Jurnal Ilmiah Kanderang Tingang
Vol.17 No.2 Juli-Desember 2026
FKIP Universitas Palangka Raya

ISSN 2087-166X (printed)
ISSN 2721-012X (online)
DOI: https://doi.org/10.37304/jikt.v17i2.466

Mapping Climate and Air Quality Risks for Acute Respiratory Infections in Eastern Priangan, Indonesia

Andhy Romdani[1,*], Mudatsir[2,a], Fahmi Rahmat Amanulloh[1,b], Muhammad Raka El Ghifari[1,c], Revianti Coenraad[3,d], Daniel Bara Padang Allo[4,e], And Haniful Birri Ramdani[1,f]

[1] Department of Civil Engineering, Faculty of Engineering, Siliwangi University, Tasikmalaya, West Java, Indonesia, 46196

[2] Medical College, Faculty of Medical and Health, Muhammadiyah University of Jakarta, Indonesia, 15419

[3]Department of Building Engineering Education, Faculty of Teacher Training and Education, Palangka Raya University, Palangka Raya, Indonesia, 73111

[4] Department of Civil Engineering, Faculty of Engineering, Universitas Cenderawasih, Jayapura, Indonesia, 99351

*Corresponding author: andhyromdani@unsil.ac.id, [a] mudatsir@umj.ac.id, [b] fahmirahmatt@gmail.com, [c] rakaghifari84@gmail.com, [d] revianti@ptb.upr.ac.id, [e]danielsipiluncen@gmail.com, [f]haniframdani19@gmail.com

Received: 12-07-2026; Accepted: 06-11-2026; Published: 09-11-2026

ABSTRACT

Climate change has become a significant public health concern, particularly through its influence on air quality and the incidence of respiratory diseases. Variations in temperature, precipitation, humidity, and wind speed have been shown to exacerbate health vulnerabilities, especially in climate-sensitive regions. This study examines the relationship between climatic parameters, air quality, and respiratory disease admissions in East Priangan, Indonesia, using observational data from 2022 to 2023. Findings reveal a distinct increase in respiratory infections during periods of climatic extremes—specifically, high rainfall and temperature during September–November (SON) 2022, and low rainfall and temperature from July to October 2023. Although air quality in the region generally meets national standards, the Air Quality Index (AQI) deteriorated during prolonged dry periods, correlating with a rise in hospital admissions for respiratory illness. Children were identified as the most affected age group, emphasizing the demographic sensitivity to environmental change. These findings highlight the multifactorial nature of respiratory disease risks, shaped by both direct and indirect effects of climate variability. The study recommends integrated mitigation strategies that combine engineering measures, healthcare preparedness, and local government action to address future climate-related health risks.

Keywords: Climate change, respiratory disease, air quality index, extreme weather, geospatial Analysis

This work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License. Copyright © Author.

ISSN 2087-166X (printed)
ISSN 2721-012X (online)
DOI: https://doi.org/10.37304/jikt.v17i2.466

INTRODUCTION

Climate change has emerged as a critical global issue, affecting a broad range of sectors, including the economy, agriculture, ecosystems, and public health (Di Napoli et al., 2022; Rocha et al., 2022). The impact of climate change, marked by increasing frequency and intensity of extreme weather events, has significant implications for public health. These include shifts in the distribution of infectious diseases, a rise in the incidence of waterborne illnesses, and a deterioration in air quality (Haines et al., 2006; IOM UN Migration, 2023; Manyullei, 2010; National Institute of Environmental Health Sciences, 2024). Among the most affected health domains are respiratory diseases, including allergic respiratory disorders, asthma, chronic obstructive pulmonary disease (COPD) exacerbations, and reduced lung function, all of which have shown strong associations with climate variability (Connolly et al., 2021).

Globally, respiratory diseases such as COPD, asthma, acute lower respiratory tract infection, tuberculosis (TBC), and lung cancer are the leading causes of morbidity and mortality (Soriano et al., 2020). In 2017, an estimated 544.9 million people were living with chronic respiratory disease− an increase of 39.8% compared to 1990. These conditions ranked as the third leading cause of death worldwide, accounting for 7.0% of global deaths and representing an 18% increase since 1990. Similarly, in the European Union, respiratory diseases contributed to 8% of all deaths in 2015, with over 440,000 fatalities−a 15% rise from the previous year (OECD/EU, 2018).

In Indonesia, respiratory diseases−including TBC, COPD, and lower respiratory infections, ranked among the top ten causes of death in 2019, affecting individuals across all ages and genders, according to World Health Organization (2020) data. Notably, children aged 1−4 years are particularly vulnerable to acute respiratory infections (ARI), a condition influenced by socioeconomic status, maternal employment, and geographic factors (Fathmawati et al., 2021; Windi et al., 2021). Additional contributors to ARI include smoking, seasonal influenza, and environmental degradation (Santika et al., 2023; Susilarini et al., 2018; Yunus et al., 2019). Studies from Indonesian cities such as Bogor, Pekanbaru, and Bandung also suggest that ARI incidence fluctuates with changes in meteorological parameters and air pollutant levels (Irawan et al., 2017; Khalida Akmatul Arsyad, 2023; Wellid et al., 2024).

In Tasikmalaya, acute nasopharyngitis and upper respiratory tract infection ranked first and third, respectively, in disease prevalence for the year 2024, according to the Tasikmalaya Central Bureau of Statistics (Badan Pusat Statistik Kota Tasikmalaya, 2024). This study utilizes hospital admissions data from dr. Soekardjo General Hospital, covering six regions in East Priangan: four regencies (Garut, Tasikmalaya, Sumedang, and Ciamis) and two cities (Tasikmalaya and Banjar) (**Figure 1**). Patterns of respiratory illness in this region appear to correlate with fluctuations in climatic variables such as temperature, wind speed,

ISSN 2087-166X (printed)
ISSN 2721-012X (online)
DOI: https://doi.org/10.37304/jikt.v17i2.466

precipitation, and humidity (BPS Kota Tasikmalaya, 2024). For example, Tasikmalaya Central Bureau of Statistics reports that the average temperature in 2018 was 24.8°C, where it increased in 2023 to 25.3°C (BPS Kota Tasikmalaya, 2019, 2024). On the other hand, precipitation has shown a downward trend, from 276.60 mm in 2018 to 136.00 mm in 2023. Similarly, humidity decreased significantly in the 5-year interval, from 83.7% in 2018 to 79.0% in 2023.

