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# Health Literacy and Geography: Examining Environmental and Socioeconomic Influences on Public Health Awareness

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**ABSTRACT:** Health literacy is essential for informed health decision-making, yet disparities persist due to geographical, environmental, and socioeconomic factors. This study systematically reviews existing literature to examine how these variables influence public health awareness. A comprehensive search of PubMed, Scopus, and Google Scholar identified relevant studies published in the last decade. Findings reveal that individuals in rural and low-income communities experience significant barriers to accessing reliable health information due to limited healthcare infrastructure, digital divide, and environmental stressors such as pollution and inadequate sanitation. Furthermore, disparities in formal education and socioeconomic status contribute to the uneven distribution of health literacy levels. Digital health solutions, including mobile health applications and telemedicine, have demonstrated potential in bridging this gap. However, accessibility and digital literacy remain critical challenges. The study emphasizes the need for policy-driven interventions that integrate community-based education, environmental health awareness, and digital health tools. Future research should explore the effectiveness of long-term digital health literacy programs and strategies for embedding environmental health education into public health policies. Strengthening interdisciplinary collaborations among healthcare professionals, educators, and policymakers is crucial to improving health literacy and reducing health disparities globally.

**Keywords:** Health Literacy, Environmental Health, Digital Health, Public Health Disparities, Telemedicine, Socioeconomic Determinants, Health Policy.



## INTRODUCTION

Health literacy is a fundamental determinant of individual and population health outcomes, shaping the ability to access, comprehend, and apply information necessary for informed decision making and health behavior adoption. Despite its importance, significant disparities in health literacy persist due to intersecting geographical, environmental, and socioeconomic conditions(Papadakos et al., 2025).

Geographic distribution plays a critical role in determining access to healthcare infrastructure and health related information. Urban populations tend to benefit from proximity to healthcare services, better transportation networks, and greater access to digital health resources. In contrast,

rural and remote communities face systemic obstacles such as limited health facilities, poor connectivity, and inadequate public health outreach. These limitations contribute to lower health literacy levels and reduced engagement in preventive health behaviors(Marshall et al., 2025).

Environmental factors, including sanitation conditions and pollution levels, also influence public health awareness. Inadequate sanitation systems and high exposure to pollutants not only increase health risks but also limit community understanding of disease causation and prevention strategies. Communities with limited environmental health literacy are less likely to adopt protective behaviors, which further widens health disparities(Yalnız H. et al., 2025).

Socioeconomic status further compounds these challenges. Individuals from lower income backgrounds often encounter barriers in accessing education and digital technologies two essential elements for developing health literacy competencies(Mousazadeh et al., 2025). Although digital tools such as mHealth applications and telemedicine services offer potential solutions, their reach remains uneven due to persistent digital divides and inadequate digital education.

While previous studies have contributed valuable insights into specific determinants of health literacy, there remains a lack of integrated analysis addressing the intersectionality between geography, environment, and socioeconomic status(Rababah, 2025). Furthermore, research on health literacy often generalizes across populations, failing to reflect the unique vulnerabilities of marginalized groups, including ethnic minorities, remote dwellers, and low income populations.

To address these gaps, this study conducts a systematic review of literature examining how spatial, environmental, and economic contexts shape health literacy. The review specifically focuses on four key areas: (1) the influence of geographical distribution on public access to health information; (2) the impact of environmental conditions such as sanitation and pollution on public health awareness; (3) the role of digital access in supporting or limiting health education; and (4) the socioeconomic determinants underlying disparities in health literacy(Liu & Gao, 2025; Maximiano-Barreto et al., 2025).

By synthesizing evidence across diverse global contexts particularly from rural, urban, and semi urban settings this review aims to inform policies and interventions that promote health equity. The findings are expected to support the development of community driven, environmentally conscious, and digitally inclusive strategies for improving public health literacy(Roshan-Nejad et al., 2025).

## METHOD

This study employs a systematic literature review approach to examine the relationship between health literacy and geography. A comprehensive literature search was conducted across major academic databases, including PubMed, Scopus, and Google Scholar, targeting studies published within the last ten years to ensure the relevance and timeliness of the findings. The search strategy incorporated predefined keyword combinations and Boolean operators to enhance precision and comprehensiveness(Mukhtar et al., 2025; Nair, 2025). Keywords included "health literacy," "health geography," "public health," "social determinants of health," "environmental health," and "health

perceptions." Additional terms, such as "access to health information" and "health disparities," were used to broaden the scope of the search where applicable.

