JURNAL TEKNIK LINGKUNGAN ITB
E-ISSN: 27146715

Study of The Effect of Dust Concentration on The Perception of Community Respiratory System Disorders in Bandung Regency

Farid W Taradita[1,*] and Indah R S Salami[1,]**
[1]Environmental Engineering Program, Civil and Environmental Engineering, Institut Teknologi Bandung, Jalan Ganesha No. 10, Bandung, Jawa Barat 40132, Indonesia
*E-mail : fwtaradita@gmail.com
**E-mail : indahrss@tl.itb.ac.id

Abstract

Dust (PM_{10} and $PM_{2.5}$) is a significant issue affecting public health globally. The impact of dust concentration particularly causing short-term respiratory system disorders. This study aims to measure dust concentration in Bandung Regency and assess its risks to public health. Dust concentration measurement was carried out for 3 time periods (morning, afternoon, and evening) in 3 sub-districts categorized by land use (agricultural, residential, and industrial). Public health data were obtained through questionnaire on perception of respiratory system disorders experienced by the community. The results of the measurement of dust concentration showed that the highest concentrations of dust were found in the industrial sector, followed by the agricultural and residential sectors. $PM_{2.5}$ and PM_{10} concentrations in the industrial sector exceeded the quality standard, while in the agricultural and residential sectors were within the quality standard. Despite this, correlation analysis showed no significant relationship between dust concentration and respiratory system disorders. Comparative analysis indicated significant differences in dust concentrations between the different sectors. Prevalence ratio analysis indicated that the concentration of dust increased the likelihood of respiratory system disorders by 1.091 times, and HQ of 1.835 showed a possibility of adverse effects occurring due to the concentration of dust in the area.

Keywords: *dust, respiratory disorders, land use*

Abstrak

Debu (PM_{10} dan $PM_{2.5}$) adalah masalah besar yang mempengaruhi kesehatan masyarakat secara global. Dampak dari konsentrasi debu terutama menyebabkan gangguan sistem pernapasan jangka pendek. Penelitian ini bertujuan untuk mengukur konsentrasi debu di Kabupaten Bandung dan menilai risikonya terhadap kesehatan masyarakat. Pengukuran konsentrasi debu dilakukan selama 3 periode waktu (pagi, siang, dan malam) di 3 kecamatan yang dikategorikan berdasarkan penggunaan lahan (pertanian, perumahan, dan industri). Data kesehatan masyarakat diperoleh melalui kuesioner tentang persepsi gangguan sistem pernapasan yang dialami oleh masyarakat. Hasil pengukuran konsentrasi debu menunjukkan bahwa konsentrasi debu tertinggi ditemukan di sektor industri, diikuti oleh sektor pertanian dan perumahan. Konsentrasi $PM_{2.5}$ dan PM_{10} di sektor industri melebihi standar kualitas, sedangkan di sektor pertanian dan perumahan berada dalam standar kualitas. Namun, analisis korelasi tidak menunjukkan hubungan signifikan antara konsentrasi debu dan gangguan sistem pernapasan. Analisis perbandingan menunjukkan perbedaan yang signifikan dalam konsentrasi debu antara sektor-sektor yang berbeda. Analisis rasio prevalensi menunjukkan bahwa konsentrasi debu meningkatkan kemungkinan gangguan sistem pernapasan sebesar 1,091 kali, dan perhitungan HQ sebesar 1,835 menunjukkan kemungkinan efek buruk terjadi akibat konsentrasi debu di daerah tersebut.

Kata kunci: *debu, gangguan pernapasan, tata guna lahan*

INFO ARTIKEL

Sitasi: *Taradita, F.W. & Salami, I.R.S. (2023). Study of The Effect of Dust Concentration on the Perception of Community Respiratory System Disorders in Bandung Regency. Jurnal Teknik Lingkungan, 29 (1), 50-59.*

Article History:
Received 31 Maret 2023
Revised 2 April April 2023
Accepted 4 April 2023
Available online 18 April 2023

1. Introduction

Ambient air pollution is one of the problems that have an impact on public health globally. Based on WHO, in 2016 there were around 4.2 million premature deaths worldwide. This mortality is due to exposure to ambient air pollution (particulate matter), which causes heart disease, stroke, ARI (acute respiratory infections), lung cancer, and COPD (chronic obstructive pulmonary disease). Air pollutant parameters that are strongly related to public health problems are dust/particulate matter (PM), ozone (O_3), NO_2, and SO_2. Air pollutant parameters, especially dust (PM_{10} and $PM_{2.5}$) are one that has a major contribution to global health. Air pollution is known to be produced in various sectors, including the industrial, residential, agricultural, and transportation sectors.

