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RESEARCH ARTICLE

Pediatrician's Perception of Air Pollution and its Impact on Children's Health in Indonesia

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Abstract:

Introduction:

Air pollution is an unseen threat to children's health as it increases the risk of respiratory infection by impairing immune responses to the respiratory tract. Nevertheless, health promotion emphasizing the impact of air pollution is not popular, even among health professionals. Therefore, this study aimed to explore the perceptions of paediatricians regarding its impact on children's health in Indonesia.

Materials and Methods:

A cross-sectional design using an online questionnaire was employed in this study. It was composed of 30 items and divided into 4 sections, *i.e.* section 1 explored the demographic variables, section 2 measured the respondent's information-seeking behavior on the issue of air pollution, section 3 measured the perception of issues related to air pollution and its impact on children's health, and section 4 explored the respondent's experience in practicing environmental health education with respect to their patients. Only completed surveys were analysed.

Results:

Of the 171 pediatricians who were accessed for the survey, 120 (70.2%) completed it. The majority of respondents (69%) resided in Java island and worked in urban areas (84%). About 41.7% of the respondents had little to no information on the impact of air pollution on children's health. More than 80% of the respondents received information from scientific articles, followed by seminars (61.5%), the internet (53.8%), colleagues (30.7%), and workshops/training (17.3%). Nearly one-third of the respondents considered air quality as poor in their working environment. Almost all agreed that air pollution can affect children's health and increase the risk of respiratory allergies and even the risk of skin allergies for children under two years of age. In daily practice, most respondents (53.3%) admitted that they never or rarely treated patients with diseases related to air pollution. About one-third of the respondents (36.7%) had never or rarely asked their patients about their living environment.

Conclusion:

Pediatricians are aware of the impact of air pollution on the risk of respiratory allergies and infection, and therefore often provide environmental health education to patients. This study has reported that the majority of pediatricians in Indonesia have an understanding of the impact of air pollution on children's health; however, there is still a lack of health promotion to be communicated to the patients and their families in their daily practice.

Keywords: Air pollution, Children's health, Pediatrician, Respiratory, Skin allergies, Pediatricians.

Article History

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1. INTRODUCTION

Air pollution is considered a major environmental threat that is increasingly becoming a global concern. The World Health Organization (WHO) reported that 6.5 million deaths annually can be attributed to air pollution [1]. Air pollution

affects low- and middle-income countries disproportionately, with the highest concentrations in Asian countries, including Indonesia. In the last decade, the air pollution levels in Indonesia increased almost double, with the average concentration of particulate matter (PM) 2.5 being $17 \mu\text{g}/\text{m}^3$, exceeding the WHO recommended concentration, *i.e.*, $10 \mu\text{g}/\text{m}^3$ [2]. Istiqomah *et al.* assessed the air quality index among several cities in Indonesia and found an average PM 2.5 among the cities in the range of 11.8 to $140 \mu\text{g}/\text{m}^3$, all above the WHO

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guideline [3]. There are many factors contributing to the level of air pollution, including vehicular sources, biomass burning activities, forest fire, coal combustion, dust and industrial sources, *etc.* Without strict regulation from the government, the PM concentrations can further increase and eventually cause health problems in the society.

Effects of short-term and long-term exposure to air pollution have been reported in many publications. The association between air pollution and the occurrence of respiratory symptoms, cardiovascular diseases, hospital admissions, and mortality, has been well established [4 - 8]. These health effects are not experienced only by adults, but also children. Ambient air pollution contributed to 4.2 million premature deaths in 2016, of which 300,000 of them were children aged under five [9, 10]. Exposures to air pollution contribute to the risk of acute respiratory infection, which is considered one of the leading causes of child mortality [11]. Evidence from sixteen Asian countries has also shown a significant association between an increase in PM 2.5 and child mortality [12]. Furthermore, exposure to air pollution has been linked to asthma incidence, allergic disease, childhood cancer, and neurobehavioral development [13].

Despite the well-known health effects of air pollution among children, little is being done to improve the air quality in Indonesia. In addition, health promotion interventions considering environmental health effects on children are limited [14]. A survey in the United States revealed that 90% of healthcare professionals require public environmental health education, and unfortunately, 68% of them also lack educational resources on specific training and public education regarding paediatric environmental health [15]. The impact of air pollution on child health in Indonesia has not been explored, and currently, no campaign or health promotion is being done to raise the awareness of parents or health professionals. Therefore, this study aimed to explore the perceptions of health professionals, particularly paediatricians, regarding the impact of air pollution on children's health.

