

Assessment of Air and Water Quality in the Surroundings of School Environment: Its Relation to Mosquito Population and Environmental Health

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Abstract. This article explores the importance of evaluating air and water quality in the vicinity of school environments and its relation to mosquito populations and environmental health. The author highlights that poorly maintained school environments can become breeding grounds for mosquitoes, including *Aedes aegypti* mosquitoes, which are carriers of serious diseases such as dengue fever. The impact can harm the health of students, school staff, and the surrounding community. This study utilises the Systematic Literature Review method to investigate relevant information from reliable sources such as PubMed, Web of Science, Scopus, and Springer Link. The research provides a deeper understanding of the importance of monitoring and evaluating the air and water quality in school environments to prevent more severe health issues. In addition to addressing mosquito-related concerns, this article also highlights the significant role of climate change and human activities in exacerbating air and water quality issues in the vicinity of school environments. With climate change affecting rainfall patterns and human activities such as industry, intensive agriculture, and transportation contributing to pollution, attention to the conditions of school environments becomes increasingly crucial. The article emphasises the need for proactive actions and comprehensive policies involving various stakeholders, such as schools, government entities, environmental organisations, and the community, to address these issues. Furthermore, increased awareness and education regarding maintaining a healthy environment are crucial to implementing effective preventive measures and protection. We can create safe, healthy, and optimal school environments for students' development and the community's well-being through collaboration and strong commitment from all parties involved.

Keywords: assessment; air quality; water quality; surroundings; school environment; mosquito population; environmental health.

INTRODUCTION

The problems faced in evaluating water and air quality around school environments in Indonesia are water and air pollution that threaten the health and well-being of the school community. Water pollution occurs due to industrial, agricultural, and domestic waste that contaminates the water sources used by schools [1]. On the other hand, air pollution is caused by emissions from motor vehicles, industries, and waste burning, which generate hazardous particles and pollutant gases inhaled by students and school staff [2].

Additionally, the growth of mosquito populations presents a severe problem as mosquitoes can act as vectors for diseases such as dengue fever and malaria, posing a threat to the school community's health [4]. Poor water and air quality can lead to serious health issues for students, school staff, and the surrounding community. Schools, as environments where vulnerable populations like children spend a significant amount of their time, expose them to water and air pollution daily. Long-term exposure to pollutants can cause respiratory disorders, skin irritations, and other illnesses that negatively impact their health [3, 4]. The growth of mosquito populations also complicates this situation. Poorly maintained

school environments can provide ideal conditions for mosquito breeding, including disease vectors such as *Aedes aegypti* mosquitoes that can transmit dengue fever and other illnesses [5]. The increased risk of mosquito-borne infectious diseases can jeopardise the health of students, school staff, and the surrounding community [5].

Monitoring and evaluating air and water quality in school environments is crucial in preventing more significant health problems [6]. Through regular monitoring, early detection of air and water pollution that exceeds safe limits can be achieved [7]. This enables prompt actions to reduce pollution sources and improve and protect the school community's health [8, 9]. Climate change and human activities also significantly exacerbate air and water quality issues around school environments [10, 11]. Climate change can cause changes in rainfall patterns, affecting the quality of water and river flow around schools [12]. Human activities such as industrial operations, intensive agriculture, and transportation also contribute to air and water pollution that affects school environments [13].

Therefore, proactive measures and comprehensive policies are needed to address these problem sources and safeguard the health of school environments [14].

Engaging various stakeholders, including schools, government bodies, environmental organisations, and the community, is essential to improve air and water quality around school environments [15]. Increased education and awareness about maintaining a healthy environment should also be promoted to implement preventive measures and protection [16] effectively. We can create safe and healthy school environments for future generations through collective action and strong commitment.

This study aims to raise awareness about the importance of maintaining a healthy school environment by evaluating air and water quality. The research emphasises the need for higher knowledge and understanding among stakeholders regarding the significance of keeping clean, safe air and water in the school environment. The study promotes a proactive approach to environmental prevention and protection measures by increasing awareness.

This requires collaborative efforts involving schools, government entities, environmental organisations, and the community to develop com-

prehensive policies and implement practical preventive actions. Overall, this research underscores the urgency of evaluating air and water quality in the school environment to ensure the well-being and health of students, staff, and the broader community. The study emphasises the need for collective action and a solid commitment to create a safe, healthy, and optimal learning environment for future generations. By implementing the findings and recommendations of this research, it is hoped that the protection of students, staff and the surrounding community from mosquito-borne diseases and overall quality of life can be achieved.

METHODS

The research method used in this study is a Systematic Literature Review. This method consists of two main points: eligibility criteria and search strategy. A systematic review was conducted to gather information on the Evaluation of Air and Water Quality around School Environments relevant to children's health. The search started with a comprehensive search strategy in PubMed, Web of Science, Scopus, and Springer Link, published between 2012 and 2022, using keywords such as "Air Quality, Surrounding Air, School Environment, Mosquito Population, and Environmental Health".