Bandung Regency is a district in West Java Province located in the south of Bandung City and has an area of ± 176,238.67 Ha consisting of 31 districts. The Bandung Regency area is populated by 3 main sectors, namely residential, industrial, and agricultural areas. Based on data obtained from the Bandung Regency BPS, in 2018 the disease with the most cases was non-specific ARI as many as 185,316 cases. ARI can be caused and/or exacerbated by air quality, especially dust, in the environment.

Based on this possibility, it is necessary to conduct further analysis to see the relationship between air quality, especially dust, in the environment and public health risks in Bandung Regency. Therefore, this research was conducted to see the relationship between air quality (dust) and public health risks. In addition, this research is follow-up research to complement research data on public health risks from possible exposure to pollutants from water use. The objectives of this research are as follows (1) determine the air quality in Bandung Regency for dust parameters in the agricultural, industrial, and residential sectors, (2) analyze the relationship between air quality (dust) and the perception of the respiratory system disorders disease in the community in Bandung Regency, and (3) analyze public health risks to dust concentrations in Bandung Regency.

2. Material and Method

This research is cross-sectional research conducted in 3 sub-districts in Bandung Regency. The three sub-districts were selected based on different land uses, namely agriculture, industry, and domestic/residential. Based on this, 3 sub-districts were used as research locations, namely the Ciparay sub-district (agriculture), Dayeuhkolot sub-district (industrial), and Margaasih sub-district (residential).

Primary data was obtained by measuring the concentration of dust in the ambient air in the Margaasih sub-district, Dayeuhkolot sub-district, and Ciparay sub-district. Dust measurement data was sampled using a portable device with the trademark HT-9600 which can directly measured the concentration of PM_{10} and $PM_{2.5}$. Measurements were carried out using the grab sample method with 13 measurement points in each sub-district. Dust measurements were carried out in 3 time periods, namely morning (06.00-10.00), noon (10.00-14.00), and afternoon (14.00-18.00), with each measurement at each point, carried out in triples. Triple measurements are carried out to minimize inaccuracies in the measurements made. The concentration obtained was then calibrated under normal atmospheric conditions (pressure at 1 atm and temperature at 25^0C).

Apart from measuring dust concentration data, primary data were also obtained through questionnaires. Questionnaires were distributed to 75 respondents spread over 3 districts. The questionnaire distributed contained questions related to public health conditions during the past 1 month related to respiratory system disorders that could be caused by exposure to dust in their environment.

The data that has been collected is then processed and analyzed using statistical analysis and risk analysis. Statistical analysis performed was univariate analysis, analysis of dust measurement results, correlation analysis, and comparative analysis. Univariate analysis was conducted to explain or describe the characteristics of each research variable used in the form of tables and/or graphs.