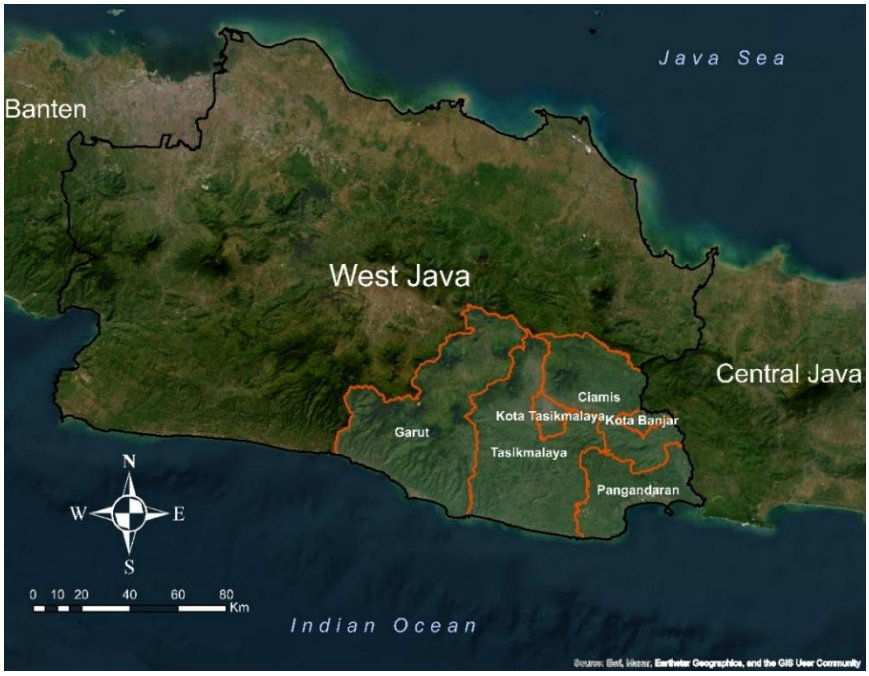


Figure 1. The map of East Priangan includes four regencies (Garut, Tasikmalaya, Sumedang, and Ciamis) and two cities (Tasikmalaya and Banjar).

Interestingly, previous studies indicate that while air pollution is often linked to respiratory disease, the air quality in Tasikmalaya generally complies with national standards (PP RI No. 41/1999), with the key parameters (e.g., SO_2, NO_2, O_3, TSP, NH_3, H_2S) within acceptable limits (Salman et al., 2023). Real-time monitoring in August 2024 also categorized the air quality as moderate to fair, with PM 2.5 identified as the dominant pollutant (Weather.com, Wunderground.com, and Air.plumelabs.com). These observations raise questions about whether climate variability, rather than poor air quality, plays a more prominent role in the incidence of respiratory infections in the region.

While previous studies have examined the association between air quality and respiratory infections in several Indonesian cities, limited attention has been given to the combined effects of climate variables—such as temperature, humidity, wind speed, and precipitation—and air quality on respiratory disease patterns in medium-sized urban settings like Tasikmalaya. Moreover, there is a lack of localized, evidence-based analysis to guide effective mitigation strategies tailored to the environmental and demographic context of this region. This study addresses this gap by analyzing the spatiotemporal relationship between climatic parameters and the incidence of acute respiratory infections (ARI) in the East Priangan region

ISSN 2087-166X (printed)
ISSN 2721-012X (online)
DOI: https://doi.org/10.37304/jikt.v17i2.466

of Indonesia. Specifically, it aims to: (1) assess the prevalence and seasonal variation of respiratory infections in East Priangan; (2) determine the peak periods of infection; (3) evaluate the strength of correlation between meteorological factors and ARI incidence; (4) investigate the impact of air quality parameters; and (5) propose evidence-based mitigation strategies to reduce the burden of respiratory infections in the context of climate change.

METHODS

This study utilized a descriptive and correlational design to examine the relationship between climate variables and the incidence of acute respiratory infections (ARI) in East Priangan, West Java, Indonesia. The analysis focused on data spanning two full years, from January 1, 2022, to December 31, 2023.

Daily meteorological data—comprising average temperature (T), precipitation (R), and relative humidity (RH)—were obtained from the Copernicus EU Climate Reanalysis database. The data originated from a single meteorological monitoring station located in Tasikmalaya (coordinates: 7.522905°S, 108.269636°E), situated approximately 21.6 km from dr. Soekardjo General Hospital, the primary healthcare facility participating in this study.

Concurrently, daily hospital admission records for respiratory infections were retrieved from the hospital's medical record unit. The dataset included confirmed cases of complicated respiratory infections such as acute bronchitis, pneumonia, and exacerbations of chronic respiratory illnesses, as classified using ICD-10 diagnostic codes. The descriptive analysis was conducted to observe temporal trends in climate variables and respiratory infection incidence. Further statistical correlation analysis was employed to assess the strength and direction of associations between climatic factors and daily ARI admissions.

RESULTS AND DISCUSSION

Complicated Respiratory Infections in East Priangan, West Java

Hospital admissions for respiratory infections recorded at dr. Soekardjo General Hospital in Tasikmalaya were used as a proxy for disease incidence in the East Priangan region between 2022 and 2023. **Table 1** summarizes the number of respiratory cases stratified by age and gender.

