CLEAN AIR, HEALTHY LIVES

A Policy Roadmap

for Health Systems to Tackle Air Pollution

GLOBAL CLIMATE & HEALTH ALLIANCE

Acknowledgement

This report was written by Shweta Narayan, with review by Jeni Miller and Jess Beagley at Global Climate and Health Alliance and Nina Renshaw at the Clean Air Fund.

The Global Climate and Health Alliance is grateful to the following contributors whose expertise, insights, and valuable inputs have enriched this policy brief through sharing of case studies:

- **Dr. Aakash Shrivastava**
  National Center for Disease Control, Ministry of Health and Family Welfare, Government of India
- **Arthur Wyns**, *University of Melbourne*
- **Dr. Fatimah Ahmad**, *Sunway Center for Planetary Health, Malaysia*
- **Jit Sohal** *from the Center for Sustainable Medicine, Singapore*
- **Juan José Castillo**, *Regional Air Quality Advisor, Pan American Health Organization*
- **Engr. Jundy Delsocorro**
  Department of Environmental and Natural Resources, Government of the Philippines
- **Engr. Maria Sonabel Anarna**, *Department of Health, Government of the Philippines*
- **Misarah Faiesall**, *Sunway Center for Planetary Health, Malaysia*
- **Dr. Mark Hayden** *of Great Ormond Street Hospital, UK*
- **Mafoko Phomane**, *groundWork South Africa*
- **Punita Kumar**, *State Health Resource Center, Chhattisgarh, India*
- **Dr. Ronald Law**, *Department of Health, Government of the Philippines*
- **Samuel David Osorio Garcia**
  Department of Social and Environmental Determinants of Health Equity (DHE/CE), Pan American Health Organisation
- **Sumi Mehta**, *Vital Strategies*

Designed by Subhashis Roy

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Introduction

Air pollution is a most critical environmental health threat worldwide, responsible for 7 million premature deaths annually,[1] making it the second leading risk factor for mortality globally, surpassing even tobacco and poor diet.[2,3] The impact of air pollution is profound; including increased risk of cardiovascular diseases, respiratory disorders like asthma and Chronic Obstructive Pulmonary Disorder (COPD), and various cancers. Nearly 90% of the deaths attributed to air pollution in 2021 resulted from noncommunicable diseases (NCDs),[4] underscoring the need for better integrated approaches to environmental determinants of disease.[5] In children under five years old, air pollution accounted for approximately 700,000 deaths every year i.e. one child every minute,[6] highlighting its devastating effect on the most vulnerable populations.[7]

In children under five years old, air pollution accounted for approximately 700,000 deaths every year, i.e., one child every minute.

This pervasive issue not only claims lives but also significantly exacerbates chronic and acute health conditions, contributing to a staggering burden of disease, particularly in low- and middle-income countries (LMICs) where health systems are already under strain.[8,9] Health systems in LMICs face unique challenges in responding to the burden of air pollution. These regions often experience higher exposure levels to pollutants due to rapid urbanization, industrialization, more polluting vehicles, and reliance on harmful fuels for cooking and heating. Consequently, populations in these areas are exposed to 1.3 to 4 times higher levels of particulate matter (PM2.5) compared to their counterparts in wealthier nations.[10,11] For example, South Asia, one of the world's most populous regions, bears a staggering health burden from air pollution, with 2.7 million deaths in 2021. In India alone, nearly 35% of all deaths were linked to air pollution.[12] The lack of resources and infrastructure further complicates effective responses to this growing health crisis.

Beyond its direct health impacts, air pollution significantly drives up hospital admissions and healthcare costs, further straining already overburdened health systems. The World Bank estimates[13] that the global cost of health damages from air pollution exposure is $8.1 trillion, equivalent to 6.1% of global GDP. This financial burden includes increased hospitalizations, medical treatments, lost productivity, and premature deaths, creating economic and social consequences that disproportionately affect LMICs. Despite the staggering costs, critical gaps remain in addressing air pollution, including insufficient investments in pollution control, lack of integration between health and environmental policies, and limited capacity to implement evidence-based interventions. Strengthening regulatory frameworks, expanding air quality monitoring, and prioritizing health-centered

The global cost of health damages from air pollution exposure is $8.1 trillion, equivalent to 6.1% of global GDP.

clean air policies are essential to mitigating these impacts and ensuring long-term public health benefits.

Through presenting a series of case studies, this policy brief aims to provide a clear and actionable pathway for health ministries—particularly in LMICs—at national, subnational, and local levels to strengthen their capacity and develop their leadership to address air pollution-related health burdens. The brief is centered on **two main objectives**:

1. To outline progressive measures and policies already adopted by health ministries and agencies in locations around the world to address air pollution and health, showcasing their design and implementation.
2. To demonstrate the efficacy of these measures through curated, evidence-based case studies from diverse global contexts, providing actionable insights for health leaders.

The case studies documented will cover key areas critical to integrating air pollution response into health systems, including:

- Conducting an assessment of the health impacts of air pollution
- Leading to a comprehensive health infrastructure assessment (including vulnerability assessment)
- Partnering to access air quality data, health infrastructure, early warning systems and enhancing the capacity of health professionals
- Promoting cross-sectoral, regional and transboundary collaboration to address upstream determinants of air pollution.
- Conducting community needs assessments and expanding access to tailored preventative and therapeutic care for air pollution-related illnesses.

The urgency to develop robust and actionable strategies addressing the critical intersection of air pollution and health has never been greater. This policy brief offers a guide for health ministries and agencies, empowering them with examples of practical tools, evidence-based strategies, and critical knowledge needed to lead transformative actions in addressing the health impacts of air pollution. By offering a clear outline for capacity building, resource optimization, and cross-sectoral collaboration, it seeks to enable policymakers and health leaders to design and implement targeted interventions effectively. Furthermore, the inclusion of global case studies and best practices will provide actionable insights and real-world examples, helping decision-makers adapt successful strategies to their unique local contexts. Ultimately, this brief aims to catalyze systemic change, fostering resilient health systems that prioritize the health and well-being of communities while combating the far-reaching consequences of air pollution.

Photo Courtesy:
Daylin Paul,
Center for Environmental Rights

Practical Approaches to Integrate Air Pollution Response into Health Systems

Effectively addressing the health impacts of air pollution requires a strategic, integrated approach within health systems. This involves starting with a comprehensive health impacts assessment of air pollution, assessment of health infrastructure for their capacity to respond to air pollution related cases, including vulnerability analyses to pinpoint at-risk populations and systemic gaps. Long-term strategic partnerships with with environmental authorities, academic institutions and civil society in sourcing local air quality data, strategic investment in health infrastructure, and early warning systems are essential, alongside efforts to strengthen the capacity of health professionals to respond to pollution-related health challenges.

Effectively addressing the health impacts of air pollution requires a strategic, integrated approach within health systems.

In addition to action within the health sector, tackling the root causes of air pollution demands cross-sectoral, regional, and transboundary collaboration to address its upstream determinants. Equally important is the need for community needs assessments and expanding access to customized preventive and therapeutic care for those affected. By aligning these efforts, health systems can become robust drivers of resilience, equity, and long-term solutions to the air pollution crisis.

1 Conducting Health Impact Assessments (HIA) of Air Pollution at the National or City Level

A Health Impact Assessment (HIA) is a critical tool for understanding and addressing the health burden of air pollution while ensuring that limited resources are allocated effectively. Conducting an HIA at the national or city level allows health agencies to quantify both the direct health impacts—such as hospitalizations, respiratory and cardiovascular diseases, and premature deaths—and the broader economic consequences, including healthcare expenditures and productivity losses. This data is essential for making a strong case to the finance and key government departments, such as taxation, environment, energy, transport, industry, agriculture, forestry, urban planning, and waste management, for prioritizing clean air policies and preventative investments as part of a whole-of-government, health-in-all-policies approach.

A key component of HIA is an environmental context analysis, which helps pinpoint the most harmful pollutants, including fine particulate matter (PM2.5), nitrogen dioxide (NO_2), ozone (O_2), and toxic chemicals and heavy metals in coarse dust (PM10). These pollutants are strongly linked to respiratory and cardiovascular diseases, and understanding their local sources allows health departments to design targeted public

health interventions. This may include clean air clinics, community education programs on pollution reduction, and enhanced access to resources for managing conditions like asthma and COPD. Additionally, these assessments provide valuable insights for the regional health system, helping to design better health service delivery and build community resilience.

Beyond direct health benefits, HIAs serve as a foundation for economic impact assessments of air pollution. The World Bank estimates that the global cost of health damages from air pollution is $8.1 trillion annually, equivalent to 6.1% of global GDP. By quantifying the financial burden on healthcare systems and lost productivity due to pollution-related illnesses, governments can present compelling, evidence-based arguments for investing in clean air solutions. This economic framing is particularly useful in engaging ministries of finance and other regulatory bodies responsible for sectors contributing to pollution, ensuring that air quality management is seen as a long-term economic and public health priority rather than just an environmental issue.