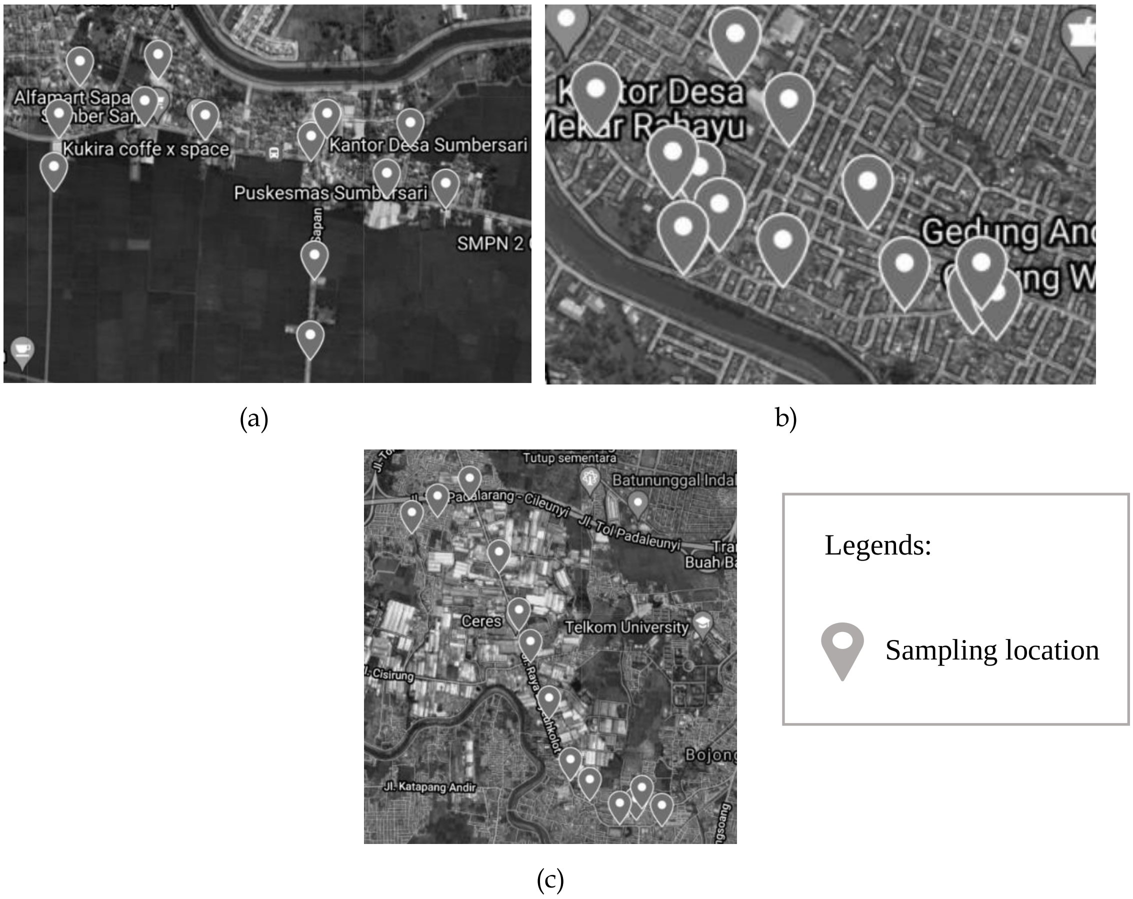


Figure 1. Dust sampling location (a) Ciparay Sub-district, (b) Margaasih Sub-district, (c) Dayeuhkolot Sub-district

Due to the dust measurement carried out using the grab sample method, it is necessary to analyze the results of the dust measurements first before they can be compared with existing quality standards. The analysis of the results of this dust measurement uses the UCL (upper confidence limit) and LCL (lower confidence limit) values because in the range of these two values there is an actual average value of dust (Leidel et al., 1992). Decision-making on the analysis of the results of this dust measurement can be seen in **Table 1**.

Table 1. Basis for drawing conclusions from dust measurement results

	Classification	Definition	Statistic criteria
A.	*Noncompliance exposure*	There is a 95% confidence that dust exposure exceeds the quality standard	LCL (at 95%) > standard
B.	*Possible overexposure*	Exposure to dust not classified under classifications A and B	
C.	*Compliance exposure*	There is a 95% confidence that dust exposure is below the quality standard	UCL (at 95%) ≤ standard

Sumber: (Leidel et al., 1992)

Correlation analysis was conducted to determine the level of closeness of the relationship between two variables. The variable that will estimate the correlation is the concentration of dust with the prevalence of perception of respiratory system disorders. The correlation test used is the Spearman correlation test. The criteria for the level of relationship between variables ranged from -1 to +1.

Comparative analysis was conducted to compare the mean scores of two or more independent groups. This analysis was conducted to compare the average dust concentration between sub-districts with different land uses, namely the agricultural, industrial, and residential sectors. The comparative analysis carried out was the Kruskal-Wallis test.

Risk analysis is carried out by determining the risk of particulate exposure to respiratory system disorders in the community. The data that has been obtained is then analyzed using the cross-sectional method using a 2 x 2 matrix which can be seen in **Table 2**.

Table 2. 2x2 matrix of respiratory system disorders

	Positive respiratory system disorders	Negative respiratory system disorders
Exposed	a	b
Not Exposed	c	d

The exposed group is a group of respondents with a concentration of dust in their environment that possible exceed the quality standard, while the non-exposed group is a group of respondents with a concentration of dust in their environment that is below the quality standard. For cross-sectional research, the risk analysis is expressed in Prevalence Ratio (PR) (Merrill, 2008). Determination of PR is expressed by using equation (1) as follows.