Age classification was divided into five groups following previous epidemiological studies (EC Department, Parul Institute of Engineering & Technology, Limda, Vadodara, India et al., 2014): infants (0–2 years), children (3–16 years), young adults (17–30 years), middle-aged adults (31–45 years), and older adults (>45 years). This stratification aims to identify vulnerable populations, especially among pediatric patients.

The data reveal that infants and children accounted for the majority of respiratory admissions across both years. Notably, there was a marked increase in cases during July to September in both 2022 and 2023 (see **Figure 2**), particularly

ISSN 2087-166X (printed)
ISSN 2721-012X (online)
DOI: https://doi.org/10.37304/jikt.v17i2.466

among children aged 3–16 years. These seasonal peaks may correspond with fluctuations in temperature and humidity during the dry season in East Priangan, suggesting a potential climate-sensitive pattern in ARI occurrence.

Table 1. Number of respiratory infection admissions by age group and gender in East Priangan, 2022–2023

Characteristics		Number of Admissions	
		2022	2023
Age Group			
	0–2	96	145
	3–16	116	142
	17–30	12	25
	31–45	13	18
	>45	14	25
Gender			
	Male	126	194
	Female	123	161

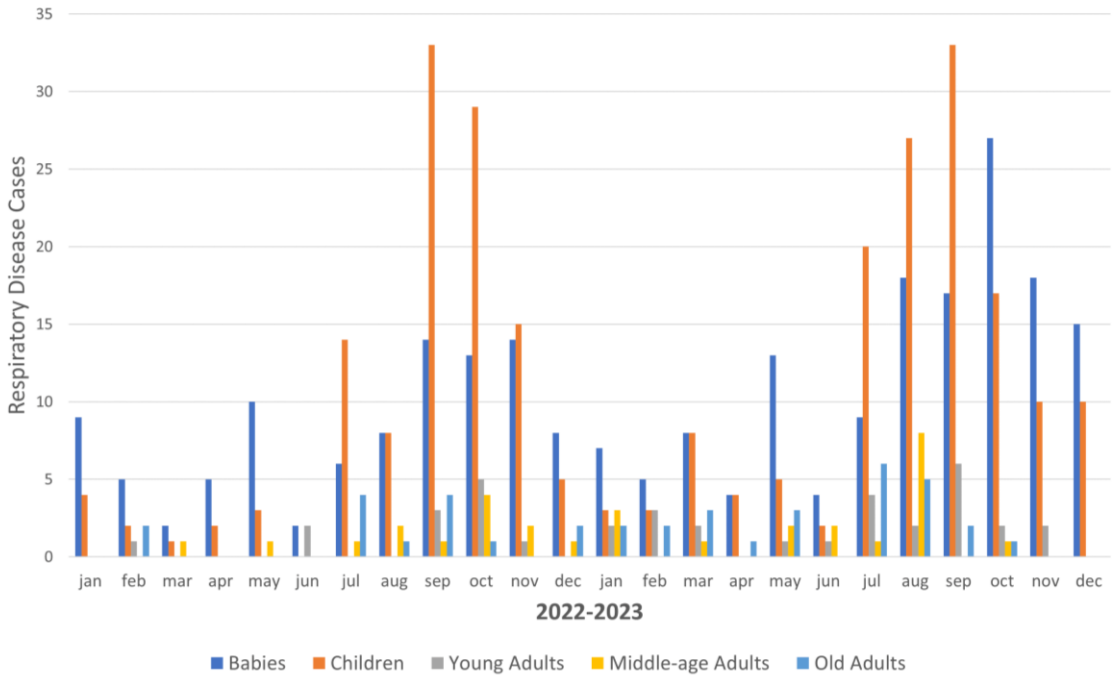


Figure 2. Monthly distribution of respiratory infection cases by age group in East Priangan (2022–2023)

While this preliminary finding suggests a seasonal correlation between climatic patterns and respiratory illness, further analysis incorporating meteorological and air quality data is necessary to confirm a causal relationship. Previous studies have highlighted similar age-group susceptibility during periods of low humidity and temperature inversion (Kinney, 2008; Pandya-Wood et al., 2024).

ISSN 2087-166X (printed)
ISSN 2721-012X (online)
DOI: https://doi.org/10.37304/jikt.v17i2.466

Evidence of Climate Variation in East Priangan Timur based on Temperature, Precipitation, and Humidity

To investigate the regional manifestation of climate variability, this study analyzed changes in temperature, wind patterns, precipitation, and relative humidity over East Priangan between 2022 and 2023. **Figures 3(a)** and **3(b)** illustrate the spatial distribution of average near-surface temperature (2 m above ground level) across Java Island. In 2022, temperature differences between the northern and southern coastal zones were relatively minimal. However, in 2023, a pronounced contrast emerged, with cooler conditions observed along the southern coast. These variations may be attributed to changes in sea surface temperatures, which modulate atmospheric pressure gradients and subsequently affect regional wind speed and direction.

The evolution of surface air temperature in East Priangan is shown in **Figure 3(c)**. The average monthly temperature in 2022 was relatively stable, with a mean of 24.93°C. In contrast, temperatures dropped significantly in mid-2023, reaching as low as 22.16°C in August. This decline appears to be associated with stronger wind circulation during the second half of 2023. As depicted in **Figure 3(d)**, elevated wind speeds from May to December likely enhanced evaporative cooling and increased atmospheric mixing, leading to lower ambient temperatures.