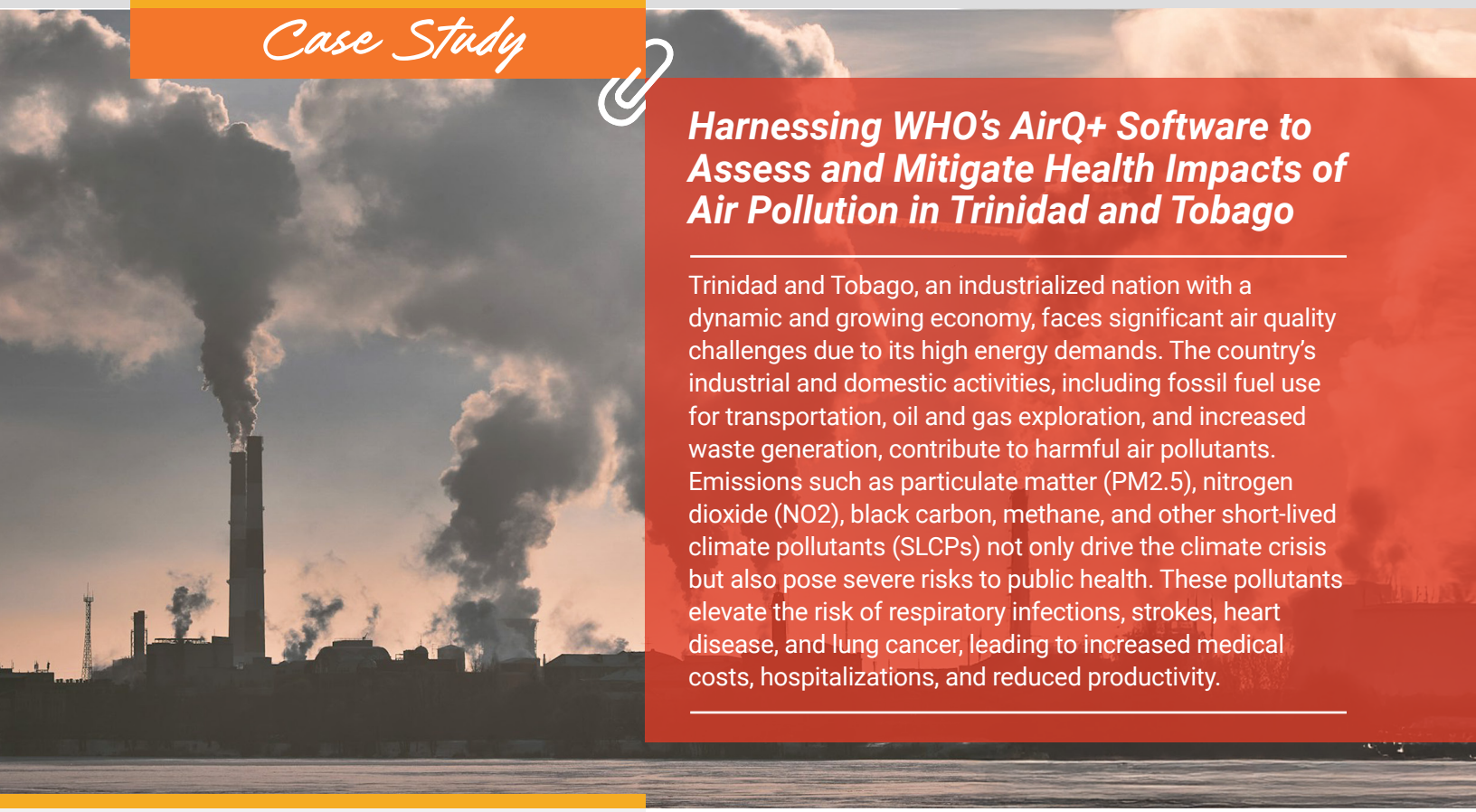
The World Health Organization (WHO) provides key tools and technical assistance support countries in conducting HIAs for air pollution, particularly through AirQ+,[14] a software tool designed to estimate the health burden air pollution exposure different scales. AirQ+ helps policymakers assess the relationship between pollution levels and health outcomes, guiding data-driven decision-making.

By integrating HIA into air pollution policy development, governments can ensure that interventions are data-driven, cost-effective, and strategically targeted. These assessments provide the foundation for advocating clean air policies, securing political and financial commitments, and fostering cross-sectoral collaboration to reduce air pollution at its source. Ultimately, HIA strengthens public health resilience while demonstrating that investing in clean air is not just a health imperative, but also an economic and social priority.

By integrating HIA into air pollution policy development, governments can ensure that interventions are data-driven, cost-effective, and strategically targeted.

Photo Courtesy:
Punita Kumar,
State Health Resource Center,
Chhattisgarh, India

Case Study



Harnessing WHO's AirQ+ Software to Assess and Mitigate Health Impacts of Air Pollution in Trinidad and Tobago

Trinidad and Tobago, an industrialized nation with a dynamic and growing economy, faces significant air quality challenges due to its high energy demands. The country's industrial and domestic activities, including fossil fuel use for transportation, oil and gas exploration, and increased waste generation, contribute to harmful air pollutants. Emissions such as particulate matter (PM2.5), nitrogen dioxide (NO2), black carbon, methane, and other short-lived climate pollutants (SLCPs) not only drive the climate crisis but also pose severe risks to public health. These pollutants elevate the risk of respiratory infections, strokes, heart disease, and lung cancer, leading to increased medical costs, hospitalizations, and reduced productivity.

Photo Courtesy: Maxim Tolchinskiy

The Health Burden of Air Pollution and the Role of AirQ+

In Trinidad and Tobago, quantifying the health impacts of air pollution was a critical step toward evidence-based action. This was achieved through a collaboration between the Environmental Management Authority (EMA) and the Pan American Health Organization (PAHO), leveraging the WHO AirQ+ software.[15]

AirQ+ is a specialized tool developed by WHO to estimate the burden of disease attributable to air pollution.

The software integrates air quality data with health statistics, allowing health professionals and policymakers to translate air pollution exposure into tangible health outcomes. By inputting local data from regional health authorities, the Ministry of Health, and the Central Statistics Office, AirQ+ provided robust estimates of health impacts, including mortality and morbidity associated with specific pollutants.

The software's analysis revealed that over 600 deaths among individuals aged 30 and above in 2019 were directly attributable to air pollution.[16] These insights were crucial in highlighting the human cost of air pollution and in motivating stakeholders to take concrete action to protect public health.

Developing a Roadmap for Change: Turning Data into Action[17]

Informed by the findings from AirQ+, Trinidad and Tobago proposed an integrated roadmap[18] focusing on air quality, SLCPs, and health, developed through a multi-stakeholder approach. This roadmap aims to:

- Foster high-level political commitment to address air quality issues.
- Mobilize actions to protect public health from the adverse effects of SLCPs.

The roadmap outlines **five key lines of action**:

1. **Regulation and Legislation:** Strengthening policies related to air quality and emissions.
2. **Infrastructure and Technological Improvements:** Enhancing air quality monitoring and pollution control technologies.
3. **Finance:** Allocating resources for air quality initiatives.
4. **Awareness and Capacity Building:** Educating the public and health professionals on air pollution risks.
5. **Monitoring and Evaluation:** Establishing robust systems to track progress and refine strategies.

The Critical Role of AirQ+ in Shaping Policy and Strategy

The use of AirQ+ went beyond merely assessing health impacts. It served as a foundational tool for:

- **Supporting Policy Development:** By providing credible, localized data, AirQ+ helped shape regulatory frameworks and set priorities within the roadmap. For example, diabetes is one of the most critical health issues in Trinidad and Tobago, with 13% of the adult population diagnosed with the disease,[19] and it is also among the health conditions most strongly associated with air pollution—thereby presenting an opportunity to align actions targeting both diabetes and air quality improvement.
- **Driving Accountability:** Quantifying the health burden of air pollution enabled stakeholders to set measurable goals and track progress effectively. AirQ+ is also highly useful for comparing actual air pollution levels with WHO air quality guideline concentrations, demonstrating the potential health benefits if Trinidad and Tobago adhered to these guidelines.
- **Engaging Stakeholders:** The concrete data facilitated communication with political leaders, health professionals, and the public, helping to build consensus and drive action.

The roadmap's objectives include enhancing the health sector's capacity to understand the link between air pollution and health, reviewing policies in critical sectors such as energy, transport, and manufacturing, and reducing harmful pollutant concentrations. The roadmap also emphasizes the importance of disseminating data and sharing lessons learned with other Caribbean countries.

Outcomes and Future Goals

Through these actions, Trinidad and Tobago aims to achieve a healthier, more productive population and promote environmental sustainability. The initiative demonstrates how HIAs with the help of tools like AirQ+ can transform air quality data into actionable insights, guiding strategic interventions that save lives and reduce healthcare burdens.