$$PR = \frac{a/(a+b)}{c/(c+d)} \qquad \textbf{Equation 1}$$

In addition, a Hazard Quotient (HQ) for $PM_{2.5}$ is calculated to assess the risk of $PM_{2.5}$ exposure to human health which compares the amount of $PM_{2.5}$ intake and the reference dose (RfD) inhalation or reference concentration (RfC). Intake is the amount of risk agent concentration (mg) that enters the human body with certain body weight (kg) every day (mg/kg day). The RfC $PM_{2.5}$ for this study uses 0.01 mg/kg/day (Novirsa & Achamdi, 2012). HQ value higher than 1 will consider giving risk to the population. Higher the number higher the risk predicted. The equation to calculate intake and HQ are as follows

$$HQ = \frac{Intake}{RfC\ inhalation} \qquad \textbf{Equation 2}$$

$$Intake = \frac{C\ x\ IR\ x\ ET\ x\ EF}{AT\ x\ BW} \qquad \textbf{Equation 3}$$

where C: Concentration of $PM_{2.5}$ in ambient air (mg/m^3); IR: Inhalation rate or the volume of air that enters the body (0.83 m^3/hour); ET: exposure time (24 hour/day); EF: exposure frequency (350 days/year); AT: averaging time period (365 days/years x 30 years (*default lifespan projection*)); BW: body weight (60 kg).

3. Result and Discussion

The results of measurements of PM_{10} and $PM_{2.5}$ dust concentrations in three sub-districts of Bandung Regency for 3 time periods (morning, noon, and afternoon) using HT-9600 are presented in **Table 3** below. Based on **Table 3**, dust concentrations in Ciparay sub-district and Dayeuhkolot sub-district have high concentrations in the morning which can be caused by atmospheric conditions and vehicle volume. Stable atmospheric conditions tend to occur when there is no solar radiation (Vallero, 2008). In the morning, the sun's rays are not as intense as in the afternoon and evening, causing the atmospheric stability to remain quite stable. This fairly stable situation makes vertical air movement in the atmosphere restrained so as to prevent the spread of pollutants. This is exacerbated by the high volume of vehicles, especially in Dayeuhkolot sub-district because dust arises from vehicle fumes and dust resuspension on the streets. The concentration of dust in the afternoon and evening tends to be lower in the three sub-districts because the atmosphere is unstable and the volume of vehicles passing by has decreased.

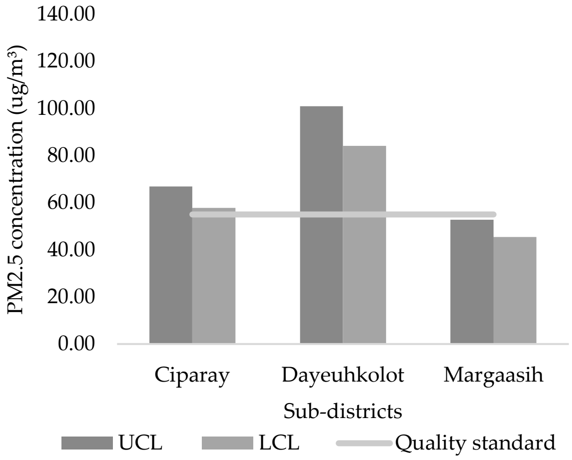
Table 3. Dust concentration in each sub-districts

Measurement location	$PM_{2.5}$ concentration (μg/m^3)			Average (μg/m^3)	PM_{10} concentration (μg/m^3)			Average (μg/m^3)
	Morning	Noon	Afternoon		Morning	Noon	Afternoon	
Ciparay sub-district (agricultural sector)	76.46± 14.24	45.59± 26.37	33.95± 8.94	52.00± 6.96	90.15± 17.35	54.26± 34.03	39.90± 12.42	61.44± 9.49
Dayeuhkolot sub-district (industrial sector)	127.46± 25.41	46.08± 11.01	62.26± 14.99	78.60± 13.11	146.51± 37.98	54.97± 13.19	74.74± 18.36	92.08± 17.62
Margaasih sub-district (residential sector)	49.05± 16.61	19.62± 9.65	58.23± 13.03	42.30± 5.80	58.62± 18.93	24.36± 13.21	68.21± 15.27	50.39± 6.68

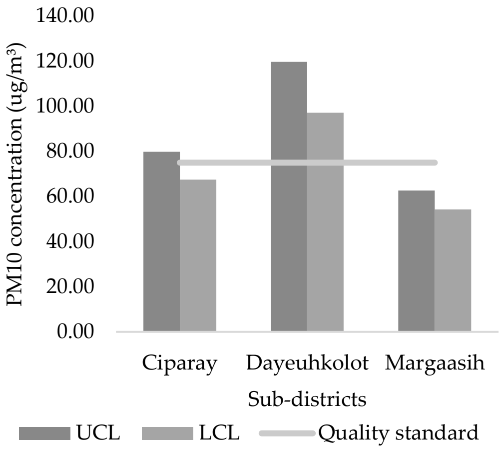
Besides dust concentration, temperature measurement was also conducted in this research with average temperature 27.21^{0}C. Weather conditions, such as temperature, are factors that cannot be controlled, but are very important elements in influencing the concentration of pollutants in the air. Based on some researches, shows that there is an inverse correlation between temperature and dust concentration where the higher the temperature, the lower the dust concentration (Nguyen et al., 2019). And also, the correlation between dust and weather conditions itself has a correlation, but the correlation is low because there is competition between two mechanisms, namely dust dispersion (removal of dust from the air by the deposition process) and dust diffusion from the surface (dust emissions from soil, vehicles, and industrial dust) (Giri et al., 2008). This shows that anthropogenic activities also contribute greatly to the concentration of dust in the environment.