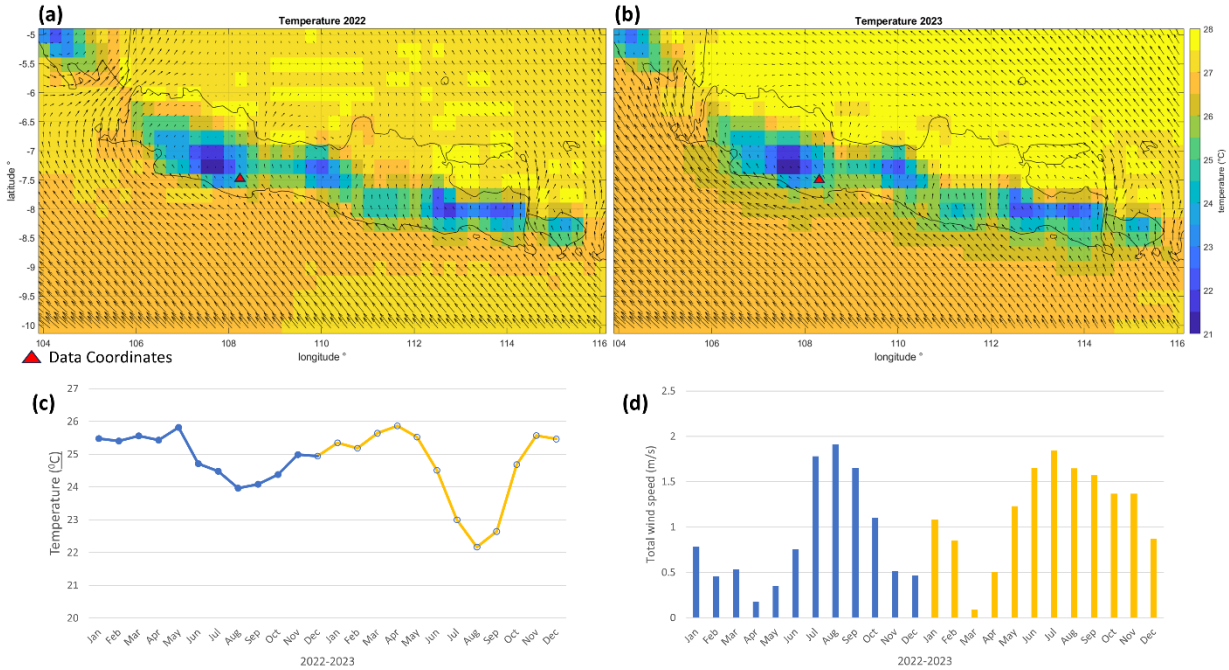


Figure 3. (a–b) Monthly averaged temperature and wind circulation over Java Island in 2022 and 2023; (c) Monthly temperature in East Priangan (2022–2023); (d) Monthly total wind speed (m/s) at 10 m height.

Wind dynamics not only affect thermal conditions but also play a crucial role in modulating precipitation patterns. **Figures 4(a)** and **4(b)** show a clear reduction in rainfall across Java in 2023 compared to 2022. Notably, early 2022

ISSN 2087-166X (printed)
ISSN 2721-012X (online)
DOI: https://doi.org/10.37304/jikt.v17i2.466

(January to March) experienced widespread rainfall, likely driven by positive zonal winds (west-to-east) and negative meridional winds (south-to-north), as illustrated in **Figure 4(c)**. In contrast, periods characterized by negative zonal and positive meridional winds, such as June–August 2022 and May–December 2023, coincided with marked reductions in precipitation.

Humidity patterns closely followed rainfall trends. As seen in **Figure 4(d)**, higher precipitation was associated with elevated relative humidity, while drier months resulted in significant humidity declines. These fluctuations have potential implications for respiratory health, as lower humidity and reduced precipitation have been associated with increased vulnerability to airborne pathogens and respiratory irritation (Kinney, 2008; Pandya-Wood et al., 2024).

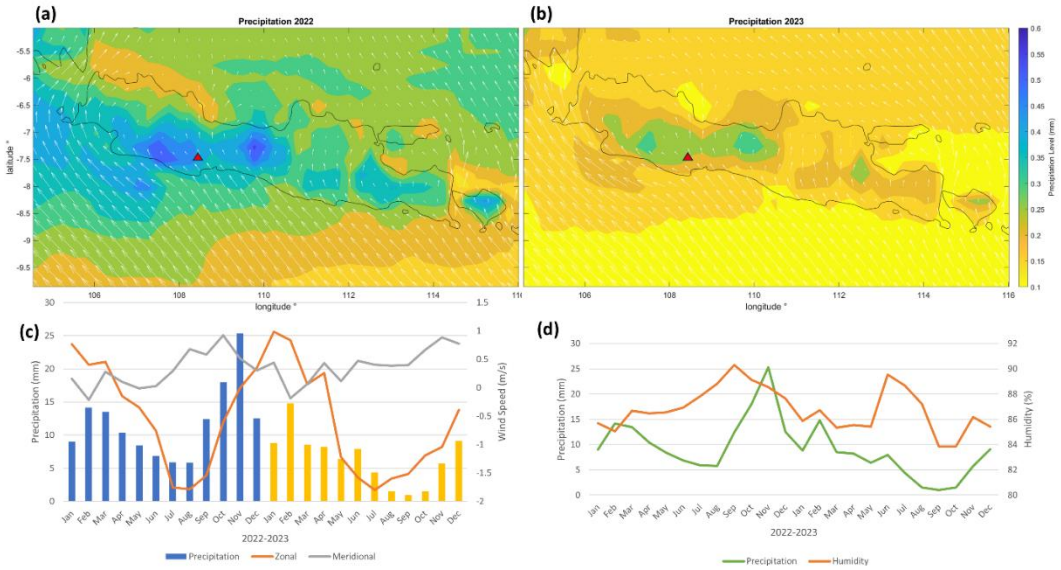


Figure 4. (a–b) Monthly total precipitation over Java Island (2022–2023); (c) Wind vector patterns and their influence on precipitation in East Priangan; (d) Correlation between precipitation and relative humidity.

Influence of Precipitation and Temperature on Air Quality and Respiratory Health

Precipitation and temperature are two primary climate parameters that are closely modulated by wind speed, which affects the vertical and horizontal transport of atmospheric particles. These variables jointly influence air quality, particularly through their effects on particulate matter concentration and pollutant dispersion. **Figure 5** illustrates the contrasting climate conditions in East Priangan across two years: 2022, characterized by higher precipitation and relatively elevated temperatures; and 2023, marked by reduced rainfall and cooler temperatures.