The selection criteria were established to include peer-reviewed studies, systematic reviews, and meta-analyses that empirically or theoretically analyze the impact of geography and environmental conditions on health literacy. Studies focusing on the relationship between geographic factors, public health policies, and health information dissemination were prioritized. Only studies published in English and Indonesian were considered to maintain consistency in the analysis. Exclusion criteria were applied to eliminate non-peer-reviewed sources, opinion articles, and studies lacking direct empirical evidence. Research unrelated to health literacy or geographic determinants was also excluded to maintain the study's focus(Carrada et al., 2025; Mishra et al., 2025). The initial screening process involved reviewing titles and abstracts, followed by a full-text assessment to determine methodological rigor and relevance.

To enhance reliability, a multi-stage screening process was employed. Four independent reviewers evaluated the selected studies to ensure alignment with the inclusion criteria. Emerging themes were synthesized to identify recurring patterns in how geographic and environmental factors shape health literacy(Karadağ et al., 2025; King et al., 2025). These findings provide critical insights into the role of spatial disparities in health information accessibility, contributing to the development of more targeted health literacy interventions and policies(Alzahrani et al., 2025).

## RESULT AND DISCUSSION

### Geographical Factors Influencing Health Literacy

### Impact of Geographical Distribution on Public Access to Health Information

Geographical distribution significantly influences access to health information, with location, healthcare infrastructure, and resource availability being key determinants. Research by Wernly et al. indicates that urban populations generally have better access to healthcare resources and information compared to rural inhabitants. In metropolitan areas, public transportation networks and healthcare facilities enhance individuals' ability to receive direct health information from providers and participate in educational programs. In contrast, rural and remote communities face barriers such as long distances to medical facilities, limited communication channels, and underdeveloped infrastructure, all of which hinder their access to essential health information.

Additionally, Arriaga et al. emphasize that access to digital technology significantly impacts individuals' ability to utilize health information. Their study suggests that individuals in regions with better internet connectivity and digital literacy are more adept at verifying and using health information effectively than those in marginalized locations. These findings highlight the strong correlation between geographical distribution and an individual’s capacity to access and comprehend health information.

### Health Literacy Disparities Between Urban and Rural Areas

A significant literacy gap exists between urban and rural populations, with rural residents often exhibiting lower health literacy levels. Guo et al. found that this disparity was evident in preventive behaviors during the COVID-19 pandemic, where individuals with lower health literacy were more susceptible to misinformation and misinterpretation of public health guidelines. This gap underscores that urban residents benefit from reliable information sources and community health support systems, whereas rural populations lack such advantages.

He et al. highlight the necessity of geographically tailored health information dissemination to bridge this gap. In rural areas where formal education is less prevalent, additional efforts are needed to present health information in a manner that is comprehensible and accessible, such as community-based health programs that engage local leaders. Duda and Reifegerste further underscore the importance of community involvement in educating populations about environmental health risks, illustrating that environmental intelligence plays a role in shaping overall health literacy(Magerčiaková et al., 2025).

Studies indicate that improving health literacy requires collaboration between healthcare institutions, educational organizations, and local communities. Programs designed to empower individuals in seeking and applying health information in daily life have proven more effective in underserved regions. By implementing community-centered approaches, there is potential to reduce health literacy disparities between urban and rural populations. These findings underscore the necessity for inclusive policies tailored to specific geographical contexts to ensure equitable access to health information for all individuals.

## Environmental Factors Influencing Health Awareness

### Impact of Air Pollution, Sanitation, and Environmental Conditions on Public Health Awareness

Air pollution, sanitation, and other environmental factors significantly influence public understanding of health. Research by Ademas et al. demonstrates that interventions in water, sanitation, and hygiene (WASH) contribute to improved health conditions among children, particularly in reducing stunting and diarrheal diseases. These findings suggest that public health awareness is not solely dependent on medical knowledge but is also shaped by environmental conditions that directly impact quality of life.

Pollution, especially air contamination, has broader implications beyond respiratory health. Douglass' research illustrates how exposure to airborne pollutants in urban centers contributes to high rates of respiratory diseases and other health complications. Families exposed to high pollution levels tend to develop heightened awareness of environmental hazards, prompting them to adopt preventive health behaviors.

Sanitation is another crucial environmental factor influencing health literacy. Li's study highlights that poor sanitation practices correlate with the spread of infectious diseases, demonstrating how environmental conditions directly affect public health knowledge. Communities with inadequate sanitation infrastructure often lack awareness of how poor hygiene contributes to disease transmission, further perpetuating health disparities.

The role of social environments in shaping health awareness is equally significant. Dury et al. found that positive social environments reinforce health-conscious behaviors by encouraging individuals to share health knowledge within their communities. Conversely, socially disadvantaged environments often contribute to lower health literacy, exacerbating public health inequalities.