Based on the measurement results, the highest average dust concentration is located in Dayeuhkolot sub-district with an average dust concentration of 78.60 g/m3 for $PM_{2.5}$ and 92.08 g/m^3 for PM_{10}, followed by Ciparay sub-district with an average dust concentration 52 g/m^3 for $PM_{2.5}$ and 61.44 g/m^3 for PM_{10}, and the lowest dust concentration is located in Margaasih sub-district with an average dust concentration of 42.3 g/m^3 for $PM_{2.5}$ and 50.39 g/ m^3 for PM_{10}. This difference in dust concentration levels may be influenced by the land use of the three locations, namely Dayeuhkolot sub-district is an industrial sector area, Ciparay sub-district is an agricultural sector area, and Margaasih sub-district is a residential sector area. These results are in line with similar studies conducted by Jassal, which examined the pollution characteristics of $PM_{2.5}$ and PM_{10} in several areas in Punjab, India (Aslam et al., 2020) and by Novianti, which examined the concentration of PM_{10} in industrial, semi-industrial, and non-industrial areas in Bandung Regency areas (Novianti & Sumeru, 2020). The results of the two studies stated that the highest dust concentration was obtained by industrial areas and the lowest was obtained by residential or non-industrial.

The results of the measurement of $PM_{2.5}$ and PM_{10} concentrations in UCL and LCL were compared with the ambient air quality standards based on Governance Regulation No. 22 of 2021 for $PM_{2.5}$ and PM_{10}, respectively, namely 55 g/m^3 and 75 g/m^3. The comparison can be seen in **Figure 2**. Based on the classification of decision making in **Table 1**, it can be concluded that the concentration of $PM_{2.5}$ in Ciparay sub-district and in Dayeuhkolot sub-district are classified as non-compliance exposure because the LCL value > quality standard and for the concentration of $PM_{2.5}$ in Margaasih sub-district is classified as compliance exposure because the UCL value ≤ quality standard. For the concentration of PM_{10} in Ciparay sub-district is classified as possible over exposure because the LCL value < quality standard and UCL > quality standard, for the concentration of PM_{10} in Margaasih sub-district is classified as compliance exposure because the UCL value ≤ the quality standard, and for the concentration of PM_{10} in Dayeuhkolot sub-district is classified as non-compliance exposure because the LCL value > quality standard.



(a)



(b)

Figure 2. Comparison of UCL and LCL (a) $PM_{2.5}$ and (b) PM_{10} against quality standards

Based on a questionnaire conducted on 75 respondents, spread across Ciparay sub-district (24 people), Dayeuhkolot sub-district (25 people), and Margaasih sub-district (26 people), the distribution of symptoms of respiratory system disorders experienced by respondents can be seen in **Figure 3**. Symptoms respiratory system disorders asked in the questionnaire are symptoms of respiratory system disorders experienced by respondents during April-May 2021.

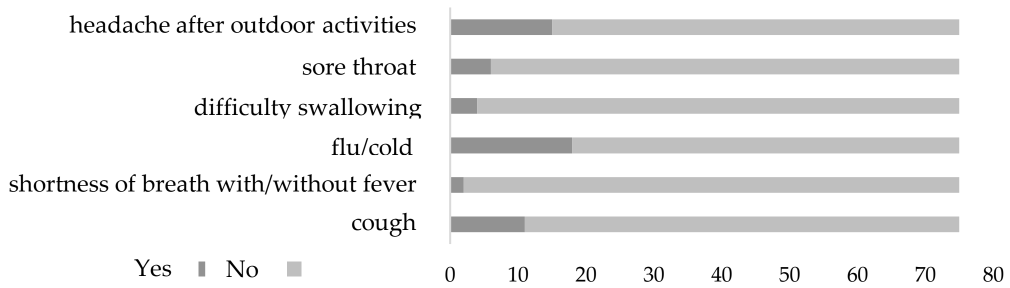


Figure 3. Distribution of symptoms of respiratory system disorders experienced by respondents