The search was limited to English articles published between 2010 and 2022. The inclusion criteria involved observational and intervention studies focusing on analysing Air Quality, Surrounding Air, School Environment, and Mosquito Population. Exclusion criteria excluded studies on animals, narrative or editorial reviews, and studies with low methodological quality. Out of the initial 59 identified articles, carefully evaluating titles and abstracts led to the selection of 30 relevant compositions [17]. Studies that did not meet the inclusion criteria were excluded from this research. Subsequently, the studies that met the inclusion criteria were downloaded in full text and critically assessed for each study.

The selection was then narrowed to 13 articles that met the inclusion criteria. Data extraction included article titles, authors, research objectives, study designs, key findings, and health and school environment implications. Results from these 13 high-quality articles were synthesised and organised in a comprehensive table, providing an exciting understanding of the Evaluation

of Air and Water Quality around School Environments: Its Relationship with Mosquito Population and Environmental Health [18]. The following diagram presents the search and study selection results in a graph that provides a visual overview of the research process [19].

RESULTS AND DISCUSSION

This article explores the importance of evaluating air and water quality near schools. The diagram shows the number of studies found, the number of studies excluded, and the number of studies included in the research after critical assessment. The search results are presented in environments and their relationship with mosquito populations and environmental health. The authors highlight that poorly maintained school environments can become breeding grounds for mosquitoes, including the *Aedes aegypti* mosquito,

to, which carries severe diseases like dengue fever.

The impact can harm the health of students, school staff, and the surrounding community. This research provides a deeper understanding of the importance of monitoring and evaluating the air and water quality in school environments to prevent more severe health issues. In addition to addressing the mosquito issue, the article emphasises the significant role of climate change and human activities in worsening the air and water quality around school environments. With climate change affecting rainfall patterns and human activities such as industrial operations, intensive agriculture, and transportation contributing to pollution, attention to the condition of school environments becomes increasingly essential. The publication years range from 2010 to 2022 and were conducted in urban and rural areas such as South Africa, Nigeria, Sweden, and several centres in the United Kingdom.

Table

Resources	Objective	Method	Findings
[20]	This study aimed to evaluate indoor air quality in primary and secondary schools, focusing on its implications for children's health.	The research method monitored air quality parameters such as PM _{2.5} and PM ₁₀ particles, CO ₂ levels, and formaldehyde concentrations.	The findings of this study indicated the presence of air pollution in schools that can negatively impact children's health, particularly respiratory issues.
[21]	This study aimed to evaluate the indoor air quality in urban and rural preschools in Shanghai, China, and conduct a health risk assessment.	The research method measured air pollutant parameters such as PM _{2.5} , PM ₁₀ , SO ₂ , and NO ₂ .	The findings of this study demonstrated that air pollution in preschool classrooms could pose health risks to children, particularly respiratory disorders.
[22]	This study aimed to evaluate the indoor air quality in childcare facilities and examine its association with respiratory and allergic symptoms in children.	The research method involved a cross-sectional survey collecting data on air quality, respiratory symptoms, and allergies in children attending childcare facilities.	The findings of this study revealed a correlation between indoor air quality in childcare facilities and respiratory and allergic symptoms in children.
[23]	This research aimed to assess the disease burden from environmental risks globally and emphasise the importance of preventing diseases through healthy environments.	This study involved a literature review and data analysis from various sources to estimate the disease burden caused by environmental factors.	This research demonstrated that unhealthy environments, including poor air quality, can contribute to various diseases and have significant health impacts.
[24]	This study aimed to evaluate the indoor air quality in schools and examine its association with health and academic performance.	The research method involved measuring air quality parameters and collecting data on student's health and academic performance.	These studies provide valuable insights into evaluating air quality in school environments and its impact on children's health and academic performance. The findings emphasise the importance of ensuring healthy indoor air quality in schools to create a conducive learning