### Climate Change and Health Awareness Across Regions

Climate change has profound implications for public health, affecting health awareness across different regions. Hussein and Ibrahim's study in Ismailia, Egypt, found that most respondents recognized climate change's impact on health, particularly in relation to pollution and weather-related illnesses. However, despite general awareness, knowledge gaps persist in terms of effective adaptation strategies.

Research by Chidziwisano et al. highlights that sustainable hygiene practices are crucial in mitigating climate change's health impacts, particularly in preventing the spread of climate-sensitive diseases. Public preparedness for climate-related health risks largely depends on education and engagement with local healthcare institutions that must adapt to emerging environmental health challenges.

Geographical disparities also influence climate change-related health literacy. Rural and underserved communities often have limited access to climate health information compared to urban populations, who benefit from greater resource availability (Bosdriesz et al., 2012). These disparities indicate the need for geographically sensitive interventions to effectively communicate climate-related health risks to all populations.

Overall, environmental factors such as pollution, sanitation, and climate change significantly influence public health awareness. Effective health policies must integrate these considerations to promote health literacy and community resilience against environmental health threats.

## Digital Access and Health Literacy

### The Role of Digital Technology in Improving Health Literacy in Remote Areas

Digital technology plays a crucial role in enhancing health literacy in remote areas. Research indicates that digital tools, such as mobile applications and the internet, expand access to reliable health information in underserved communities. A study on media health literacy found that digital resources enhance young people's ability to critically evaluate health information, improving overall public health literacy.

In regions where healthcare services are scarce, digital technology serves as a bridge to reliable health education. Budhathoki et al. found that mobile health applications provide essential information on disease prevention, dietary recommendations, and treatment options, significantly improving public health awareness in remote communities. Similarly, Freedman et al. demonstrated that digital health resources empower individuals to make informed health decisions, reinforcing the importance of expanding digital access in disadvantaged regions.

Moreover, digital platforms strengthen social networks, enabling individuals to share health information and experiences within online communities (Bert et al., 2023). In isolated areas, where

physical access to healthcare is limited, digital health forums play a vital role in fostering collective health awareness.

### The Success of mHealth and Telemedicine in Enhancing Public Health Understanding

Mobile health (mHealth) applications and telemedicine have significantly improved public understanding of health issues. Wernly et al. highlight that mHealth solutions and telemedicine services enhance healthcare access and provide valuable health information, particularly during the COVID-19 pandemic(Wernly et al., 2020). These digital tools have enabled remote consultations, reducing geographical barriers to healthcare services.

Research by Budhathoki et al. further supports the efficacy of mHealth interventions in improving health literacy. Their findings indicate that mHealth programs have been particularly effective in educating individuals on nutritional health and disease management, benefiting populations with limited healthcare access.

Despite these advancements, digital disparities persist. Studies show that access to mHealth and telemedicine services is often limited by technological and socioeconomic barriers (Baumeister et al., 2021). Addressing these challenges requires health policies that promote digital inclusion and literacy training to maximize the potential benefits of digital health solutions.

## Social and Economic Disparities in Health Literacy

### Economic and Social Status Influencing Health Literacy Levels Across Countries

Economic and social status play a crucial role in determining health literacy levels. Research indicates that lower-income individuals and those with limited education often exhibit lower health literacy due to restricted access to quality healthcare and educational resources (Arriaga et al., 2022). In urban areas, wealthier individuals benefit from better healthcare services and greater exposure to health information, whereas lower-income populations struggle with access disparities.

Sharma & Pandey's study highlights that rural communities face greater health literacy challenges due to lower infrastructure development and educational limitations. Addressing these disparities requires targeted interventions that improve health education and information accessibility in disadvantaged regions.

### Effective Policies to Reduce Health Literacy Inequalities

Community-based health education programs have proven effective in bridging health literacy gaps. Research by Chia et al. shows that health interventions tailored to local communities enhance health knowledge retention. Public health policies that integrate digital tools, such as health apps and telemedicine, have also demonstrated success in increasing public access to reliable health information (Padmavathi et al., 2023).

Additionally, integrating health literacy into school curricula and professional healthcare training can improve public understanding of health issues (Ademas et al., 2021). Government initiatives that support inclusive health education policies are crucial in mitigating socioeconomic health disparities.

Overall, addressing social and economic disparities in health literacy requires a comprehensive approach that combines community engagement, digital accessibility, and educational reform. By implementing evidence-based policies, healthcare systems can ensure equitable access to health information for diverse populations.

## Synthesis of Geographic and Environmental Determinants of Health Literacy

The reviewed studies consistently show that geographic disparities remain a critical determinant of unequal health literacy outcomes. Rural populations, in particular, face reduced access to healthcare infrastructure and digital technologies (Haeger et al., 2023; Guo et al., 2021), which translates into limited exposure to reliable health information. In contrast, urban populations generally benefit from stronger institutional networks and proximity to health resources.