Because there are respondents who have more than 1 symptoms, the data is reprocessed to see the number of positive and negative respondents experiencing symptoms of respiratory system disorders which can be seen in **Table 4.**

Table 4. Respondent with respiratory system disorders distribution

Positive respiratory system disorders	41 (45%)
Negative respiratory system disorders	34 (55%)
Total	75 (100%)

The correlation test using the Spearman correlation test which can be seen in **Table 5**, the value of the Spearman correlation coefficient for the concentration of $PM_{2.5}$ and PM_{10} for cases of respiratory system disorders in Bandung Regency is 0.047. This value shows no correlation between the concentrations of $PM_{2.5}$ and PM_{10} on cases of respiratory system disorders symptoms in Bandung Regency. The significance value between $PM_{2.5}$ and PM_{10} concentrations with cases of respiratory system disorders in Bandung Regency is

0.687 (> 0.05) so that there is no significant relationship between $PM_{2.5}$ and PM_{10} concentration variables on cases of respiratory system symptoms. This can be caused by the health data that is seen only based on the subjective memory of each respondent, while respiratory system disorders require further observation, such as checking lung capacity and also too limited data.

Table 5. Spearman correlation test result between dust concentration and cases of respiratory system disorders

Parameter	Correlation coef.	Sig.
$PM_{2.5}$ concentration	0.047	0.687
PM_{10} concentration	0.047	0.687

Then a comparative analysis was carried out to see the difference in dust concentration between the three research locations. Because the data is not normally distributed, non-parametric statistics are used for comparative analysis, namely the Kruskal-Wallis test. In the Kruskal-Wallis test, the assumption is that the data are interval, ratio, or ordinal and are independent. The formulation of the Kruskal-Wallis test hypothesis used for the $PM_{2.5}$ and PM_{10} variable is:
H_0 : There is no difference in $PM_{2.5}$ or PM_{10} concentration between the three research areas
H_a : There is a significant difference in $PM_{2.5}$ or PM_{10} concentration between the three research areas

Table 6. Kruskal-Wallis test result of dust concentration between agricultural sector, industrial sector, and residential sector

Parameter	Kruskal-Wallis value	Chi-square table value	Sig.
$PM_{2.5}$ concentration	29.241	5.991 (df=2)	0.000
PM_{10} concentration	28.084	5.991 (df=2)	0.000

Based on the results of the Kruskal-Wallis comparative test in **Table 6**, it is known that the Kruskal-Wallis value is 29.241 ($PM_{2.5}$) and 28.084 (PM_{10}) which is greater than the value in the chi square table, namely 5.991 (df = 2). In addition, also obtained asymp. Sig. 0.000 (PM_{10} and $PM_{2.5}$) < 0.05. From these two values, the same conclusion can be drawn, namely H0 is rejected and Ha is accepted which means that there is a real or significant difference between dust concentrations from the three research areas (agricultural, industrial, and residential sectors) with the average concentration of $PM_{2.5}$ and PM_{10} respectively from the highest industrial sector > agriculture sector > residential sector. Based on research by Sung, in Daejeon, Korea, the PM_{10} and $PM_{2.5}$ data showed moderate levels of particulate matter, with significant differences in concentration between groups and at the same time between groups over time. The concentration of dust was higher in the order of industry, housing, commerce, and green in all periods. However, the concentration of the industrial group was higher than that of the housing group. This may be due to increased mixed land use (Sung et al., 2020).

In the risk analysis, the concentration of $PM_{2.5}$ and PM_{10} as a risk factor because there is a concentration value that exceeds the quality standard in one sub-district so that it can endanger the health of the surrounding community. The exposed respondents were respondents who were located in sub-districts that had measurement results of $PM_{2.5}$ and PM_{10} concentrations that exceeded the quality standard, while respondents who were not exposed were respondents located in sub-districts that had measurements of $PM_{2.5}$ concentrations below the quality standard. From this definition, 25 respondents were exposed and 50 were not exposed, with details which can be seen in **Table 7** below.