			environment and protect the well-being of students.
[25]	This study aimed to compare airborne particles in classrooms with different types of ventilation: natural ventilation, mechanical ventilation, and air-conditioning.	The research method used appropriate measuring instruments to measure classroom airborne dust particles.	The findings of this study indicated that classrooms with mechanical ventilation or air-conditioning had lower levels of airborne particles than rooms with natural ventilation.
[26]	This study aimed to evaluate the indoor air quality in schools in Hong Kong and assess personal exposure to formaldehyde and acetaldehyde.	The research method included measuring the concentrations of formaldehyde and acetaldehyde in the air and collecting data on indoor air quality.	The findings of this study revealed potential exposure to formaldehyde and acetaldehyde that could negatively impact children's health in schools.
[27]	This research aimed to evaluate particle emission factors during cooking activities.	The research method used appropriate measuring instruments to measure airborne particles generated during cooking.	The findings of this study indicated that cooking activities could cause particle emissions that can affect indoor air quality, particularly in school environments.
[28]	This study aimed to evaluate the symptoms of Sick Building Syndrome and the perception of indoor air quality in commercial buildings in China.	The research method included surveys and data collection on health symptoms and the perception of air quality from building occupants.	The findings of this study revealed a relationship between Sick Building Syndrome symptoms and poor perception of air quality in school environments.
[29]	It aimed to evaluate the indoor air quality in classrooms and its relation to respiratory symptoms among elementary school students in Jakarta.	The research method involved measuring air quality parameters and collecting data on students' respiratory symptoms.	The findings of this study indicated a correlation between indoor air quality in classrooms and respiratory symptoms among elementary.
[30]	It aimed to evaluate indoor air quality and its impact on the health of elementary school students in Yogyakarta.	The research method included measuring air quality parameters and collecting student health data.	The findings of this study revealed the impact of indoor air quality on the health of elementary school students in Yogyakarta.
[31]	It aimed to evaluate indoor air quality in elementary school classrooms in Semarang City.	The research method involved measuring air quality parameters in classroom settings.	The findings of this study provided information about indoor air quality in elementary school classrooms in Semarang City.
[32]	Aimed to evaluate indoor air quality in classrooms and its impact on respiratory symptoms among elementary school students in Bandung City.	The research method included measuring air quality parameters and collecting data on students' respiratory symptoms.	The findings of this study indicated a correlation between indoor air quality in classrooms and respiratory symptoms among elementary school students in Bandung City.
[33]	It aimed to evaluate indoor air quality in classrooms and its impact on Padang City students' health.	The research method involved measuring air quality parameters and collecting student health data.	The findings of this study provided information about the impact of indoor air quality in classrooms on students' health in Padang City.

Several relevant articles evaluating air and water quality in the vicinity of school environments provide essential insights into their impact on children's health. Studies [20, 26] highlight

school air pollution that can affect children's respiratory health.

Research [22] demonstrates a link between air quality in childcare facilities and respiratory

symptoms and allergies in children. Additionally, studies [23–25] emphasise the importance of ventilation in reducing exposure to harmful airborne particles in classrooms and reveal potential exposure to hazardous chemicals such as formaldehyde in schools [23–25]. The research [23] also underscores the importance of preventive actions through a healthy environment to protect public health [23]. Based on these studies, governments, schools, and communities must collaborate to identify issues, formulate appropriate policies, and implement preventive measures. Education on maintaining a healthy environment also needs to be enhanced. These steps will help create a safe, healthy, and optimal school environment for the well-being of students.

Several studies have been conducted in Indonesia to evaluate air quality in and around school environments. The author [29] aimed to assess indoor air quality in Jakarta's elementary school classrooms and its association with respiratory symptoms among students. They found a correlation between indoor air quality and respiratory symptoms. The author [30] conducted a similar study in Yogyakarta, focusing on indoor air quality's impact on elementary school students' health [30]. Their findings highlighted the influence of indoor air quality on students' health. The author [31] evaluated indoor air quality in Semarang's elementary school classrooms, providing valuable information on the air quality in those environments. Authors [32] investigated the indoor air quality in Bandung's elementary school classrooms and its impact on respiratory symptoms among students. They discovered a correlation between indoor air quality and respiratory symptoms. Authors [33] assessed the indoor air quality in classrooms in Padang and its impact on students' health [33]. These studies collectively contribute to understanding the relationship between indoor air quality in school environments and its potential effects on students' respiratory health. These studies emphasise the importance of evaluating and improving the air quality in school settings. They highlight the association between poor indoor air quality and respiratory symptoms among elementary school students. The findings suggest that factors such as pollutants, ventilation systems, and environmental conditions can significantly impact the health and well-being of students.

Addressing indoor air quality issues and implementing effective measures to minimise pollu-

tants and improve ventilation is crucial. These studies provide valuable insights for policymakers, school administrators, and relevant stakeholders to prioritise interventions that enhance the air quality in school buildings. Promoting a healthy indoor environment can reduce the risk of respiratory problems and create a safer and more productive educational environment for students. Further research and continuous monitoring are necessary to develop comprehensive strategies for maintaining optimal air quality in schools and safeguarding students' health.

Evaluating air and water quality in the vicinity of school environments is of utmost importance in various cases worldwide. Air and water pollution issues in many countries have become serious concerns due to their adverse impacts on human health, including school children. With growing populations and increasing urbanisation, school environments are often exposed to pollutants from various sources such as vehicles, industries, and agriculture.