2 Comprehensive Health System Assessment (Including Vulnerability Assessment)

A comprehensive health system assessment is a crucial next step following a Health Impact Assessment (HIA) for health departments aiming to mitigate the health impacts of air pollution. While HIAs identify the health burden of air pollution and its economic costs, a health system assessment evaluates the capacity of healthcare facilities, workforce readiness, medical equipment, and access to essential medicines and diagnostics to ensure they are equipped to manage pollution-related illnesses effectively.

Beyond assessing healthcare capacity, these evaluations also identify operational practices within health facilities that may inadvertently contribute to air pollution, such as the use of diesel generators for backup power. Diesel generators not only emit harmful pollutants like nitrogen oxides and particulate matter but also contribute to greenhouse gas emissions, exacerbating climate change. Implementing solarization initiatives in health systems, can effectively mitigate this issue by providing clean, renewable energy that reduces reliance on diesel power.

By identifying gaps in healthcare infrastructure and professional training, targeted programs can be developed to equip providers with the necessary skills to diagnose, treat, and manage air pollution-related conditions such as asthma, COPD, and cardiovascular diseases. Additionally, like in the case of HIAs, insights from these assessments help guide resource allocation, ensuring that the most affected regions receive adequate support.

This proactive approach not only informs policy development and prioritizes investments in pollution control but also establishes a baseline for monitoring and evaluating the effectiveness of clean air interventions over time. Ultimately, comprehensive health system assessments play a vital role in strengthening healthcare resilience and improving public health outcomes for communities most vulnerable to air pollution.

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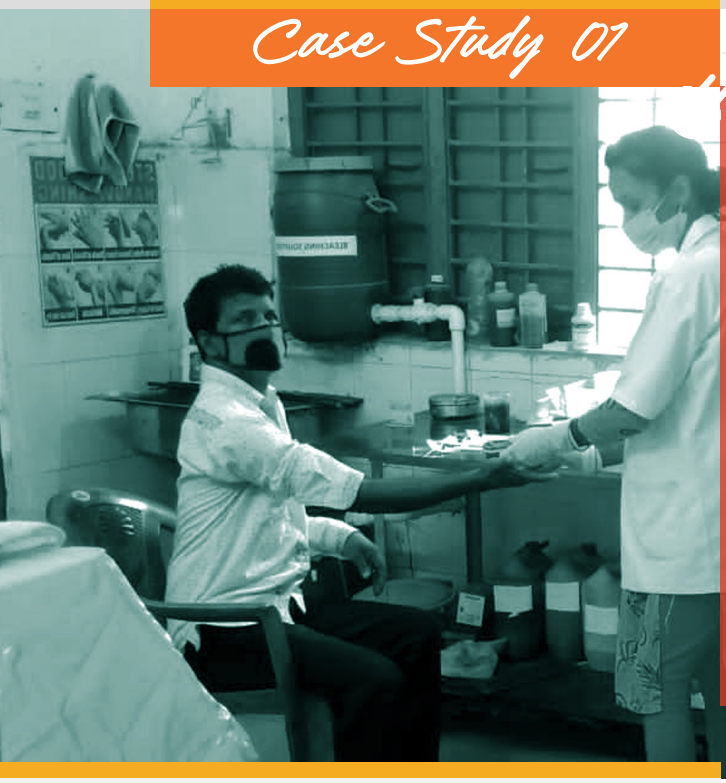
Photo Courtesy: freepik

Case Study 01



Health system assessment conducted in the State of Chhattisgarh, India, by the State Health Resource Center (SHRC) Raipur in 2022[20]

The State of Chhattisgarh in central India is heavily affected by industrial air pollution, particularly in regions with dense coal mining, thermal power plants, and industrial operations. Recognizing the escalating health crisis, the SHRC undertook a detailed assessment to evaluate the region's health system readiness to address air pollution-related health harms in two of the most polluted districts of the State.

Photo Courtesy: Punita Kumar, State Health Resource Center

Key Components of the Assessment

The SHRC's study focused on several critical dimensions:

1. **Healthcare Facility Preparedness:**
   - The assessment reviewed hospitals and primary healthcare centers to identify gaps in infrastructure, such as a lack of isolation wards for respiratory illnesses and insufficient ventilation in clinics in high-pollution zones.
   - It recorded the availability of diagnostic tools like spirometers for lung function tests, X-ray machines for detecting respiratory damage, and basic monitoring devices like pulse oximeters.
2. **Medical Personnel Capacity:**
   - The study highlighted the need for healthcare workers trained in recognizing and managing air pollution-related illnesses, such as chronic obstructive pulmonary disease (COPD), asthma, and cardiovascular conditions.
   - It assessed workforce distribution, noting shortages of specialists in pulmonary medicine and general practitioners in rural and semi-urban areas.
3. **Essential Medicines and Diagnostic Supplies:**
   - The study reviewed the availability of medications and diagnostic supplies, particularly for managing chronic respiratory and cardiovascular diseases linked to air pollution.
   - Supply chain inefficiencies, including delays in the procurement and distribution of medicines, were identified as barriers to consistent treatment.

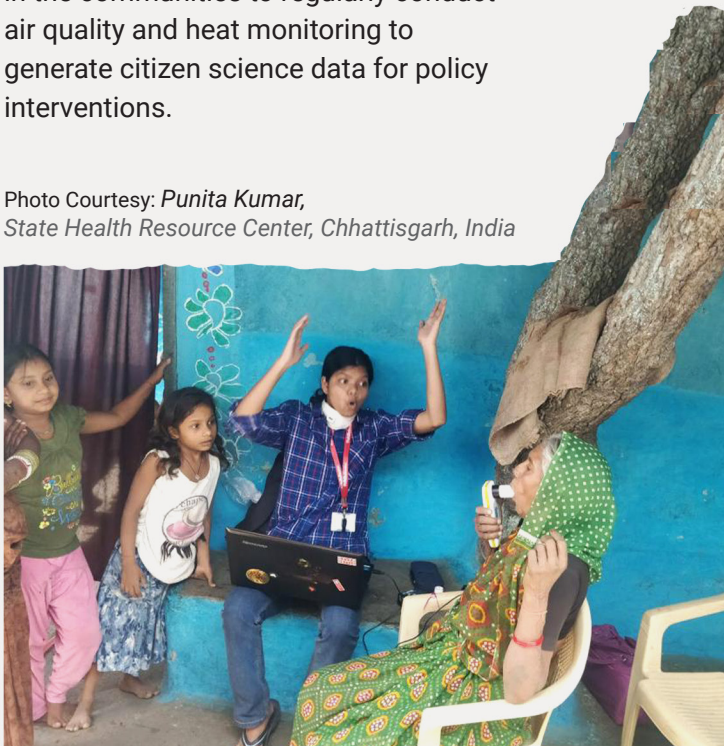
4. **Community Vulnerability:**
    - The assessment incorporated social and environmental data, analyzing how socio-economic status, occupational exposure, and proximity to pollution sources exacerbated vulnerabilities.

Targeted Interventions Based on Assessment Findings

Following the assessment, the Chhattisgarh government implemented several targeted measures to address the identified gaps in the two districts where the study was carried on:

1. **Upgrading Infrastructure:**
    - District hospitals and primary health centers have been equipped with advanced diagnostic tools, such as digital X-ray machines, spirometers, and nebulizers, enabling early detection and management of respiratory conditions. Trained personnel are being assigned to manage and maintain the facilities and effectively utilize them.
    - Ventilation systems in clinics were improved to mitigate indoor air pollution exposure for patients and staff.
2. **Workforce Development:**
    - The SHRC has designed training modules for healthcare workers to enhance their understanding of air pollution-related health conditions. This includes workshops for the doctors and nurses on diagnosing respiratory illnesses and managing long-term care for chronic diseases.
    - Community health workers are trained to include air pollution related questions in the patient history uptake including occupational and indoor exposure.
    - All the primary and the sub-health centers throughout the state display information, education and communication (IEC) materials on the health impacts of air pollution and means to mitigate them.
3. **Improving Medicine Supply Chains:**
    - An efficient logistics framework has been established to ensure consistent availability of essential medicines for respiratory diseases.
    - A stock-monitoring system has been introduced to prevent shortages and enhance distribution to remote health centers. Follow-up of stock monitoring of respiratory medicines is promoted not only seasonally but regularly in polluted districts.
    - Respiratory medicines are also being included in the Essential Drug List for health facilities in the air pollution vulnerable regions. SHRC is working closely with the health workers to ensure that inhalers are available and prescribed when needed.
4. **Community Engagement and Awareness:**
    - Public health campaigns have been launched to educate communities about the health risks of air pollution, preventive measures, and the importance of timely medical care.
    - SHRC has developed and is promoting the design for *smokeless chulahs*[21] (cookstoves) to mitigate indoor air pollution in the rural regions of the state.
    - SHRC is working in supporting capacity in the communities to regularly conduct air quality and heat monitoring to generate citizen science data for policy interventions.

