Regulation No. 1077/2011, the physical air quality in the rooms of toddlers who have pneumonia in the Pakusari Community Health Center working area, Jember Regency, still does not meet the requirements, so there is a risk of pneumonia in toddlers. Toddlers with pneumonia typically have characteristics such as ages between 0-24 months and 24-59 months, gender, exclusive breastfeeding, and a history of measles. Suggestions, such as a program providing glass blocks, can increase monitoring and the number of healthy houses for those affected by pneumonia. Health cadres can engage the community through posyandu and disseminate information on social media. People can enhance air circulation and sunlight by increasing ventilation, adopting the habit of opening windows and window curtains, refraining from smoking indoors, and enhancing the practice of drying pillows, bolsters, and mattresses, particularly in the morning, as well as regularly changing pillowcases, bolsters, and bed sheets.

## REFERENCES

1. WHO. Pneumonia [Internet]. 2021. Available from: <https://www.who.int/news-room/fact-sheets/detail/pneumonia>
2. UNICEF. Lembaga kesehatan dan anak memperingatkan satu anak meninggal akibat pneumonia setiap 39 detik [Internet]. 2019. Available from: <https://www.unicef.org/indonesia/id/press-releases/lembaga-kesehatan-dan-anak-memperingatkan-satu-anak-meninggal-akibat-pneumonia-setiap#:~:text=Lembaga kesehatan dan anak memperingatkan satu anak meninggal akibat pneumonia setiap 39 detik>
3. Kemenkes. Rencana Strategi Kementerian Kesehatan Tahun 2020-2024. 2020;