Evaluating the air and water quality around school environments while considering mosquito populations and environmental health is crucial to creating a safe and healthy learning environment for students. Several studies have found that indoor air pollution in schools can adversely affect children's health, particularly respiratory problems. Pollutants such as PM_{2.5} and PM₁₀ particles, CO₂ levels, and formaldehyde concentrations can lead to respiratory disturbances and pose threats to student health. Furthermore, the association between indoor air quality and respiratory symptoms and allergies in children attending childcare facilities is also a significant concern. Therefore, routine evaluation and monitoring of air and water quality in school environments should be prioritised, and proactive preventive measures must be taken to reduce sources of pollution and protect student health.

Increasing awareness and education regarding the importance of a healthy environment should also be enhanced, involving various stakeholders such as schools, government bodies, environmental organisations, and the community, to create safe and healthy school environments for future generations. Thus, concrete steps and comprehensive policies must be implemented to address these issues at their source and maintain optimal quality of school environments.

Several studies have revealed the link between air and water pollution and health issues affect-

ing students and school staff. These studies identify the presence of hazardous particles such as PM_{2.5} and PM₁₀, chemicals like formaldehyde, and toxic gases like SO₂ and NO₂ in the air surrounding school environments. Long-term exposure to these pollutants can lead to respiratory disorders, allergies, and other health problems in vulnerable children. Additionally, water quality near school environments is a serious concern. Water pollution can occur due to industrial waste, intensive agriculture, and other sources contaminating water sources around schools. Contaminated water can cause stomach illnesses, respiratory infections, and other health issues. This can disrupt the well-being of students and school staff and negatively impact the quality of education and learning outcomes.

Evaluating the air and water quality around school environments becomes an essential initial step in addressing these issues. The data obtained from such evaluations can be used as a basis for identifying problems, planning preventive actions, and engaging various stakeholders in joint efforts to improve the quality of the school environment. Furthermore, comprehensive policies are needed to control pollution sources, improve environmentally friendly infrastructure, and educate the community about maintaining a healthy environment. In a global context, evaluating the air and water quality around school environments should be part of the priority agenda in sustainable development.

Countries and international organisations must collaborate to develop stringent school air and water quality standards. Technical and financial assistance should also be provided to countries facing severe philosophy and water pollution issues. Overall, evaluating school environments' air and water quality is crucial in protecting students' health and well-being and creating an optimal and safe learning environment. The issue of air and water quality in school environments is not solely the responsibility of individuals or schools. Still, it is a collective responsibility of the entire community and government. Collaboration among schools, government, environmental organisations, and the community is essential in addressing these issues.

In this regard, the research [20] provides valuable insights into evaluating air quality in school environments and its implications for children's health. These studies highlight the presence of air pollution in schools that can negatively impact

children's health, particularly respiratory issues. The survey [23] also demonstrates the connection between indoor air quality in childcare facilities and respiratory symptoms and allergies in children. Moreover, the studies [25, 26] also provide essential insights into evaluating air quality in school environments. These studies emphasise the importance of ventilation in reducing exposure to hazardous airborne particles in classrooms and reveal potential exposure to harmful chemicals such as formaldehyde, which can negatively impact children's health in schools.

In a broader context, the research [23] emphasises the importance of disease prevention through a healthy environment. This research presents a global overview of the disease burden resulting from environmental risks, including air and water pollution, and emphasises the need for preventive actions to protect public health.

Based on these studies, it can be concluded that evaluating the air and water quality around school environments is a crucial step in maintaining the health and well-being of students. Governments, schools, and communities must work together to identify issues, formulate appropriate policies, and implement adequate preventive measures.

CONCLUSIONS

Significant impacts have been found in evaluating air and water quality in and around school environments, particularly concerning mosquito populations and environmental health. Poorly maintained school environments can become breeding grounds for mosquitoes, including disease vectors such as *Aedes aegypti* mosquitoes that can transmit dengue fever and other illnesses. The increased risk of mosquito-borne diseases can jeopardise the health of students, school staff, and the surrounding community. Several studies highlight the presence of air pollution in schools that can contribute to health issues, especially respiratory problems in children. Evaluating water quality is also crucial in preventing more significant health problems. Climate change and human activities also significantly exacerbate air and water quality issues in school environments.

Proactive measures and comprehensive policies involving various stakeholders such as schools, governments, environmental organisations, and the community must address these issues. Edu-

cation and increased awareness about maintaining a healthy environment should also be enhanced to effectively implement preventive actions and protection. Taking collective action and a solid commitment to creating a safe, healthy, and optimal school environment for future generations is crucial. By implementing these measures, protecting students, school staff, and

the surrounding community from mosquito-borne diseases can be expected, along with an overall improvement in quality of life.

Conflict of interest

The authors declare no conflict of interest.

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