2. MATERIALS AND METHODS

2.1. Research Design

This study employed a cross-sectional approach. Data were collected by all authors, consisting of 3 females (Dewi Sumaryani Soemarko, Levina Chandra Khoe, Erika Wasito) and 1 male (Ray Basrowi) with the help of a trained study team using questionnaires developed based on the literature review and expert discussion. Data collection was conducted from August to October, 2021.

2.2. Population and Study Setting

This study was carried out using an online questionnaire. The participants were paediatricians legally able to practice medicine in Indonesia and who responded to an invitation sent. Consent from the participants was obtained at the start of the questionnaire after providing them with an explanation of the study. Participants could continue to fill out the questionnaire only after agreeing to participate in the study by performing an electronic tick in the questionnaire.

2.3. Sample Size and Sampling Process

The population of paediatricians was estimated to be approximately 3,700 people in Indonesia and only 27% of the respondents were found to have sufficient knowledge of air pollution [16]. Using an 8% margin error and 95% confidence level, the recommended minimum sample size was 115 paediatricians. The survey was disseminated using the snowball sampling technique through the Whatsapp group platform, email addresses, and telephone numbers in the database of paediatricians enlisted in Alomedika.

2.4. Instrument

The instrument used for data collection was adopted from the Survey on Child Environmental Health Awareness of Health Care Professionals [17]. The survey was composed of 30 items that could be completed in about 10 minutes duration and divided into 4 sections, *i.e.*, section 1 explored the demographic variables, section 2 measured the respondent's information-seeking behavior on the issue of air pollution, section 3 measured the perception about issues related to air pollution and its impact on children's health, and section 4 explored the respondent's experience in practicing environmental health education with respect to their patients. In section 3, the respondent may choose a score on a four-point Likert scale with the response options: strongly agree, agree, disagree, and strongly disagree. While in section 4, the respondents may choose among the following options: never, rarely, sometimes, and almost always.

2.5. Data Analysis

Data were analysed using the Statistical Package for Social Sciences (SPSS) version 22.0 (IBM Corp., USA). Data analysis was done using proportions and percentages. For the association, the Chi-square test was employed. A p-value of < 0.05 was considered significant and presented.

2.6. Research Ethics

All subjects gave their informed consent before filling out the questionnaire. The study received ethics approval from the Ethics Committee of Atma Jaya Catholic University of Indonesia (No: 06/05/KEP-FKIKUAI/2021).

3. RESULTS

3.1. Demographic Details

Of the 171 paediatricians who were accessed for the survey, 120 (70.2%) completed it. As the survey was a voluntary response and a self-administered one, no data were obtained on the reason for those who were not responding and not completing the survey. Only completed surveys were analysed (Table 1). The majority of respondents (69%) resided in Java island and worked in urban areas (84%). Half of the respondents were male (50%), with the mean age of overall respondents being 44±13 years.

3.2. Information-seeking Behavior

About 41.7% of respondents had little to no information about the impact of air pollution on children's health. More

than 80% of the respondents received information from scientific articles, followed by seminars (61.5%), the internet (53.8%), colleagues (30.7%), and workshops/training (17.3%). In daily practice, most respondents (53.3%) admitted that they

never or rarely treated patients with diseases related to air pollution. About one-third of the respondents (36.7%) had never or rarely asked the patients about their living environment.

Table 1. Demographics of respondents.

Characteristics	Java Island (n=83)		Outside Java Island (n=37)		p-value
	n	%	n	%	
-					-
Gender	39	32.5	21	17.5	0.323
Male	44	36.7	16	13.3	
Female					
Type of workplace	-	-	-	-	-
General hospital	29	24.2	25	20.8	0.002*
Private hospital	50	41.7	10	8.3	-
Private practice	4	3.3	2	1.7	-
Working area	-	-	-	-	-
Urban	71	59.2	30	25	0.050*
Rural	7	5.8	7	5.8	-
Industrial area	5	4.2	0	0	-
Length of work	40	33.3	25	20.8	0.049*
≤ 5 years	43	35.8	12	10.8	
> 5 years					

Note: * significant (p ≤ 0.05).

Table 2. Perceptions regarding the impact of air pollution on children's health.