Table 7. Matrix of respiratory system disorders

	Positive respiratory system disorders	Negative respiratory system disorders	Total
Exposed	12	13	25
Not exposed	22	28	50
Total	41	34	75

The PR value is calculated based on **Equation (1)**, the PR is 1.091 (95% CI 0.652-1.824). A PR value of more than 1 indicates that people who are exposed to concentrations of $PM_{2.5}$ and PM_{10} exceeding the quality standard are considered to be associated with cases of the perception on respiratory system disorders because concentrations of $PM_{2.5}$ and PM_{10} increase the likelihood of symptoms of respiratory system disorders by 1.091 times compared to those not exposed to the concentrations of $PM_{2.5}$ and PM_{10} which exceed the quality standard. But because the PR value is near 1, it can be concluded there is a small association between dust concentration with cases of the perception on respiratory system disorders. The 95% CI value is the probability that based on the data it is believed that 95% of the prevalence ratio results are actually in the range of 0.652-1.824. This PR value can be affected by the amount of dust concentration data obtained and also objective measures of respiratory system disorders in the community. The amount of dust concentration data can be obtained by doing continuous (24 hours) measurements using low or high-volume sampler.

The HQ calculation for $PM_{2.5}$ showed that for average adult lives in the area has HQ 1.835. The HQ value is above 1 indicates there is a possibility the adverse effects of dust concentration in the area will occur. This result is in accordance with the estimate of PR. While the HQ value in each sub-district showed respectively from the highest Dayeuhkolot sub-district (2.502) > Ciparay sub-district (1.655) > Margaasih sub-district (1.347). The industrial sector (Dayeuhkolot sub-district) has higher HQ value than other sectors, so it is more likely the effects of dust concentration will be perceived by the community lived in this area.

Table 8. Hazard Quotient (HQ) results

Location	Dust concentration		Intake (mg/kg/day)	HQ
	$\mu g/m^3$	mg/m^3		
Ciparay	52	0.052	0.016554521	1.65545
Dayeuhkolot	78.6	0.0786	0.025022795	2.50228
Margaasih	42.3	0.0423	0.013466466	1.34665
Average	57.633	0.0576	0.018347927	1.83479

In addition to these analyzes, an analysis of secondary data on cases of disease that occurred in Bandung Regency was also carried out. This secondary data was obtained from the Bandung Regency Health Office. The disease data analyzed are disease data related to the concentration of dust in the environment, namely TB, pneumonia, and cough not pneumonia. According to several studies, high PM_{10} and $PM_{2.5}$ air pollution may increase the risk of TB disease (Jassal et al., 2013), and pneumonia can be triggered and exacerbated by the concentration of PM_{10} and $PM_{2.5}$ in ambient air (Pirozzi et al., 2018). Based on **Figure 4**, it can be seen that the number of cases of TB and pneumonia in the last 5 years (2016-2020) in the three sub-districts showed the highest number of cases in Margaasih sub-district and the lowest number of cases in Dayeuhkolot sub-district.

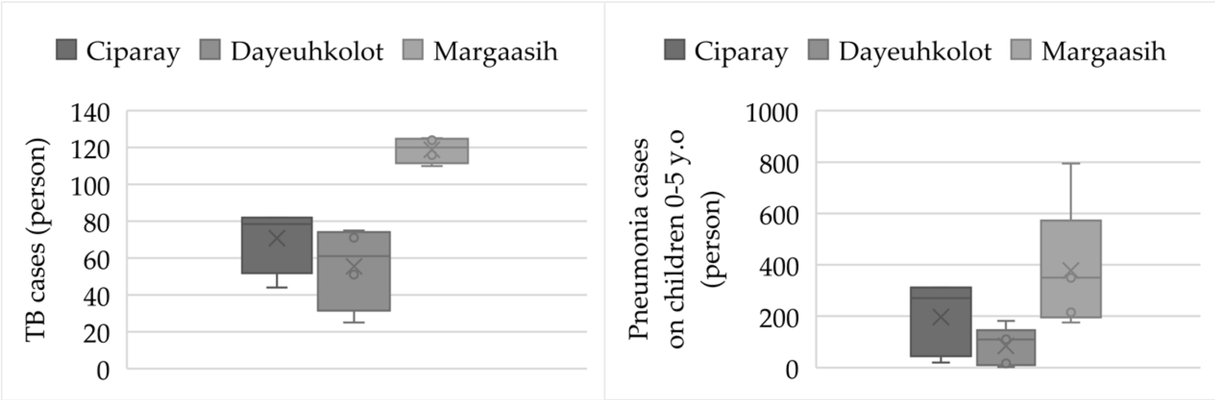


Figure 4. Number of cases of TB and pneumonia in Ciparay, Dayeuhkolot, and Margaasih sub-districts

This secondary data is inversely proportional to the measured dust concentration data so that it can be concluded that this dust concentration does not significantly affect the incidence of the disease. This is can happen because of the sampling data is not representative (too little) and there are other risk factors that contribute more to the incidence of the disease, TB and pneumonia, such as the level of population density where Margaasih sub-district is the district with the highest population density level compared to the other two sub-districts so that the process of spreading the disease will be easier (Depkes, 2007) and also there is other materials in dust besides particulate matter that can cause respiratory system diseases, such as heavy metals, pathogen organisms, etc. The different land uses will also affect the distribution of materials in dust. Research based in Changsha, China showed that heavy metals in street dust have higher concentration in residential area than agricultural area, it cause by the wear of motor vehicles, road materials, and weathering of building coatings and paint is higher in urban area (He et al., 2021). Further research is needed to determine the cause of other than particulate matter.