The Air Quality Index (AQI), a composite measure of multiple pollutants including $PM_{2.5}$, PM_{10}, NO_2, SO_2, CO, and O_3, is used as an indicator of ambient air pollution levels. As shown in **Figure 6**, AQI values were generally lower (better air quality) during 2022, coinciding with increased rainfall. This suggests a scavenging

ISSN 2087-166X (printed)
ISSN 2721-012X (online)
DOI: https://doi.org/10.37304/jikt.v17i2.466

effect, wherein raindrops effectively remove atmospheric particulates—a phenomenon well-documented in atmospheric sciences (Yoo et al., 2014; Zheng et al., 2019).

Conversely, during 2023, the limited rainfall corresponded with elevated AQI values, indicating poorer air quality. Reduced precipitation impairs the wet deposition process, allowing pollutants to accumulate in the lower atmosphere. This scenario may increase exposure to harmful air pollutants, particularly $PM_{2.5}$, which is known to exacerbate respiratory conditions such as asthma and acute lower respiratory infections (Zoran et al., 2020). These findings underline the critical role of climate variables—especially precipitation—in modulating air pollution levels, which in turn may influence the incidence of respiratory illnesses in vulnerable populations.

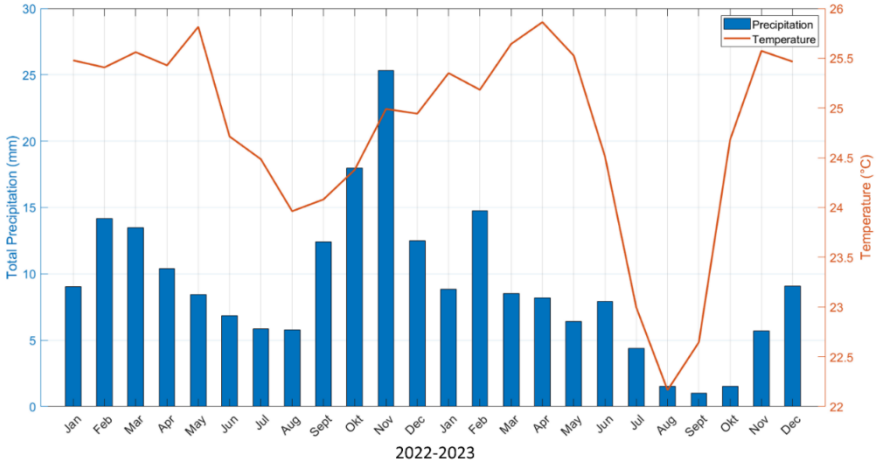


Figure 5. Relationship between average monthly precipitation and temperature in East Priangan, 2022–2023.

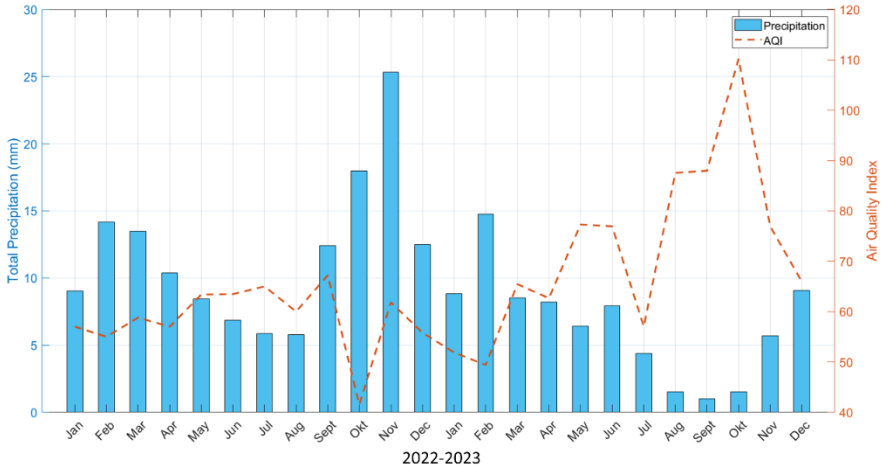


Figure 6. Association between monthly precipitation and Air Quality Index (AQI) in East Priangan, 2022–2023.

ISSN 2087-166X (printed)
ISSN 2721-012X (online)
DOI: https://doi.org/10.37304/jikt.v17i2.466

Admission of Respiratory Diseases Related to Air Quality Index and Climate Parameters

Hospital admissions for respiratory diseases in East Priangan showed seasonal variation that correlates with air quality fluctuations driven by climate conditions. **Figure 7** illustrates the monthly Air Quality Index (AQI) alongside hospital admission data from 2022 to 2023. During 2022, respiratory disease cases were relatively lower, coinciding with predominantly good to moderate AQI levels. This suggests that favorable air quality contributed to reduced disease burden during that year. However, anomalies in September to November 2022 (SON) exhibited an unexpected increase in admissions despite stable AQI, indicating the influence of additional climate factors such as elevated temperature and humidity during this period (**see Figure 5**).

In 2023, there was a marked increase in respiratory disease admissions, especially during July to October, which corresponded with degraded air quality and extreme dry conditions. This pattern supports the hypothesis that both poor air quality and climate extremes (either excessively wet or dry periods) contribute to respiratory health risks. While AQI serves as a key environmental health indicator, its health impact is likely modulated by concurrent meteorological conditions including temperature, humidity, and wind patterns. Therefore, respiratory disease trends in East Priangan appear to be jointly influenced by climatic and atmospheric parameters.