Photo Courtesy: *Punita Kumar, State Health Resource Center, Chhattisgarh, India*



Broader Impacts of the Assessment

These targeted interventions not only strengthened the health system but also empowered communities to demand better environmental policies especially in the context of air pollution. For example:

- Access to improved healthcare services helped individuals understand the direct links between air pollution and their health, fostering increased public awareness.
- Community members began to organize and advocate for stricter enforcement of environmental regulations, such as a moratorium on expansion of polluting industries, strict emission controls on polluting industries, and vehicular pollution controls.
- The heightened public demand for action catalyzed government efforts to implement more stringent air quality monitoring and enforcement measures in the region.

Key Lessons on Comprehensive Health Infrastructure Assessment (Including Vulnerability Assessment)

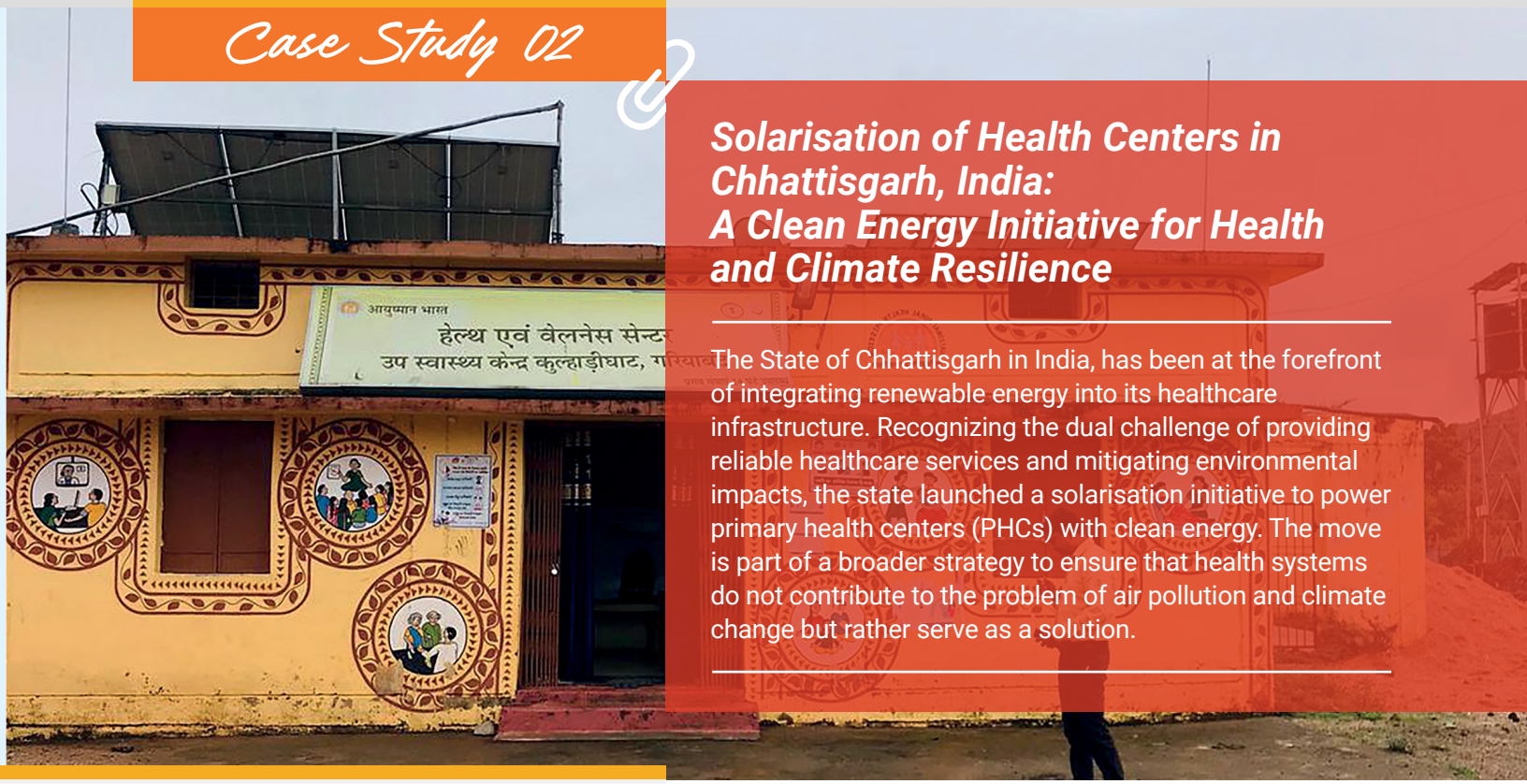
The Chhattisgarh experience highlights the power of comprehensive health infrastructure assessments to drive systemic change. By identifying gaps and implementing evidence-based interventions, health systems can effectively address air pollution-related health harms while building community resilience. Furthermore, the interplay between improved health services and public advocacy underscores the dual role of health systems—not only as providers of care but also as enablers of societal transformation.

Additionally, this approach is less resource-intensive, making it particularly valuable for countries where real-time air quality data may be unavailable in certain localities. In such cases, sufficient information can be gleaned from within the healthcare sector itself, allowing for informed and targeted interventions without relying solely on external air monitoring networks.

This case study provides a replicable model for other regions grappling with air pollution, demonstrating how strategic assessments and targeted health infrastructure improvements can lead to tangible health outcomes and stronger public demand for clean air and environmental justice.

The Chhattisgarh experience highlights the power of comprehensive health infrastructure assessments to drive systemic change.

Case Study 02



Solarisation of Health Centers in Chhattisgarh, India: A Clean Energy Initiative for Health and Climate Resilience

The State of Chhattisgarh in India, has been at the forefront of integrating renewable energy into its healthcare infrastructure. Recognizing the dual challenge of providing reliable healthcare services and mitigating environmental impacts, the state launched a solarisation initiative to power primary health centers (PHCs) with clean energy. The move is part of a broader strategy to ensure that health systems do not contribute to the problem of air pollution and climate change but rather serve as a solution.

Photo Courtesy: CREDA, Chhattisgarh, India

India's healthcare sector is a significant energy consumer, often relying on diesel generators during power outages, contributing to air pollution and greenhouse gas emissions.[22] The climate footprint of the Indian healthcare sector at 39 million tons of carbon dioxide equivalent is comparable to the annual GHG emissions from 10 coal-fired power plants.[23] In Chhattisgarh, where healthcare facilities often face erratic power supply and low voltage, diesel generators were not only expensive but also detrimental to air quality and health.

To address these challenges, Chhattisgarh initiated the solarisation of over 1400 health centers.[24] The initiative involved installing rooftop solar panels with battery storage systems to provide a reliable, healthy and clean power supply. The project was supported by the National Health Mission and Chhattisgarh State Renewable Energy Development Agency (CREDA).

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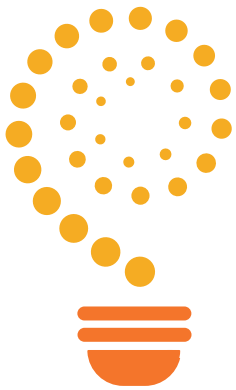
Impact and Outcomes

1. **Reduction in Air Pollution:** The shift from diesel generators to solar energy helped reduce local air pollutants such as PM2.5 and nitrogen oxides.
2. **Energy Resilience and Last-Mile Connectivity:** During extreme weather events, which are becoming more frequent due to climate change, solar-powered health centers maintained critical services. The stored solar energy ensured uninterrupted operation of cold chains, vital for vaccine storage, enabled nighttime healthcare services and efficient communications. Reliable power also improved last-mile connectivity, ensuring that remote and underserved communities had consistent access to essential healthcare services.
3. **Improved Access and Staff Retention:** The availability of reliable power significantly enhanced the working conditions at PHCs. Health centers could operate medical equipment, lighting, and digital health tools seamlessly, which boosted healthcare worker morale and retention especially for female health workers by creating a safer work environment. The enhanced facilities also encouraged healthcare professionals to serve in rural and remote areas, improving healthcare access for vulnerable populations.
4. **Economic and Health Benefits:** According to a study, "ninety per cent of the solar-powered PHCs reported cost savings from using solar PV systems over diesel generators."[25] The savings were redirected towards purchasing medical supplies and improving healthcare services. Additionally, healthcare workers and patients benefitted from improved air quality within health facilities.
5. **Scalability and Replicability:** The success of Chhattisgarh's model has become a blueprint for other Indian states. The Ministry of Health and Family Welfare has recommended scaling similar projects to improve healthcare resilience nationwide.[26]

The solarisation of health centers in Chhattisgarh exemplifies how health systems can adopt solutions that provide clean and healthy energy access, reduce air pollution, and build resilience to climate impacts. The initiative highlights the need for health systems globally to adopt sustainable energy solutions, demonstrating that health facilities can lead by example in the fight against air pollution and climate change while improving healthcare access and staff retention.



3 Strengthening Health Systems: Infrastructure, Early Warning, Air Quality Data, and Capacity Building

Strengthening the health infrastructure is a critical component of building resilience to air pollution-related health challenges. Such efforts allow regions with poor air quality to better respond to the increasing health burden through improved healthcare facilities, early warning systems, and enhanced respiratory care units. These interventions not only strengthen healthcare systems but also provide tangible benefits in reducing air pollution exposure and its associated health risks.