4. Conclucion

The dust concentration was measured in 3 sub-districs in Bandung Regency. It is found that the dust concentration measured in 3 time periods, morning, noon, and afternoon has the highest concentration value in the morning. From the three sub-districts, it is known that the concentrations of $PM_{2.5}$ and PM_{10} in Ciparay sub-district and Margaasih sub-district under normal atmospheric conditions are exceeding the quality standard. While concentrations of $PM_{2.5}$ and PM_{10} in Margaasih sub-district under normal atmospheric conditions still meet the quality standard.

Correlation analysis showed no correlation between $PM_{2.5}$ and PM_{10} concentrations on the perception of symptoms of respiratory system disorders in Bandung Regency. The comparative test showed the dust measurement sequentially from the highest, it was found that Dayeuhkolot sub-district > Ciparay sub-district > Margaasih sub-district. Based on the risk analysis, the PR value is 1.091 and the HQ value for $PM_{2.5}$ is 1.835 indicates there is a possibility the adverse effects of dust concentration in the area will occur.

Based on secondary data on cases of disease incidence related to dust concentrations, such as TB, pneumonia, cough not pneumonia, and other diseases, the results showed that the highest number of cases of the disease was in Margaasih sub-district, followed by Ciparay sub-district and Dayeuhkolot sub-district. The results are inversely proportional to this research results so it needs further research to know if dust concentration and pollutant parameters in the dust can affect public health.

Acknowledgment

This study was supported by P2MI 2021 ITB Research Grant.

References

Aslam, A., Ibrahim, M., Shahid, I., Mahmood, A., Irshad, M. K., Yamin, M., ... & Shamshiri, R. R. (2020). Pollution characteristics of particulate matter (PM2. 5 and PM10) and constituent carbonaceous aerosols in a South Asian future megacity. *Applied Sciences*, *10*(24), 8864.

Depkes. (2007). *National Guidelines for Countermeasures Tuberculosis Edition 1.* Jakarta: Depkes RI.

Giri, D., Adhikary, P. R., & Murthy, V. K. (2008). The influence of meteorological conditions on PM10 concentrations in Kathmandu Valley.

He, Y., Zhang, Y., Peng, C., Wan, X., Guo, Z., & Xiao, X. (2021). Distribution characteristics and risk assessment of heavy metals in soil and street dust with different land uses, a case in Changsha, China. *International Journal of Environmental Research and Public Health*, *18*(20), 10733.

Jassal, M. S., Bakman, I., & Jones, B. (2013). Correlation of ambient pollution levels and heavily-trafficked roadway proximity on the prevalence of smear-positive tuberculosis. *Public health*, *127*(3), 268-274.

Leidel, N. A., Busch, K. A., & Lynch, J. R. (1992). *Occupational Exposure Sampling Strategy Manual.* Ohio: OSHA.

Merrill, R. M. (2008). *Environmental Epidemiology Principles and Methods.* London: Jones and Bartlett.

Nguyen, A. D., Duong, H. S., Nguyen, T. D., & Doan, Q. T. (2019). Effect of Meteorological Factors on PM_{10} Concentration in Hanoi, Vietnam. *Journal of Geoscience and Environment Protection*, 7 138-150.

Novianti, S. F., & Sumeru, K. (2020). Pengukuran Konsentrasi PM10 pada Daerah Industri, Semi-Industri, dan Non-Industri di Kabupaten Bandung. *Prosiding The 11th Industrial Research Workshop and National Seminar.*

Pirozzi, C. S., Jones, B. E., VanDerslice, J. A., Zhang, Y., Paine III, R., & Dean, N. C. (2018). Short-term air pollution and incident pneumonia. A case–crossover study. *Annals of the American Thoracic Society*, *15*(4), 449-459.

Sung, S. J., Sang, H. L., & Yountaik, L. (2020). Temporal Changes in Air Quality According to Land-Use Using Real Time Big Data from Smart Sensors in Korea. *Sensors*, 20 6374

Vallero, D. A. (2008). *Fundamental of Air Pollution: Fourth Edition .* California: Academic Press.