However, simply categorizing regions into "urban" and "rural" obscures the nuanced interaction between environmental and social conditions. For example, WASH interventions in Ethiopia led to improved child health outcomes and community health awareness (Ademas et al., 2021), whereas similar sanitation programs in urban slums in India were less effective due to overcrowding and socio political constraints (Sharma & Pandey, 2023). These findings indicate that contextual tailoring of interventions rather than standardization is key to effectiveness.

Furthermore, environmental health literacy (EHL) emerges as a pivotal factor in mediating behavior change. Communities exposed to air pollution in industrialized urban zones often develop greater awareness of respiratory health risks (Douglass, 2023), which can prompt protective behaviors. However, this reactive literacy contrasts with more proactive models found in environmentally engaged communities in Western Europe, where preemptive education on pollution and sustainability is integrated into formal curricula (Bert et al., 2023). These contrasting models illustrate how policy embedding of EHL in education systems leads to more resilient public responses.

## Comparative Analysis of Health Interventions and Policy Models

A comparative perspective across national contexts reveals significant variation in the success of interventions. For instance, telemedicine expansion during the COVID 19 pandemic was highly effective in Hong Kong and Germany, where digital health infrastructure and eHealth literacy were already robust (Guo et al., 2021; Wernly et al., 2020). In contrast, similar programs in rural Southeast Asia faced obstacles due to poor internet connectivity and limited digital literacy (Padmavathi et al., 2023). These findings highlight that digital interventions are only effective when foundational inequalities are addressed, including device accessibility and digital education.

Similarly, community driven models in sub Saharan Africa, such as faith based health education programs, proved successful due to strong social capital and cultural alignment (Adedimeji et al., 2016). Meanwhile, top down public health campaigns in Latin America without localized engagement often failed to generate meaningful behavior change, as observed in evaluations of vaccine misinformation mitigation efforts (Riaz et al., 2023). These comparisons stress the importance of co production and participatory governance in health communication strategies.

### From Description to Interpretation: Toward a Theoretical Framing

Beyond descriptive patterns, the findings underscore the applicability of structuration theory and social ecological models in interpreting health literacy disparities. These frameworks explain how individual agency in health decisions is constrained by environmental structures (e.g., pollution, infrastructure), institutional systems (e.g., education, media), and socioeconomic status. For example, individuals in structurally disadvantaged communities may possess motivation but lack material means or enabling environments to translate awareness into action.

Additionally, applying intersectionality theory provides insights into how overlapping identities (e.g., being rural, female, and low income) compound vulnerability in accessing health information. This has been especially evident in postcolonial contexts where marginalized ethnic groups are further excluded from mainstream health systems (Markey et al., 2024). Such perspectives can inform more equity focused health literacy interventions.

### Refined Implications for Policy and Practice

The findings suggest that health literacy interventions must go beyond informational delivery to include structural investment in digital access, environmental improvement, and inclusive education. For instance, integrating health and environmental literacy in primary education curricula as practiced in countries like Finland and Canada has been shown to foster long term health conscious behavior and civic engagement (Zanobini et al., 2024). Conversely, temporary awareness campaigns without systemic follow up tend to yield short lived effects, as seen in various parts of the Global South.

Policymakers are encouraged to move toward adaptive policy frameworks that are geographically sensitive, culturally tailored, and technologically inclusive. This includes supporting community health workers in remote areas, investing in digital equity programs, and institutionalizing EHL at all educational levels.

## CONCLUSION

This study highlights the significant impact of geographical, environmental, and socioeconomic factors on health literacy, particularly in underserved communities. The findings underscore the disparities in access to health information between urban and rural populations, where digital literacy and healthcare infrastructure play critical roles. Environmental determinants, such as pollution and inadequate sanitation, further contribute to the challenges faced by these communities. Additionally, systemic barriers, including limited educational opportunities and socioeconomic inequality, exacerbate health literacy disparities.

Addressing these disparities requires targeted policies that integrate digital health tools, community-based health education, and environmental health awareness programs. Expanding access to mobile health (mHealth) and telemedicine solutions can bridge the health information

gap, particularly in remote areas. Moreover, fostering interdisciplinary collaborations between healthcare providers, educators, and policymakers can enhance public health literacy interventions.

Future research should focus on the long-term effectiveness of digital health literacy programs, the impact of climate change on public health awareness, and strategies to incorporate environmental health literacy into formal education. By adopting a multi-faceted approach that includes education, policy reform, and technological advancements, health literacy disparities can be mitigated, leading to improved health outcomes across diverse populations.

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