The implementation of early warning systems is vital for communities facing high levels of air pollution. These systems can monitor air quality in real-time and disseminate alerts to residents, allowing them to take precautions such as staying indoors or using precautions. By seeking partnerships to access existing air quality data—such as with environmental protection agencies, local and international academic researchers, and civil society organizations—health authorities can leverage available monitoring infrastructure rather than starting from scratch, which can be prohibitively expensive. In many places, air quality data already exists and by integrating such data into health systems, authorities can significantly reduce exposure to harmful pollutants and mitigate associated health risks, particularly for vulnerable populations such as children, pregnant women, the elderly, and those with pre-existing heart or lung conditions.

The implementation of early warning systems is vital for communities facing high levels of air pollution.

Similarly, enhancing the capacity of healthcare workers to effectively address air pollution-related health conditions is a cornerstone of creating resilient health systems. Integrating air pollution-related content into medical education and professional training equips healthcare professionals with the knowledge and skills necessary to diagnose, treat, and manage illnesses exacerbated by poor air quality. Beyond clinical expertise, these initiatives foster a multidisciplinary approach that empowers healthcare workers to engage in patient education and advocate for systemic improvements in air quality.

The financial implications of investing in health infrastructure are significant. Enhanced healthcare facilities lead to reduced hospitalizations and lower healthcare costs associated with treating chronic diseases linked to air pollution. Moreover, a healthier population contributes to increased productivity and economic stability within communities.

Case Study 01

Health Community Leadership in the UK: Air Quality Monitoring and Patient Health

The medical health community in the UK has been making significant interventions to protect patients from the adverse effects of air pollution, particularly through the efforts of the Royal College of Physicians (RCP) UK, Royal College of Physicians London, Royal College of Physicians (RCP) Edinburgh, and the Royal College of Paediatrics and Child Health (RCPCH). These institutions have taken important strides in integrating air quality monitoring into clinical practice to improve patient health outcomes. This initiative demonstrates how strategic collaboration and the effective use of existing data systems can strengthen healthcare responses, particularly for vulnerable populations most impacted by air pollution.

Photo Courtesy: Shiro Kazan

Air Quality Monitoring Integration

1. **School-Based Monitoring:** The Royal College of Physicians of Edinburgh has advocated for the installation of air quality monitors around schools in Scottish cities. This initiative aims to gather localized data on air pollution levels, which is crucial for assessing health impacts, especially among children who are particularly vulnerable to air quality issues. The proposal emphasizes that robust data is essential for understanding the safety of school environments and for informing public health policies.[27]
2. **Localized Data Utilization:** The RCP, UK has successfully integrated air quality monitoring into clinical practice, using localized data to assess the health impacts of pollution on vulnerable populations.[28] By leveraging real-time air quality data, clinicians can identify patterns and correlations between exposure to pollutants such as PM2.5 and NO2 and the onset or exacerbation of conditions like asthma and COPD.[29]
3. **Focus on Vulnerable Populations:** The Royal College of Paediatrics and Child Health (RCPCH) has highlighted that already deprived populations experience greater health impacts from air pollution, despite contributing less to it. Their position statement calls for targeted actions from

governments and local authorities to protect these groups, reinforcing the need for localized monitoring to inform health interventions.[30]

Integration into Clinical Practice

1. **Educational Resources:** The RCPCH in the UK has developed a comprehensive resource known as the "Air Pollution Companion",[31] aimed at integrating knowledge about air pollution into clinical practice. This toolkit is designed to help healthcare professionals communicate effectively with patients about air quality and advocate for necessary changes to improve public health outcomes.
2. **Collaboration and Advocacy:** The RCPCH has mobilized a network of child health professionals to advocate for clean air initiatives at local and national levels.[32] This includes gathering case studies[33] and showcasing best practices in tackling air pollution, thereby fostering a collaborative approach to addressing this public health issue. The RCP UK and the RCPCH jointly produced an influential 2018 report[34] highlighting the severe health impacts of air pollution across a lifetime. The report links air pollution to major health challenges, attributing 40,000 UK deaths annually and over £20 billion in health and economic costs. It also addresses indoor air pollution, calling for major reforms, including stricter regulations on polluters, enhanced air quality monitoring, stronger indoor pollution research, and NHS leadership in reducing emissions. It urges collective action through active transport, energy efficiency, and public awareness to mitigate exposure.
3. **Personalized Care for High-Risk Patients:** With access to localized air quality data, healthcare providers have been able to develop personalized care plans,[35] advising high-risk patients to limit outdoor activities during high pollution periods and to use protective measures such as masks. Respiratory care units have been upgraded with advanced diagnostic and therapeutic equipment, enabling timely intervention for pollution-related health issues. Notably, respiratory clinicians—particularly Sir Stephen Holgate, RCP's special advisor for air quality—played an instrumental role in the coroner's inquiry into Ella Adoo-Kissi-Debrah's death,[36] marking a pivotal moment in recognizing air pollution as a direct cause of mortality and reinforcing the urgency of stronger air quality policies.

Public Health Benefits

These investments have not only improved patient outcomes but also heightened public awareness of the health impacts of air pollution, encouraging communities to demand cleaner air policies.

Case Study 02

Integrating Air Pollution Data into Patient Care: Great Ormond Street Hospital,[37] UK

Great Ormond Street Hospital (GOSH) has launched an innovative initiative to integrate air pollution data into patient care, aiming to enhance the health outcomes of children affected by environmental factors. This initiative stems from a partnership with the MRC Centre for Environment and Health at Imperial College London, enabling the hospital to display annual average air pollution estimates for patients' home postcodes directly within their Electronic Medical Record (EMR) Epic system, an electronic patient record system used in several UK hospitals. Key features of the initiative are:

Photo Courtesy: Hornbeam Arts

Real-Time Data Access

Clinicians can now access localized average annual air pollution data, which serves as an educational resource to inform and support patients and their families regarding health risks associated with air quality.

Response to Criticism

This initiative follows critical findings[38] from the South London Coroner regarding the death of a young patient, Ella Adoo Kissi-Debrah, which highlighted the need for healthcare professionals to communicate the health impacts of air pollution more effectively.

Survey-Driven Development

Prior to implementation, GOSH conducted surveys among clinicians and parents to tailor the system to meet their needs. The display went live in November 2022 for healthcare workers, with ongoing efforts to gather feedback for continuous improvement. In March 2025 the scope was extended to include patients and families via an app.

Potential for Replication

The success of this initiative has garnered interest from other NHS trusts and government bodies, indicating a potential for broader application across the healthcare system in the UK. It has been replicated in several large London hospitals. Additionally, with Epic already in use in hospitals internationally, including in the US, Canada, and the

Netherlands, this model can be replicated beyond the UK, offering a scalable approach to integrating air quality into healthcare systems globally. The concept can be incorporated into any local or national electronic patient record, if suitable localized air quality data is available.

Outcomes and Future Goals

This proactive approach not only aims to improve clinical practice but also seeks to empower families with knowledge about environmental health risks, ultimately fostering better health outcomes for children.

Case Study 03

Respiratory Disease Surveillance and Successful Integration of Air Pollution in Medical Training: National Center for Disease Control (NCDC), Ministry of Health and Family Welfare, India

The NCDC under the Ministry of Health and Family Welfare, Government of India, is actively implementing its Health Adaptation Plan for Diseases Due to Air Pollution (2021),[39] a pioneering effort to address the growing public health crisis posed by air pollution in India. This plan underscores the need for a comprehensive and integrated response to mitigate the health impacts of air pollution while strengthening the country's health systems to respond effectively to this challenge.

Photo Courtesy: Shweta Narayan

Key Focus Areas of Implementation

1. **Air Pollution related Respiratory Illness (ARI) Sentinel Surveillance Program:**

   The Air Pollution related Respiratory Illness (ARI) Sentinel Surveillance Program, initiated in 2017 with four hospitals in New Delhi, manage, and mitigate air pollution-related health issues, and initiated efforts to integrate air pollution and its health impacts into medical education across all branches of the healthcare system, including allopathy

The Air Pollution related Respiratory Illness (ARI) Sentinel Surveillance Program, initiated in 2017 with four hospitals in New Delhi, has evolved into a nationwide network encompassing over 175 sentinel hospitals across 31 states in India.

has evolved into a nationwide network encompassing over 175 sentinel hospitals across 31 states in India. In the current phase, the surveillance prioritizes the 131 cities identified by the Ministry of Environment, Forest and Climate Change and the most polluted cities in the country. This program systematically monitors and analyzes the incidence of ARIs in relation to air pollution levels, leveraging air quality data provided by the Central Pollution Control Board (CPCB). By correlating health and environmental data, the program generates critical insights into the health impacts of air pollution, enabling evidence-based public health responses. The program has significantly expanded its footprint, ensuring a robust surveillance framework that spans diverse regions and populations, making it a cornerstone for monitoring air pollution-related health issues.