4. Sari DA, Budiyo, Darundiati YH. Hubungan antara Kualitas Udara dalam Ruang dengan Kejadian Pneumonia pada Bayi di Wilayah Kerja Puskesmas Bandarharjo Kota Semarang. Media Kesehat Masy Indones [Internet]. 2019;18(3):12–8. Available from: <https://ejournal.undip.ac.id/index.php/mkmi/article/view/23233/15468>
5. WHO. Household air pollution and health [Internet]. 2022. Available from: <https://www.who.int/news-room/fact-sheets/detail/household-air-pollution-and-health>
6. Suseno B, Pratiwi SR. Description Of Risk Factors For The Case Of Pneumonia In Toddlers In The Work Area Of Uptd Puskesmas Banjarnegara 1 In 2021. Medsains. 2022;8(01):1–9.
7. Zairinayati. Lingkungan Fisik Rumah dan Penyakit Pneumonia [Internet]. Tangerang Selatan: Pascal Books; 2022. Available from: [https://www.google.co.id/books/edition/Lingkungan\\_Fisik\\_Rumah\\_Dan\\_Penyakit\\_Pneu/93hjEAAAQBAJ?hl=en&gbpv=1&dq=jenis+kelamin+pneumonia&pg=PA80&printsec=frontcover](https://www.google.co.id/books/edition/Lingkungan_Fisik_Rumah_Dan_Penyakit_Pneu/93hjEAAAQBAJ?hl=en&gbpv=1&dq=jenis+kelamin+pneumonia&pg=PA80&printsec=frontcover)
8. Departemen Kesehatan RI. Pedoman Program Penyakit Infeksi Saluran Pernapasan Akut untuk Penanggulangan Pneumonia pada Balita. Jakarta; 2004.
9. Jannah M, Abdullah A, Hidayat M, Asrar Q. Analisis Faktor Risiko Yang Berhubungan Dengan Kejadian Pneumonia Balita Di Wilayah Kerja Uptd Puskesmas Banda Raya Kota Banda Aceh Tahun 2019. Jukema (Jurnal Kesehat Masy Aceh). 2020;6(1):20–8.
10. Pratama IH. Faktor-Faktor Yang Berhubungan Dengan Penyakit Pneumonia Pada Anak Di Rsu Royal Prima Medan Tahun 2016. J Prim (Prima Med Journal). 2020;3(2):0–5.
11. WHO. Breastfeeding [Internet]. 2023 [cited 2023 Mar 9]. Available from: [https://www.who.int/health-topics/breastfeeding#tab=tab\\_2](https://www.who.int/health-topics/breastfeeding#tab=tab_2)
12. Saunders R. ASI Eksklusif sebagai Salah Satu Proteksi terhadap Pneumonia pada Anak. Cermin Dunia Kedokt [Internet]. 2017;44(7):2017. Available from: <https://media.neliti.com/media/publications/401011-asi-eksklusif-sebagai-salah-satu-proteks-82823c8e.pdf>
13. Kulsum U, Astuti D, Wigati A. Kejadian Pneumonia Pada Balita Dan Riwayat Pemberian Asi Di Uptd Puskesmas Jepang Kudus. J Ilmu Keperawatan dan Kebidanan. 2019;10(1):130.
14. Handayani VV. Penyebab Campak Bisa Meningkatkan Risiko Alami Pneumonia [Internet]. 2020. Available from: <https://www.halodoc.com/artikel/penyebab-campak-bisa-meningkatkan-risiko-alami-pneumonia>
15. Maulianti S, As ZA, Junaidi J. Kecukupan Udara Mempengaruhi Kenyamanan Pada Ruang Kamar. J Kesehat Lingkung J dan Apl Tek Kesehat Lingkung. 2021;18(1):19–26.
16. Agustyana K, Ginandjar P, Dian Saraswati L, Hestningsih R. Hubungan Kondisi Lingkungan Rumah dengan Kejadian Pneumonia pada Balita di Daerah Perkotaan (Studi di Wilayah Kerja Puskesmas Bergas). J Kesehat Masy [Internet]. 2019;7(1):176–85. Available from: <http://ejournal3.undip.ac.id/index.php/jkm>
17. Bahri S. Udara dan Populasi Berisiko [Internet]. Bandung: Media Sains Indonesia; 2022. Available from: [https://www.google.co.id/books/edition/Udara\\_dan\\_Populasi\\_Berisiko/8ZeJEAAAQBAJ?hl=id&gbpv=1&dq=kualitas+udara+dan+pneumonia&pg=PA168&printsec=frontcover](https://www.google.co.id/books/edition/Udara_dan_Populasi_Berisiko/8ZeJEAAAQBAJ?hl=id&gbpv=1&dq=kualitas+udara+dan+pneumonia&pg=PA168&printsec=frontcover)
18. Bahri B, Raharjo M, Suhartono S. Dampak Polusi Udara Dalam Ruangan Pada Kejadian Kasus Pneumonia: Sebuah Review. Link. 2021;17(2):99–104.
19. Kementrian Kesehatan. Profil Kesehatan Indonesia. Jakarta; 2019.
20. Wahyudi A, Zaman C, Studi P, Kesehatan M, Ventilasi L, Risiko F, et al. Analisis kejadian ispa pada anak dalam lingkungan keluarga perokok di wilayah kerja uptd puskesmas x kota palembang. 2022;2(3):475–82.
21. Dewi G, Hazainudin F, Sari D, Joegijantoro R. Analisis Risiko Lingkungan Fisik Rumah dan Kebiasaan Merokok terhadap Kasus Pneumonia pada Balita di Pamekasan. 2023;2:95–

- 105.
22. Harahap. Hubungan Lingkungan Fisik Rumah Dengan Kejadian Pneumonia Pada Balita Di Desa Tarai Bangun Wilayah Kerja Upt Blud Puskesmas Tambang. *Kesehat Tambusai*. 2021;2(September):296–307.
23. Fariyah N' U, Sumeru K. Pengaruh Asap Rokok pada Konsentrasi Partikulat PM10 di Dalam Rumah. *Ind Res Work Natl Semin*. 2021;12:814–20.
24. Prabowo K, Muslim B. Penyehatan Udara [Internet]. Buku Bhan. Badan PPSDM Kesehatan Kemenkes; 2018. Available from: [https://perpus.poltekkesjkt2.ac.id/setiadi/index.php?p=show\\_detail&id=3362&keywords=](https://perpus.poltekkesjkt2.ac.id/setiadi/index.php?p=show_detail&id=3362&keywords=)
25. Yani A, Tuahta Sipayung S. Penyuluhan Bahaya Paparan Asap Rokok Terhadap Penyakit ISPA Balita di Kelurahan Helvetia Timur Kecamatan Medan Helvetia. *Jukeshum J Pengabd Masy*. 2023;3(1):52–7.