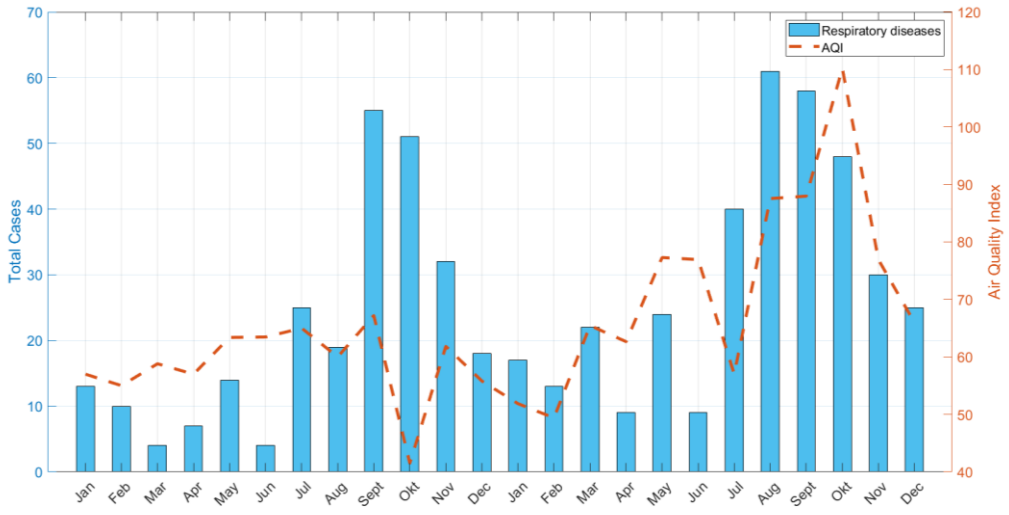


Figure 7. Air Quality Index and monthly data of respiratory diseases taken from dr. Soekardjo General Hospital of Tasikmalaya

Mitigation Strategies for Climate-Related Respiratory Diseases

Mitigating climate-related respiratory diseases requires a dual-pronged approach from both engineering and medical perspectives. From the engineering side, long-term climate adaptation involves sustainable urban planning, enhancement of green infrastructure, and reduction of emissions through improved

ISSN 2087-166X (printed)
ISSN 2721-012X (online)
DOI: https://doi.org/10.37304/jikt.v17i2.466

waste management and public transportation. Urban greening and reforestation not only help sequester carbon but also reduce ambient air temperatures and filter airborne pollutants, contributing to improved respiratory health outcomes.

In parallel, the health sector must enhance adaptive capacity through surveillance systems, early warning mechanisms for extreme climate events, and public health preparedness. Vulnerable groups, particularly children and the elderly, should receive prioritized access to healthcare, vaccination, and education about environmental risks. Health facilities in high-risk areas must be equipped to manage seasonal surges in respiratory illnesses.

Importantly, engineering strategies such as atmospheric monitoring stations and climate modeling can provide early warnings for health agencies, allowing proactive medical responses. **Figure 8** illustrates the complementary roles of engineering and medicine in both short-term and long-term mitigation strategies against climate-related respiratory diseases.

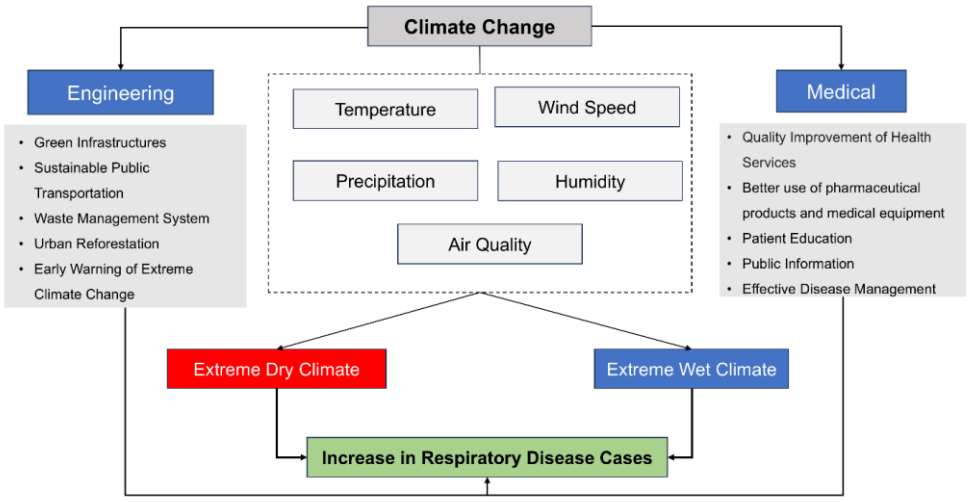


Figure 8 Conceptual framework of integrated engineering and medical strategies in mitigating climate-induced respiratory diseases.

Policy Implications for Local Government and Health Authorities

The findings of this study emphasize the urgent need for local governments and health authorities in East Priangan to adopt integrated climate and health governance. The increasing incidence of climate-related respiratory diseases, particularly among vulnerable age groups, signals that climate change is no longer a distant environmental issue but an immediate public health threat. Local governments should prioritize policies that bridge environmental monitoring and public health response. (a) Development of Early Warning Systems. Establishing a climate-health early warning system is crucial. By utilizing meteorological data (e.g., temperature, wind speed, precipitation, and humidity) from sources like BMKG and Copernicus, combined with real-time air quality monitoring (AQI),

ISSN 2087-166X (printed)
ISSN 2721-012X (online)
DOI: https://doi.org/10.37304/jikt.v17i2.466

authorities can forecast high-risk periods for respiratory diseases and alert healthcare facilities in advance. (b) Strengthening Surveillance Systems. Health departments must improve data integration between hospitals, clinics, and environmental agencies. A centralized digital system that links disease incidence with local climate and air quality data will allow for faster, evidence-based responses to outbreaks. (c) Public Education and Risk Communication. Educational campaigns targeting schools, workplaces, and community groups are essential to raise awareness about respiratory risks during extreme weather events. Messaging should include preventive measures, such as staying indoors during poor AQI periods and using protective masks. (d) Urban Environmental Management. Local governments should accelerate investments in green infrastructure such as urban forests, green belts, and improved public transportation systems to reduce emissions. These strategies not only improve air quality but also mitigate urban heat islands, which are exacerbated by climate change. (e) Healthcare System Preparedness. Hospitals and clinics must be equipped to handle seasonal surges in respiratory illnesses. Resource planning—such as adequate staffing, medication supplies, and triage protocols—should be informed by climate-health forecasting models. (f) Targeted Support for Vulnerable Populations. Policy should prioritize medical and social support for babies, children, and elderly citizens who are disproportionately affected by poor air quality and temperature extremes. This includes mobile health services, vaccination programs, and subsidized access to clean air shelters.