- **Data-Driven Insights:** By integrating air quality data from CPCB with ARI incidence parameters, the program highlights the direct link between deteriorating air quality and rising hospital admissions for respiratory illnesses. This evidence is instrumental in shaping targeted health interventions. The program's findings underscore a strong association between poor air quality and increased respiratory health burdens, reinforcing the urgency of health-focused air quality policies.
    - **Policy Integration:** The program's insights contribute to more informed policy decisions, driving the integration of health considerations into air quality management and environmental governance.
    - **Program Expansion:** Currently focused on respiratory illnesses, the program aims to broaden its scope to include cardiovascular diseases, mortality data, and case-based documentation. This expansion will provide a more comprehensive understanding of air pollution's multifaceted health impacts.

2. **Improving Health Infrastructure to Respond to Air Pollution Related Emergencies:**
    - Supporting the health sector strengthening in the states through their State Action Plans on Climate Change and Human Health. Air pollution and Health is a critical part of the action plans where states outline measures to combat the crisis.
    - Improving healthcare facilities, including equipping hospitals and clinics with measures to address air pollution-related illnesses.
    - Establishing early warning systems and hospital preparedness and response mechanisms to mitigate the impact of acute air pollution episodes. The early warning system allows for prompt public health responses, such as issuing advisories during periods of poor air quality, which can mitigate the impact on vulnerable populations.
    - Enhancing institutional capacities to respond to air pollution emergencies and developing protocols for public health interventions.
3. **Capacity Building for Health Professionals:**
    - The NCDC has developed comprehensive training modules to equip healthcare professionals with the knowledge and skills to recognize,

and AYUSH (Ayurveda, Yoga and Naturopathy, Unani, Siddha, and Homeopathy) with an aim to fostering a unified and multidisciplinary approach to addressing this critical public health challenge.

- The NCDC has collaborated with the National Health Systems Resource Center (NHSRC) to include air pollution related information in the training of the Accredited Social Health Activists (ASHAs) in India.[40] Currently there are over 930,000 ASHAs[41] who are the first link between communities and health systems across the country.
- Conducting regular training programs from National to State and District level for healthcare professionals to improve their ability to diagnose, manage, and treat air pollution-induced illnesses.

4. **Multisectoral Collaboration, Community Awareness and Engagement:**
   - An organizational framework has been established of programme implementation officers at all States and Districts with the aim to put in place systems required for service delivery related to air pollution and health, under oversight committees such as multisectoral taskforce and governing body chaired by senior leadership in the government. Multisectoral participation has been fostered by inviting officials of related programmes such as non-communicable diseases, maternal and child health as well as from sectors such as environment, power, renewal energy, Panchayati Raj Institution etc in its multisectoral taskforce committees.
   - Launching nationwide campaigns to educate communities about the health risks of air pollution and promote behaviors that reduce exposure, such as using masks and avoiding outdoor activities during high pollution periods.
   - Building community resilience through outreach programs that empower citizens to advocate for cleaner air and demand health-focused policies.
   - Health advisories for poor air quality day disseminated over all media channels and in various languages.
   - Healthcare professionals conduct workshops in schools and communities, teaching families about preventive measures during high pollution days.
   - Initiatives aimed at raising awareness about the importance of clean air have been launched throughout the year, especially on key days like the National Pollution Day (Dec. 3) and International Day of Clean Air for Blue Skies (Sept. 7), leading to increased community participation in local environmental advocacy.

Photo Courtesy:
Punita Kumar,
State Health Resource Center, Chhattisgarh, India

Case Study 04

Accredited Social Health Activist (ASHA): Advancing Air Pollution Awareness in India

The ASHA programme, launched in 2005-2006 under the National Health Mission, is India's largest community health worker initiative, recognized globally for its impact on underserved populations. ASHAs—trained female health activists—serve as the first point of contact for primary healthcare, building trust and improving health literacy. Each ASHA supports 1,000–2,500 people, directly impacting millions nationwide. Initially focused on maternal and child health, immunization, nutrition, and sanitation, ASHAs have expanded their role to address emerging challenges like climate change and air pollution. During COVID-19, they were India's frontline health workers, earning the WHO Director-General's Global Health Leaders Award (2022).[42]

Photo Courtesy: Vital Strategies

Through capacity-building initiatives under the National Programme for Climate Change and Human Health (NPCCHH), with support from Vital Strategies, ASHAs in Indore, Madhya Pradesh, and other states are now integrating air pollution awareness into their routine activities. By delivering critical messages on air pollution's health impacts and mobilizing communities, ASHAs are fostering behavior change and driving public health action at the grassroots level.

Story of ASHA worker Chintamani Kushwaha, Indore, India: For Chintamani Kushwaha, an ASHA worker from Rajnagar, Indore, health work is more than a job—it's a mission. "I have always wanted to work closely with people, ensuring they understand how small changes in their daily lives can lead to better health," she says. Since 2016-17, she has served nearly 2,000 community members, conducting daily household visits and regular meetings to share knowledge and experiences.

A turning point came when she attended a National Programme on Climate Change and Human Health (NPCCHH) training on air pollution's health impacts and ASHAs' role in community awareness. "*This was the first time I truly understood the importance of clean air and how it affects different age groups*," she recalls. She learned simple yet effective measures—preventing tobacco smoke exposure, promoting cleaner cooking fuels, wearing masks, and discouraging open waste and crop burning—to help protect public health.

Simple yet effective measures—preventing tobacco smoke exposure, promoting cleaner cooking fuels, wearing masks, and discouraging open waste and crop burning—to help protect public health.

Chintamani integrates air pollution awareness into her routine activities:

- **Household Visits:** Educating families on air pollution's effects on children, pregnant women, and the elderly.
- **Community Gatherings (Village Health Sanitation & Nutritional Committees, MAS Meetings):** Raising discussions on clean air.
- **Schools & Adolescents (RKSK Programmes):** Teaching youth about air pollution and green initiatives.
- **Workplace Awareness (Factories & Construction Sites):** Helping outdoor workers understand AQI levels and adopt protective measures.
- **Social Media Outreach:** Using WhatsApp and Facebook groups to share air quality updates and preventive tips.

"*People often ignore air pollution because they cannot see its immediate effects. My role is to bridge this gap—to help them connect their breathing problems, allergies, and chronic coughs to the air they live in every day*," she explains.

Building Trust, Overcoming Challenges & Driving Change

Like a family doctor, Chintamani ensures consistent follow-ups, making her efforts sustainable and impactful. Despite low awareness, traditional practices, and resistance to change, she remains committed: "*I am aware that children, the elderly, and pregnant women are the most impacted. If I can make even a few families understand the importance of clean air, I know I have done my job well*."

Chintamani's journey reflects the dedication of ASHAs across India—not just as health workers but as catalysts for social change. Through trust, education, and persistence, she is helping her community take steps toward cleaner air and healthier lives, proving that one person's effort can create a ripple effect—turning clean air from an aspiration into a reality.

Lessons from integrating frontline health workforce in air pollution action

Over the last two years, several milestones have been achieved at both the central and state levels to integrate air pollution action in ongoing efforts by frontline workers. Local health workers are trusted by their communities and can play a huge role in educating people on the ill effects of air pollution and how to decrease their risk. To achieve measurable health benefits of clean air solutions, rigorous efforts are needed by:

Training and knowledge building of frontline health workers to act as clean air advocates in their communities

Bridging knowledge gaps through ongoing training on air pollution and environmental health will equip health workers to provide accurate and actionable advice confidently.

Providing Accessible and Tailored Resources

Create simple, user-friendly materials such as leaflets, pollution alerts, and localized air quality updates with specific guidance for children, the elderly, and those with chronic illnesses. Equip community health workers with clear protocols and risk stratification methods for consistent and effective health communication.

Leveraging Trusted Health Cadres

Enhancing the role of ASHAs, Medical Officers, and Community Health Workers as trusted

health communicators will improve the reach and impact of public health messages in communities.

Incorporating Innovative Engagement Tools

Introduce and orient health workers to tools like the Air Quality Index, real-time pollution alerts, and interactive advisories to simplify complex health information. Conduct local research to understand community needs and refine communication strategies for better access and impact.

Building Capacity through Collaboration

The NPCCHH, in partnership with the National Health Systems Resource Center (NHSRC), has integrated air pollution education into ASHA training in India. This includes a dedicated handbook and updated induction materials, ensuring all new ASHAs are trained on this critical issue.

Key Lessons Investment in Air Quality Data, Health Infrastructure, Including Early Warning Systems and Enhancing the Capacity of Health Professionals

1. **Leveraging Real-Time Data:** Integrating air quality monitoring systems into clinical workflows empowers healthcare providers to deliver personalized, data-driven care. By utilizing real-time air quality information, clinicians can identify high-risk periods, tailor interventions for vulnerable populations, and provide timely guidance on minimizing exposure. This proactive approach enhances patient outcomes and strengthens the healthcare system's ability to respond effectively to air pollution-related health risks.