Item Question	n	%
Exposure to air pollution during pregnancy and the first year of life increases the risk of respiratory tract infections in infants under 2 years of age.	53	44.2
Strongly agree	63	52.5
Agree	3	1
Disagree	1	0.8
Strongly disagree		
There is a relationship between air pollution and skin infections.		
Strongly agree	13	10.8
Agree	88	73.3
Disagree	19	15.8
Strongly disagree		
Nutritional intervention, through the provision of prebiotics, probiotics, and symbiotics, can increase immunity to reduce health risks related to air pollution.	13	10.8
Strongly agree	93	77.5
Agree	13	10.8
Disagree	1	0.8
Strongly disagree		
Providing prebiotics, probiotics, and symbiotics can indirectly stimulate the immune system in children.		
Strongly agree	27	22.5
Agree	90	75.0
Disagree	2	1.7
Strongly disagree		
Exposure to air pollution is associated with gastrointestinal disease.		
Strongly agree	12	10.0
Agree	81	67.5
Disagree	27	22.5
Strongly disagree		
Exposure to air pollution is associated with inflammatory bowel disease.		
Strongly agree	9	7.5
Agree	72	60.0
Disagree	39	32.5
Strongly disagree		

(Table 2) contd.....

Item Question	n	%
Exposure to air pollution is associated with irritable bowel syndrome.		
Strongly agree	9	7.5
Agree	68	56.7
Disagree	43	35.8
Strongly disagree		

3.3. Perceptions about Air Pollution and its Impact on Children's Health

Nearly one-third of the respondents (29.17%) answered that the air quality in their working environment was bad. Respondents agreed that forest fire is the main source of air pollution (70.8%), followed by smog (55.0%), industrial emissions (38.8%), and vehicle emissions (35.8%). As mentioned in Table 2, almost all respondents agreed that exposure to air pollution would influence children's health in general (99.1%), increase the risk of respiratory allergies (98.3%), and increase the risk of skin allergies among children under two years of age exposed during pregnancy or infant (91.7%).

3.4. Practice of Providing Environmental Health Education

Based on the survey, respondents often provide environmental health education to patients regarding the association between air pollution and the risk of respiratory allergies and infection. However, more than half of the respondents did not provide education on the association between air pollution and the risk of inflammatory bowel disease (64.1%). Upon further analysis, it was found that pediatricians who worked longer (> 5 years) were significantly associated with providing education on the association between air pollution during pregnancy and the first year of life and increasing risk of respiratory infections in infants under 2 years of age (OR: 2.23; 95% CI: 1.05-4.75; $p < 0.05$), but not significant in terms of the domicile area (Java island/outside Java).

4. DISCUSSION

The results of this study are useful to identify the gap in providing environmental health education to patients and their caregivers. In our study, most respondents had been found to have minimum information related to the impact of air pollution on children's health. The source of information was mainly from scientific articles that could be accessed online. This is understandable since the topic of air pollution is not included in the medical curriculum in detail. The International Pediatric Association has encouraged basic training or continuing educational activities for pediatricians on environmental health [18, 19]. Nevertheless, currently, there is no coordinated strategy on this issue at the global and national levels [20].

The strategy to increase the knowledge and skills of health professionals is part of the effort to improve health outcomes in the population. Low literacy has been linked to poor health outcomes, like more hospitalization and low utilization of health services. Adults with poor health literacy have been reported to have poorer health outcomes than those with better

health literacy [21]. Information from health professionals is believed to be more trusted than information from social media or the internet. A study in the US revealed that information from doctors is the most trusted by patients [22]. Additionally, patients with higher trust in their doctors have reported having better health outcomes [23]. Health professionals who have knowledge regarding the impact of air pollution on children's health are expected to be able to inform patients and their families on this subject, and therefore, could prevent health risks related to air pollution.

Despite the rising issue of the impact of air pollution on children's health, about one-third of the respondents stated that they did not ask about the environmental condition of their patients during their daily practice. We assume that there is not much concern regarding this issue among the health professionals. A qualitative study held in India assessed the perception of medical doctors and found that they paid minimal attention to the air pollution issue [16]. This is also consistent with previous research, which found that clinicians (family physicians, general practitioners, pediatricians, obstetricians, gynecologists, nurses, and midwives) focus on a single environmental exposure (notably tobacco) because they believe they have a broader set of concrete mitigation strategies to recommend to patients for these environmental hazards, as opposed to others over which individual patients have no direct control (including air pollution) [24].

Most pediatricians are well aware of the impact of air pollution on the increasing risk of respiratory and gastrointestinal-related diseases, as evident in the level of agreement by respondents (Tables 2 and 3). However, this has not been translated into daily practice. We hypothesized respondents residing in Java to have better access to information and a better attitude toward practicing environmental public health education. Nevertheless, there was not found any difference in terms of respondents' practice between those living in Java and outside Java island. We also assumed that those with a longer working period (> 5 years) may have better attitudes and practices. Nevertheless, we found a significant difference only in question about providing education on the association between air pollution during pregnancy and the risk of respiratory infections in infants in the first two years of life ($p < 0.05$).