In summary, multi-sectoral coordination between environmental agencies, public health departments, and local governance is imperative to mitigate the health impacts of climate change. Investing in proactive, evidence-driven policies will significantly reduce the burden of climate-related respiratory diseases in East Priangan and similar regions across Indonesia.

CONCLUSION

This study highlights the direct link between climate variability—particularly temperature, wind speed, precipitation, and humidity—and the incidence of complicated respiratory diseases in East Priangan, West Java. Among these parameters, temperature emerged as the primary indicator of climate change, with significant influence on air quality and subsequent respiratory health outcomes. Extreme weather conditions during the September–November (SON) periods of 2022 and 2023 coincided with marked surges in respiratory hospital admissions. Notably, the number of cases reached 139 in SON 2022 and 136 in SON 2023, with both peaks recorded in September, indicating consistent seasonal vulnerability.

Children represent the most susceptible group, underscoring the urgency for targeted interventions. These findings reveal the need for an integrated,

ISSN 2087-166X (printed)
ISSN 2721-012X (online)
DOI: https://doi.org/10.37304/jikt.v17i2.466

interdisciplinary approach to public health and environmental management in the face of a changing climate.

From a strategic standpoint, engineering-based climate mitigation solutions—such as urban greening, improved air quality monitoring, and sustainable infrastructure—must be aligned with public health efforts. Simultaneously, the healthcare sector should strengthen its climate resilience through adaptive capacity building, early warning systems, and specialized care for vulnerable populations.

In conclusion, this research reinforces the importance of localized, data-driven policies and cross-sector collaboration in mitigating climate-induced health impacts. Policymakers, public health authorities, and environmental planners must act proactively to safeguard community health in an era of accelerating climate change.

Acknowledgement

My gratitude to all of staff dr. Soekardjo General Hospital of Tasikmalaya, particularly the medical record unit who provides valuable data so the study can be completed.

REFERENCES

Badan Pusat Statistik Kota Tasikmalaya. (2024). *Jumlah Kasus 10 Penyakit Terbanyak Menurut Jenis Penyakit di Kota Tasikmalaya, 2021 dan 2022*. https://tasikmalayakota.bps.go.id/id/statistics-table/1/MTUxNCMx/jumlah-kasus-10-penyakit-terbanyak-menurut-jenis-penyakit-di-kota-tasikmalaya-2021-dan-2022.html

BPS Kota Tasikmalaya. (2019). *Kota Tasikmalaya dalam Angka 2019* (Number 112).

BPS Kota Tasikmalaya. (2024). *Kota Tasikmalaya Dalam Angka 2024* (Vol. 18, Number August).

Connolly, C., Day, R., & Goodall, H. (2021). The Effect of Climate Change on Respiratory Diseases. *Journal of Pulmonary & Respiratory Medicine*, *11*.

Di Napoli, C., McGushin, A., Romanello, M., Ayeb-Karlsson, S., Cai, W., Chambers, J., Dasgupta, S., Escobar, L. E., Kelman, I., Kjellstrom, T., Kniveton, D., Liu, Y., Liu, Z., Lowe, R., Martinez-Urtaza, J., McMichael, C., Moradi-Lakeh, M., Murray, K. A., Rabbaniha, M., … Robinson, E. J. (2022). Tracking the impacts of climate change on human health via indicators: Lessons from the Lancet Countdown. *BMC Public Health*, *22*(1), 663. https://doi.org/10.1186/s12889-022-13055-6

EC Department, Parul Institute of Engineering & Technology, Limda, Vadodara, India, Prajapati, J., Patel, A., & Raninga, P. (2014). Facial Age Group Classification. *IOSR Journal of Electronics and Communication Engineering*, *9*(1), 33–39. https://doi.org/10.9790/2834-09123339

ISSN 2087-166X (printed)
ISSN 2721-012X (online)
DOI: https://doi.org/10.37304/jikt.v17i2.466

Fathmawati, F., Rauf, S., & Indraswari, B. W. (2021). Factors related with the incidence of acute respiratory infections in toddlers in Sleman, Yogyakarta, Indonesia: Evidence from the Sleman Health and Demographic Surveillance System. *PLoS ONE*, *16*(9 September), 1–13. https://doi.org/10.1371/journal.pone.0257881

Haines, A., Kovats, R. S., Campbell-Lendrum, D., & Corvalan, C. (2006). Climate change and human health: Impacts, vulnerability and public health. *Public Health*, *120*(7), 585–596. https://doi.org/10.1016/j.puhe.2006.01.002

IOM UN Migration. (2023). *Climate Change Impacts on Health Affecting Development and Human Mobility*.

Irawan, A., Sutomo, A. H., & Sukandarrumidi. (2017). Indeks standar pencemaran udara, faktor metereologi dan infeksi saluran pernapasan akut di Pekanbaru. *Berita Kedokteran Masyarakat (BKM Journal of Community Medicine and Public Health)*, *33*(5), 225–232.

Khalida Akmatul Arsyad, Y. P. (2023). Studi Kausalitas antara Polusi Udara dan Kejadian Penyakit Saluran Pernapasan pada Penduduk Kota Bogor, Jawa Barat, Indonesia. *Jurnal Multidisiplin West Science*, *02*(06), 462–472.