Integrating air quality monitoring systems into clinical workflows empowers healthcare providers to deliver personalized, data-driven care.

Crucially, this does not require regulatory-grade (expensive) air quality monitors. Low-cost sensors are increasingly available and affordable, making them well-suited for tracking pollution peaks and informing health interventions. Health departments should also leverage existing local air quality monitoring efforts, which may be conducted by meteorological agencies, universities, environmental authorities, community projects, and civil society organizations (CSOs). Identifying and collaborating with these groups can enhance data accessibility and integration into health system responses.

2. **Preventive and Proactive Approaches:** The integration of early warning systems and real-time air quality data empowers healthcare providers and the public to adopt preventive and proactive measures during high-pollution events. By identifying and communicating potential risks, these systems enable timely actions, such as advising vulnerable populations to limit outdoor activities or implementing targeted health interventions, ultimately reducing exposure and mitigating the health impacts of air pollution.
3. **Strengthening Healthcare Facilities:** Enhancing healthcare facilities, including upgrading respiratory care units and equipping hospitals with advanced diagnostic tools, is critical for effectively managing air pollution-related health conditions. These improvements ensure

timely diagnosis, specialized care, and better health outcomes for affected populations, while also increasing the resilience of health systems to address the growing burden of air pollution-induced illnesses.

4. **Capacity Enhancement of Healthcare Professionals:** Strengthening the skills and knowledge of healthcare professionals—including doctors, nurses, and community health workers—is crucial to addressing air pollution's health impacts. Enhanced capacity enables the early detection and management of air pollution-related illnesses, ensuring timely and effective patient care. It also prepares the healthcare workforce to actively engage with patients and communities on air pollution's risks and prevention measures. Furthermore, an informed and empowered health workforce can play a pivotal role in advocacy efforts, building trust and championing environmental and health justice at local, national, and global levels.

Enhanced capacity enables the early detection and management of air pollution-related illnesses, ensuring timely and effective patient care.

Overall, these case studies demonstrate that health authorities, in collaboration with allies in the health professions and civil society, can play a pivotal role in integrating air quality data into health systems, strengthening advocacy, and enhancing the capacity of health professionals to address pollution-related health risks effectively.

4 Strengthening Health Leadership and Cross Sectoral Collaboration to Tackle Air Pollution

Strong and effective leadership within health ministries is pivotal for shaping and implementing policies that tackle the health impacts of air pollution. Recognizing this, many governments have embraced innovative approaches to bolster health leadership, establish robust coordination mechanisms, and foster intersectoral collaboration. These strategies enhance the capacity of health ministries to address air quality challenges comprehensively, while ensuring that public health remains a central pillar in air quality management. By integrating health considerations into broader environmental and policy frameworks, these efforts create a unified and impactful response to the multifaceted challenges posed by air pollution.

Case Study 01

ASEAN's Transboundary Haze Management Efforts

The transboundary haze pollution that affects Southeast Asia has significant environmental, health, and economic implications. In response to this recurring crisis, the Association of Southeast Asian Nations (ASEAN) has demonstrated regional leadership through coordinated strategies to address the issue. Central to these efforts is the ASEAN Agreement on Transboundary Haze Pollution (AATHP)[43], adopted in 2002, which was the first regional treaty in the world specifically aimed at combating haze pollution. The Second Haze-Free Roadmap 2023–2030[44] builds on these foundations to ensure a sustainable, haze-free ASEAN by focusing on prevention, preparedness, and response mechanisms.

Photo Courtesy: iStock

Key Features of ASEAN's Efforts

1. **Regional Leadership and Coordination:**
   - **Institutional Framework:** The establishment of the ASEAN Coordinating Centre for Transboundary Haze Pollution Control[45] facilitates collaboration and cooperation among member states. This center supports enhanced monitoring, prevention, and mitigation of haze events.
   - **Health Integration:** Health ministries across ASEAN member states play a critical role in shaping policies that address the health impacts of haze. Regular cross-border dialogues ensure that health outcomes remain central to policy discussions.
2. **Collaborative Monitoring and Early Warning Systems:**
   - **Technological Integration:** Satellite-based monitoring systems, developed and implemented by ASEAN, play a crucial role in tracking hotspots and predicting haze episodes. These systems empower member states to take proactive measures to minimize the health and environmental impacts of haze. The ASEAN Specialised Meteorological Centre (ASMC),[46] a collaborative program involving the national meteorological services of ASEAN member countries, is central to managing the haze problem in the region. The ASMC's primary responsibility is to monitor and provide assessments of forest fires and transboundary smoke haze affecting ASEAN, enabling coordinated and informed responses.

- **Data Sharing:** Member countries share real-time data on air quality, forest fires, and health outcomes. This collaborative approach enhances understanding and facilitates the development of evidence-based solutions.

3. **Capacity Building and Policy Implementation:**
   - **Technical Support:** ASEAN provides member states with the resources and expertise needed to strengthen health systems and implement air quality management policies. For instance, the Regional Haze Action Plan[47] encourages countries to develop tailored sub-regional and local health preparedness plans for haze scenarios.
   - **Public Health Campaigns:** Regionally coordinated campaigns ensure consistent messaging about protective measures and health advisories. These communications campaigns help to educate and empower communities across borders.

4. **Multisectoral Collaboration:**
   - **Integrated Approach:** ASEAN emphasizes the importance of collaboration among health, agriculture, and environmental sectors. This approach addresses the root causes of haze by promoting sustainable agricultural practices and discouraging slash-and-burn techniques.
   - **Private Sector Engagement:** Businesses and industries are increasingly involved in sustainable land management initiatives, reducing the risk of practices that contribute to haze pollution.

Outcomes and Lessons Learned

Regional Solidarity:

The AATHP has fostered a shared commitment among ASEAN member states to address haze pollution as a cross-border issue requiring collective action. The Second Haze-Free Roadmap further underscores the importance of unity in achieving sustainable outcomes. What sets AATHP apart is that, unlike EU directives, it preserves national sovereignty (Article 3, Principle 1)[48] while driving collective, tangible action to reduce air pollution—a rare balance of autonomy and cooperation.

Improved Health Responses:

By pooling resources and sharing expertise, ASEAN member states have enhanced their capacity to manage the health crises associated with haze pollution. Improved health systems are better equipped to handle the increased burden of respiratory and cardiovascular diseases during haze events.

By pooling resources and sharing expertise, ASEAN member states have enhanced their capacity to manage the health crises associated with haze pollution.

Focus on Prevention:

Efforts to address the root causes of haze align health priorities with environmental and economic objectives. Initiatives such as reforestation, sustainable land management, and education campaigns reduce the occurrence of forest fires and haze pollution while promoting regional sustainability.

Challenges and Future Directions

Despite significant progress, challenges remain in achieving a haze-free ASEAN. These include differences in national priorities, enforcement of anti-deforestation laws, and financial constraints. Moving forward, ASEAN aims to enhance accountability mechanisms, strengthen multisectoral partnerships, and leverage technology for more effective prevention and response.

Case Study 02

Singapore's Haze Action Plan

Singapore's Haze Action Plan (HAP) serves as a powerful example of how governments can establish strong leadership and effective coordination mechanisms to address transboundary air pollution crises. Faced with recurring haze caused by forest fires in neighboring countries, in September 1994, Singapore established the Haze Task Force to coordinate the government's response to haze pollution. By September 2023, the Task Force had grown to include representatives from 28 government agencies.[49] Its key objectives are to protect public health and safety, collaborate with neighbouring countries to reduce forest burning, and maintain social and economic resilience. This strategic framework highlights the importance of cross-sectoral collaboration and proactive governance in tackling complex air quality challenges that transcend national borders.

Photo Courtesy: istock

Key Features of the Haze Action Plan

1. **Centralized Leadership and Coordination:**
   - Singapore's Ministry of Health (MOH) plays a pivotal role in leading the health-related response to haze episodes. The MOH collaborates closely with the National Environment Agency (NEA), which monitors air quality, and the Ministry of Education, which ensures the safety of students during haze events.
   - The government established an inter-agency Haze Task Force, chaired by the NEA, which includes representatives from health, environment, and urban planning authorities. This task force ensures seamless coordination during haze episodes, enabling rapid decision-making and implementation of protective measures. One notable example of coordination occurred in June 2013, during severe haze conditions. The Singapore government established an Inter-Ministerial Committee, chaired by the Defence Minister to oversee national efforts in managing the crisis.[50] Various ministries, including Education, Health, and Defence, collaborated to issue health advisories, urging the public to

monitor their well-being and limit outdoor activities. The government also released its stockpile of N95 masks, distributing them free to low-income families and making them available at retail outlets. To further protect vulnerable populations, such as the elderly and young children, medical subsidies were provided, showcasing a comprehensive and well-coordinated approach to addressing the health impacts of the haze.[51]

2. **Health Advisory System Linked to Air Quality:**
   - The NEA provides hourly updates on the Pollutant Standards Index (PSI), which measures air quality. Based on these readings, the MOH issues tailored health advisories for different population groups, such as children, the elderly, and individuals with pre-existing respiratory or heart conditions.
   - The advisories include practical recommendations such as minimizing outdoor activities, using air purifiers indoors, and wearing N95 masks during high-pollution periods.
3. **Preparedness and Response Framework:**[52]
   - The MOH ensures that healthcare facilities are equipped to handle an influx of patients during severe haze episodes. This includes stocking up on respiratory medications, deploying additional medical staff, and preparing emergency protocols for managing respiratory and cardiovascular cases.[53]
   - A public awareness campaign, supported by healthcare professionals, educates citizens about the health risks of haze and preventive measures to protect their well-being.
4. **Collaboration Across Sectors:**
   - The HAP integrates health considerations into broader air quality management strategies through collaboration between health, environmental, and urban planning authorities. For example:
     - The Ministry of Transport works to reduce outdoor exposure by adjusting public transport operations during severe haze events.
     - Urban planning authorities incorporate green spaces and urban vegetation to mitigate localized air pollution.
   - Singapore's bilateral cooperation with neighboring countries focuses on addressing the root causes of haze, such as illegal land clearing and forest fires.