In this study, we merely sought the risk perception from health practitioners, and not from the public. Previous studies have analyzed the perceptions of pediatricians, other health professionals, and the public regarding environmental health, and this have resulted in information disparities between these groups. Those working in the health sector had been reported to have higher concerns and better knowledge than the public. However, the actions had not been translated into daily practice among health professionals [25].

Table 3. Respondent's practice of providing environmental health education.

Item Question	n	%
Education on the association between air pollution and the risk of respiratory allergies.	60	50.0
Almost always	40	33.3
Sometimes	16	13.3
Seldom	4	3.3
Never		
Education on the association between air pollution exposure during pregnancy and the first year of life and the risk of skin allergies in children.	28	23.3
Almost always	42	35.0
Sometimes	28	23.3
Seldom	21	17.5
Never		
Education on the association between air pollution during pregnancy and the first year of life and increased risk of respiratory infections in infants under two years of age.	59	49.2
Almost always	30	25.0
Sometimes	24	20.0
Seldom	7	5.8
Never		
Education on the association between air pollution and the risk of inflammatory bowel disease.	15	12.5
Almost always	28	23.3
Sometimes	25	20.8
Seldom	52	43.3
Never		
Giving recommendations for patients to consume prebiotics/probiotics/symbiotics to reduce the risk of allergies in children due to air pollution.	45	37.5
Almost always	31	25.8
Sometimes	30	25.0
Seldom	14	11.7
Never		

The air quality in Indonesia is a concern since the PM 2.5 concentration in general is above the WHO guideline. Jakarta itself has been categorized as one of the cities with the poorest air quality in the world. In this study, we did not find any difference in terms of the perception of pediatricians regarding air quality between those working in urban and rural areas. Yet, previous studies have highlighted higher concerns regarding air pollution from urban dwellers due to vehicle emissions, industrial facilities, and city construction [26].

4.1. Strengths and Limitations

To the best of our knowledge, this is the first study in Indonesia that has sought to understand the risk perception of pediatricians regarding air pollution. The result of this study would be beneficial to the government and medical communities in developing effective strategies to promote environmental health awareness among the public. Nevertheless, this study involves several limitations. The survey only sought to obtain the risk perception from pediatricians; however, parents and teachers also have an important role in the promotion of children's health [27]. In addition, the questions in this study have not been specific to the type of air pollutants that might have provided a picture of different impacts on the children's health [28].

CONCLUSION

In conclusion, this study has revealed that the majority of pediatricians in Indonesia are aware of the impact of air pollution on children's health. However, there is still a need for improvement in promoting environmental health in daily

practice, specifically in relation to the impact of air pollution on children's health.

AUTHORS' CONTRIBUTION

Dewi Sumaryani Soemarmo and Ray Wagiu Basrowi contributed to the study conceptualization. Levina Chandra Khoe, Erika Wasito, and Ray Wagiu Basrowi participated in data curation and formal analysis. Erika Wasito and Ray Wagiu Basrowi contributed to the funding acquisition. Erika Wasito performed the investigation. Dewi Sumaryani Soemarmo and Levina Chandra Khoe contributed to the methodology. Levina Chandra Khoe and Erika Wasito participated in project administration. Levina Chandra Khoe selected the software. Dewi Sumaryani Soemarmo and Ray Wagiu Basrowi supervised the study. Dewi Sumaryani Soemarmo performed the validation. Ray Wagiu Basrowi participated in visualization. Levina Chandra Khoe and Erika Wasito contributed to the writing of the original draft. Dewi Sumaryani Soemarmo and Ray Wagiu Basrowi participated in writing, reviewing, and editing.

LIST OF ABBREVIATIONS

- WHO** = World Health Organization
- PM** = Particulate Matter
- SPSS** = Statistical Package for Social Sciences

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was approved by the Institutional Review Board

(or Ethics Committee) of Universitas Katolik Indonesia, Atma Jaya, with No. 06/05/KEP-FKIKUAJ, on May 14th 2021.

HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All procedures performed in studies involving human participants were in accordance with the ethical standards of institutional and/or research committee, and with the 1975 Declaration of Helsinki, as revised in 2013.

CONSENT FOR PUBLICATION

Informed consent was obtained from all the participants involved in the study.

STANDARDS OF REPORTING

COREQ guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

This data is obtained based on data collection by authors by using questionnaires. Please kindly find the attached dataset (file name: Copy of Survey Air Pollution Raw Data - final (011121)-English translated).

FUNDING

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CONFLICTS OF INTEREST

Dewi Sumaryani Soemarmo and Levina Chandra Khoe have declared no conflict of interest, while Erika Wasito and Ray Wagiu Basrowi are employees of Danone Specialized Nutrition Indonesia.

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SUPPLEMENTARY MATERIALS

Supplementary material is available on the Publisher's website.

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