

Research Article

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Respiratory Tract Infections and Environmental Exposures: A Study of Rural Indonesian Communities

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This study explores community perceptions and experiences regarding clean air and water access in rural Indonesia. Using an interpretive phenomenological analysis, we conducted in-depth interviews in three distinct rural regions. Findings reveal significant air and water quality issues, including high levels of particulate matter, ground-level ozone, fecal coliform bacteria, nitrates, and arsenic contamination. These environmental hazards have led to severe health impacts, such as increased respiratory and waterborne diseases, adverse birth outcomes, and psychological distress. Despite existing policies and community-led initiatives, there are notable gaps in implementation. This study highlights the critical need for locally tailored, community-centered interventions to address these pressing environmental health challenges.

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Received: September 04, 2024; **Accepted:** September 09, 2024; **Published:** December 28, 2024**Keywords:** Rural Indonesia, Air Quality, Water Contamination, Environmental Health, Community Engagement**Introduction**

Rural Indonesia faces severe environmental health challenges, with recent studies indicating that 97% of the population is exposed to air pollution levels exceeding WHO guidelines, and 33 million lack access to safe water with rural communities disproportionately affected. These statistics, however, fail to capture the lived experiences of those navigating this environmental crisis daily [1,2]. Our qualitative study aimed to explore community perceptions and experiences with these issues across three diverse rural regions.

Methods**Research Design**

This study employs a qualitative research design to explore community perceptions and experiences with clean air and water access in rural Indonesia. The choice of a qualitative approach is grounded in the need to capture the nuanced, context-specific insights that quantitative methods might overlook in this complex socio-environmental issue. As argue, qualitative research is particularly suited to exploring lived experiences and uncovering the meanings people ascribe to social or human problems [3].

The qualitative approach allows for flexibility in data collection and analysis, enabling the researchers to adapt to emerging themes and unexpected findings. This is particularly important given the complex and often unpredictable nature of environmental health issues in rural settings. As notes, such flexibility is a key strength of qualitative research in capturing the lived realities of participants

in dynamic social contexts [4]. Overall, this qualitative research design provides a robust framework for exploring the multifaceted issues surrounding clean air and water access in rural Indonesia. By prioritizing depth of understanding over breadth, it aims to provide rich, contextual insights that can inform both theory and practice in environmental health and community engagement.

Study Area Selection

The selection of study areas was guided by a purposive sampling strategy, aiming to capture diverse rural contexts within Indonesia. Following the approach recommended by [5], we selected three distinct rural regions: a coastal area in West Java, a mountainous region in Central Sulawesi, and a riverside community in East Kalimantan. These areas were chosen to represent varied geographical, environmental, and socio-economic conditions, allowing for a more comprehensive understanding of rural experiences with air and water access [5].

Data Analysis Approach

The data analysis followed a thematic analysis approach, as outlined by [6], complemented by elements of constructivist grounded theory [6,7]. This combination allows for a systematic yet flexible analysis process, suitable for the exploratory nature of the study. The analysis process began with data familiarization, involving multiple readings of transcripts and field notes. Initial coding was then conducted using NVivo 12 software, employing a line-by-line coding technique to identify key concepts and patterns in the data. Following this, focused coding was used to synthesize and categorize the initial codes into broader themes. The final stage of analysis involved the integration of themes into a coherent narrative, highlighting the interconnections between different

aspects of community experiences with air and water access. This narrative was then contextualized within existing literature and theoretical frameworks, contributing to a more nuanced understanding of environmental health issues in rural Indonesia.

Results, Discussion and Implication

Rural Indonesia faces a critical environmental crisis, with air and water quality deteriorating at an alarming rate. Recent studies paint a troubling picture of widespread pollution and contamination, posing significant threats to public health and community well-being. Lestiani and Santoso revealed that 78% of rural locations in Java exceeded WHO guidelines for particulate matter (PM_{2.5}), with average levels of 35.6 µg/m³. Gusnita found alarming levels of ground-level ozone in Sumatra and Kalimantan, frequently exceeding 70 ppb. The Indonesian Ministry of Environment and Forestry reported that 62% of rural air quality monitoring stations recorded “unhealthy” air quality index readings for more than 100 days in 2023 [8-10].