Kinney, P. L. (2008). Climate Change, Air Quality, and Human Health. *American Journal of Preventive Medicine*, *35*(5), 459–467. https://doi.org/10.1016/j.amepre.2008.08.025

Manyullei, S. (2010). Basheer, Mohamed Khadeer Ahamed, and Amin Malik Shah Abdul Majid. "Medicinal potentials of Orthosiphon stamineus Benth." (2010). *Asia-Pacific Journal of Public Health / Asia-Pacific Academic Consortium for Public Health*, *22*(3), 310–319.

National Institute of Environmental Health Sciences. (2024). *Climate Change and Human Health* (Number February).

OECD/EU. (2018). *Health at a Glance: Europe 2018: State ofHealth in the EU Cycle*. https://doi.org/10.1787/fd41e65f-es

Pandya-Wood, R., Azhari, A., Johar, H., Johns-Putra, A., Muhamad, N., & Su, T. T. (2024). Systematic review of climate change induced health impacts facing Malaysia: Gaps in research. *Environmental Research: Health*, *2*(3), 032002. https://doi.org/10.1088/2752-5309/ad6208

Rocha, J., Oliveira, S., Viana, C., & Ribeiro, A. I. (2022). *Climate change and its impacts on health, environment and economy* (pp. 253–279). https://doi.org/10.1016/B978-0-12-822794-7.00009-5

Salman, N., Taqwa, F. M. L., Alimuddin, A., & Arthono, A. (2023). Air Quality Monitoring and Analysis in Tasikmalaya City. *Journal of Community Based Environmental Engineering and Management*, *7*(1), 25–32. https://doi.org/10.23969/jcbeem.v7i1.7187

Santika, T., Muhidin, S., Budiharta, S., Haryanto, B., Agus, F., Wilson, K. A., Struebig, M. J., & Po, J. Y. T. (2023). Deterioration of respiratory health

ISSN 2087-166X (printed)
ISSN 2721-012X (online)
DOI: https://doi.org/10.37304/jikt.v17i2.466

following changes to land cover and climate in Indonesia. *One Earth*, *6*(3), 290–302. https://doi.org/10.1016/j.oneear.2023.02.012

Soriano, J. B., Kendrick, P. J., Paulson, K. R., Gupta, V., Abrams, E. M., Adedoyin, R. A., Adhikari, T. B., Advani, S. M., Agrawal, A., Ahmadian, E., Alahdab, F., Aljunid, S. M., Altirkawi, K. A., Alvis-Guzman, N., Anber, N. H., Andrei, C. L., Anjomshoa, M., Ansari, F., Antó, J. M., … Vos, T. (2020). Prevalence and attributable health burden of chronic respiratory diseases, 1990–2017: A systematic analysis for the Global Burden of Disease Study 2017. *The Lancet Respiratory Medicine*, *8*(6), 585–596. https://doi.org/10.1016/S2213-2600(20)30105-3

Susilarini, N. K., Haryanto, E., Praptiningsih, C. Y., Mangiri, A., Kipuw, N., Tarya, I., Rusli, R., Sumardi, G., Widuri, E., Sembiring, M. M., Noviyanti, W., Widaningrum, C., Lafond, K. E., Samaan, G., & Setiawaty, V. (2018). Estimated incidence of influenza-associated severe acute respiratory infections in Indonesia, 2013-2016. *Influenza and Other Respiratory Viruses*, *12*(1), 81–87. https://doi.org/10.1111/irv.12496

Wellid, I., Simbolon, L. M., Falahuddin, M. A., Nurfitriani, N., Sumeru, K., Bin Sukri, M. F., & Yuningsih, N. (2024). Evaluasi Polusi Udara PM2.5 dan PM10 di Kota Bandung serta Kaitannya dengan Infeksi Saluran Pernafasan Akut. *Jurnal Kesehatan Lingkungan Indonesia*, *23*(2), 128–136. https://doi.org/10.14710/jkli.23.2.128-136

Windi, R., Efendi, F., Qona'ah, A., Adnani, Q. E. S., Ramadhan, K., & Almutairi, W. M. (2021). Determinants of Acute Respiratory Infection Among Children Under-Five Years in Indonesia. *Journal of Pediatric Nursing*, *60*(xxxx), e54–e59. https://doi.org/10.1016/j.pedn.2021.03.010

World Health Organization (WHO). (2020). *Global health estimates: Leading causes of death*. https://www.who.int/data/gho/data/themes/mortality-and-global-health-estimates/ghe-leading-causes-of-death

Yoo, J.-M., Lee, Y.-R., Kim, D., Jeong, M.-J., Stockwell, W. R., Kundu, P. K., Oh, S.-M., Shin, D.-B., & Lee, S.-J. (2014). New indices for wet scavenging of air pollutants (O3, CO, NO2, SO2, and PM10) by summertime rain. *Atmospheric Environment*, *82*, 226–237. https://doi.org/10.1016/j.atmosenv.2013.10.022

Yunus, F., Ariawan, W. P., & Nurwidya, F. (2019). Smoking behaviors and related factor in indonesian patients with chronic obstructive pulmonary disease in national reference hospital for respiratory diseases. *Pakistan Journal of Chest Medicine*, *25*(1), 6–10.

Zheng, Z., Xu, G., Li, Q., Chen, C., & Li, J. (2019). Effect of precipitation on reducing atmospheric pollutant over Beijing. *Atmospheric Pollution Research*, *10*(5), 1443–1453. https://doi.org/10.1016/j.apr.2019.04.001

Zoran, M. A., Savastru, R. S., Savastru, D. M., & Tautan, M. N. (2020). Assessing the relationship between surface levels of PM2.5 and PM10 particulate

ISSN 2087-166X (printed)
ISSN 2721-012X (online)
DOI: https://doi.org/10.37304/jikt.v17i2.466

matter impact on COVID-19 in Milan, Italy. *Science of The Total Environment*, *738*, 139825. https://doi.org/10.1016/j.scitotenv.2020.139825