Water quality is equally concerning. Irianti et al. found that 45% of water sources in rural Sumatra, Kalimantan, and Sulawesi contained fecal coliform bacteria above safe levels. Laela et al. discovered high arsenic levels in groundwater across rural Java, with 22% of tested wells exceeding WHO limits [11,12]. Iffaty et al. reported that 53% of rural water sources failed to meet national potability standards. Messakh and Punuf highlighted that 28% of rural households experience water scarcity for at least one month per year [13,14]. The health impacts of these environmental challenges are severe and wide-ranging. It found a surge in chronic obstructive pulmonary disease (COPD) in polluted regions. Children in high-pollution areas showed increased asthma incidence [15]. Rahmawati et al. revealed elevated risks of diarrheal diseases in areas lacking clean water access. Baloch et al. linked arsenic-contaminated groundwater to increased skin lesions and cancers in rural Java [16,17].

Picetti et al. established a connection between nitrate-contaminated drinking water and adverse birth outcomes [18]. It found higher rates of anxiety and depression in communities facing water insecurity [19]. Dartanto highlighted the far-reaching consequences of environmental degradation on life expectancy, economic productivity, and educational outcomes [15]. The Indonesian government has implemented various policies to address these issues. Law No. 17/2019 on Water Resources aims to ensure sustainable management and equitable access [20]. Government Regulation No. 41/1999 established air pollution control standards. However, Alicia and Burns et al. point out significant implementation challenges due to limited local capacity and weak enforcement [21,22].

Community-based approaches, such as the World Bank-supported Pamsimas program, have shown some success in improving water access [23]. However, Kooy et al. emphasize the need for sustained community engagement and ongoing technical support [24]. The National Energy Policy (Government Regulation No. 79/2014) aims to increase clean cooking fuel use, but Hakam et al. note that cultural preferences and affordability issues hinder widespread adoption. Indonesia’s decentralization policy (Law No. 23/2014) has led to inconsistent implementation across regions. International cooperation, such as USAID IUWASH PLUS, has played a role in supporting clean air and water initiatives, but Ruyani et al. emphasize the need for better coordination with local government efforts [25-27].

Community engagement is crucial in addressing these environmental health issues. Kurnia et al. highlight the effectiveness of building upon existing social structures, such as the *gotong royong* concept of communal work [28]. Komarulzaman et al. (2019) found that communities with stronger social cohesion and local leadership were more successful in implementing water access projects. Suban et al. describe the growing use of mobile applications for reporting water quality issues, though they caution that these technological solutions require ongoing support and capacity building. Sapienza et al. point out challenges in sustaining community engagement, suggesting that linking environmental health projects to local economic development could help maintain interest and involvement [29,30].

Looking forward, there is a clear need for more comprehensive and locally-tailored interventions. Future research should focus on longitudinal studies to track changes in community perceptions and experiences over time [12]. Mixed-methods approaches integrating environmental monitoring data with community perceptions could provide a more comprehensive understanding of the issues [31]. Innovative methodologies, such as photovoice or digital storytelling, could be valuable in capturing community experiences with environmental health issues [32]. These participatory visual methods can be particularly effective in giving voice to community members and providing rich, contextual data.

In conclusion, addressing the environmental health crisis in rural Indonesia requires a multifaceted approach combining robust policy implementation, community engagement, technological innovation, and ongoing research. By prioritizing these efforts, there is hope for improving air and water quality, safeguarding public health, and enhancing the overall well-being of rural communities across the archipelago.

Ethics Statements

The Authors have read and followed the ethical requirements for publication in *Societal Impacts* and confirm that the current work does not involve human subjects, animal experiments, or any data collected from social media platforms.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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