Outcomes and Best Practices

The Haze Action Plan has demonstrated significant success in mitigating the health impacts of transboundary haze and provides valuable lessons for other countries:

1. **Effective Cross-Sectoral Collaboration:** The coordination between health, environmental, and urban planning authorities ensures that health considerations are embedded in air quality management strategies.
2. **Rapid Health Response:** The integration of health advisories with real-time air quality monitoring enables timely interventions, reducing the health burden during haze episodes.
3. **Public Awareness and Engagement:** Continuous public education campaigns have increased awareness of the health risks associated with haze and empowered citizens to take preventive actions.
4. **Strengthened Healthcare Capacity:** Healthcare facilities are well-prepared to handle the surge in respiratory and cardiovascular cases during haze events, ensuring continuity of care.

Case Study 03

The Philippines' Inter-Agency, Multi-Stakeholder, and Health-Centered Collaboration to Address Air Pollution

Air pollution is a major environmental and health crisis in the Philippines, driving respiratory and cardiovascular diseases, economic losses, and ecosystem damage. In 2021, average PM2.5 levels were three times the revised WHO standard, highlighting the urgent need for action. The Philippines has taken a leadership role through the Inter-Agency Committee on Environmental Health (IACEH) and the National Environmental Health Action Plan (NEHAP), integrating health into environmental policy and pioneering a multi-stakeholder approach, positioning the country as a regional leader in environmental health governance.

Photo Courtesy: JC Gellidon, unsplash.com

A Pioneer in Health-Centered Environmental Governance

Established in 1991 through Executive Order No. 489, the Inter-Agency Committee on Environmental Health (IACEH) made the Philippines a regional pioneer in institutionalizing a health-led, cross-sectoral approach to environmental governance. While other countries focused on sectoral solutions, the Philippines recognized the deep interconnection between health and the environment, driven by rising urban air pollution and global commitments like the 1992 Earth Summit and WHO's Health and Environment Agenda. By designating the Department of Health (DOH) and the Department of Environment and Natural Resources (DENR) as co-chairs, the IACEH positioned health at the core of environmental policy, setting a precedent for multi-stakeholder action on air pollution and related challenges.

The Multi-stakeholder Approach: Key Features and Contributions

1. **Health at the Helm:** The leadership of the DOH has been a key factor in the success of the IACEH in ensuring that public health outcomes remain the first metric for the evaluation of air pollution policies. IACEH has been able to galvanize support from the most diverse stakeholders, including government agencies, private sector partners, and civil society, by framing air quality as a public health crisis rather than just another environmental issue.
2. **Broad-Based Collaboration:** Membership in IACEH is not limited to health and environment alone but comprises transportation, economic and development authority, department

of interior & local government, and non-government organizations. This multi-stakeholder approach has been instrumental in letting the committee be:

- **Integrating sectoral policies:** It aligns policies on transportation and energy with objectives in air quality through the use of cleaner fuel and a shift to renewable sources of energy.
- **Foster public-private partnerships:** Engaging industries in adopting cleaner technologies and corporate social responsibility initiatives related to air quality.
- **Empower local governments:** Supporting local government units (LGUs) in developing localized air quality action plans, tailor-made for the specific needs of their community.

3. **The NEHAP Framework:** The National Environmental Health Action Plan (NEHAP), which was first launched in 1997, is a flagship of the work of IACEH. It considers air quality management as one of the critical pillars of the plan and is aligned with the Philippine Clean Air Act of 1999 (Republic Act No. 8749). Through its periodic updates, including the NEHAP 2030, the plan has evolved to include:
   - **Enhanced monitoring systems:** Establishing air quality monitoring networks that provide data to guide policy decisions.
   - **Health-focused interventions:** Developing programs to mitigate the health impacts of air pollution, particularly on vulnerable populations.
   - **Capacity building:** Training LGUs and other stakeholders in air quality monitoring and enforcement.

Achievements and Regional Significance

The Philippines was one of the first countries to adopt a health-led multi-stakeholder approach, thus positioning itself as a trailblazer in the region. With its public health integration into environmental governance, IACEH has managed to influence neighboring countries to consider similar frameworks, particularly in the context of transboundary air pollution challenges such as haze. Some of the big policy wins of IACEH and NEHAP include:

The Philippines was one of the first countries to adopt a health-led multi-stakeholder approach, thus positioning itself as a trailblazer in the region.

- **Updating of the air quality guideline values for PM2.5[54,55] and PM10:** The EMB-DENR has updated the Philippines' air quality standards to protect public health and align with the WHO Air Quality Guidelines through DENR Administrative Order No. 2020-14. Developed with a Technical Working Group of experts, the new PM2.5 breakpoints classify air quality into six levels with corresponding health precautions. This update reflects the urgency of strengthening air quality management to safeguard health and achieve WHO standards. Presented to the Inter-Agency Committee on Environmental Health and the public, it underscores the government's commitment to stricter air quality regulations. Similar efforts are underway to update the PM10 standards.
- **Tighter vehicle emission standards:** Encouraging the adoption of Euro 4 fuel standards, and promoting a shift to cleaner vehicle technologies;
- **Energy sector reform:** Encouraging the movement from coal towards renewable sources of energy; and,
- **Health-oriented urban planning:** Green spaces and sustainable development within cities to control urban air pollution.

In addition, the Philippine government's establishment of air quality monitoring stations in urban areas provided the critical data that has informed evidence-based interventions. Public awareness campaigns, such as BREATHE Philippines, have educated communities on the health risks posed by air pollution, nurturing grassroots support for cleaner practices and technologies.

Challenges, Lessons and Implications

While the Philippines has made progress, challenges remain. Uneven policy implementation, especially in rural areas, limits the enforcement of air quality standards, and monitoring infrastructure remains largely urban-centered. The multi-stakeholder approach, while inclusive, can also be slow and resource-intensive when priorities diverge.

Despite these hurdles, the Philippines' health-led environmental governance offers valuable lessons. IACEH and NEHAP demonstrate how multi-sector collaboration can keep public health central in addressing air pollution. To sustain its leadership, the country must overcome structural barriers, strengthen political commitment, and embed equity in air quality strategies.

As a regional pioneer, the Philippines has the opportunity to scale innovations, deepen collaborations, and set a global example in tackling air pollution through health-driven, cross-sectoral governance.

Photo Courtesy:
freepik

Key Lessons from ASEAN, Singapore and the Philippines approaches

The experiences of ASEAN, Singapore and the Philippines in addressing air pollution offer critical insights into effective strategies for managing its health and environmental impacts.

1. **Leadership and Coordination:** Centralized leadership, as demonstrated in both the cases, ensures effective decision-making and a cohesive response during air pollution crises. These structures, combined with inter-agency coordination, facilitate timely and efficient implementation of health and environmental policies.
2. **Regional and Multisectoral Collaboration:** Collaboration across sectors and borders is critical to addressing the systemic drivers of air pollution. ASEAN's transboundary haze management efforts and Singapore and Philippines integrated domestic strategies highlight the importance of aligning health, environmental, and economic policies to achieve sustainable outcomes.

Collaboration across sectors and borders is critical to addressing the systemic drivers of air pollution.

3. **Real-Time Monitoring and Communication:** Linking health advisories to air quality indices enables responsive and targeted interventions, ensuring that populations receive timely guidance during air pollution episodes.
4. **Integration of Health into Policy:** Embedding health considerations into broader air quality management and urban planning strategies ensures public health remains a priority. Singapore's approach exemplifies how aligning health with environmental and urban policies creates a comprehensive framework for tackling air pollution.
5. **Public Engagement and Awareness:** Empowering communities through education and practical guidance fosters a collective approach to addressing air pollution. Public health campaigns and tailored advisories not only enable individuals to take protective actions but also drive advocacy for systemic change, making public engagement a cornerstone of success.

Photo Courtesy: freepik

5 Community Needs Assessment and Response

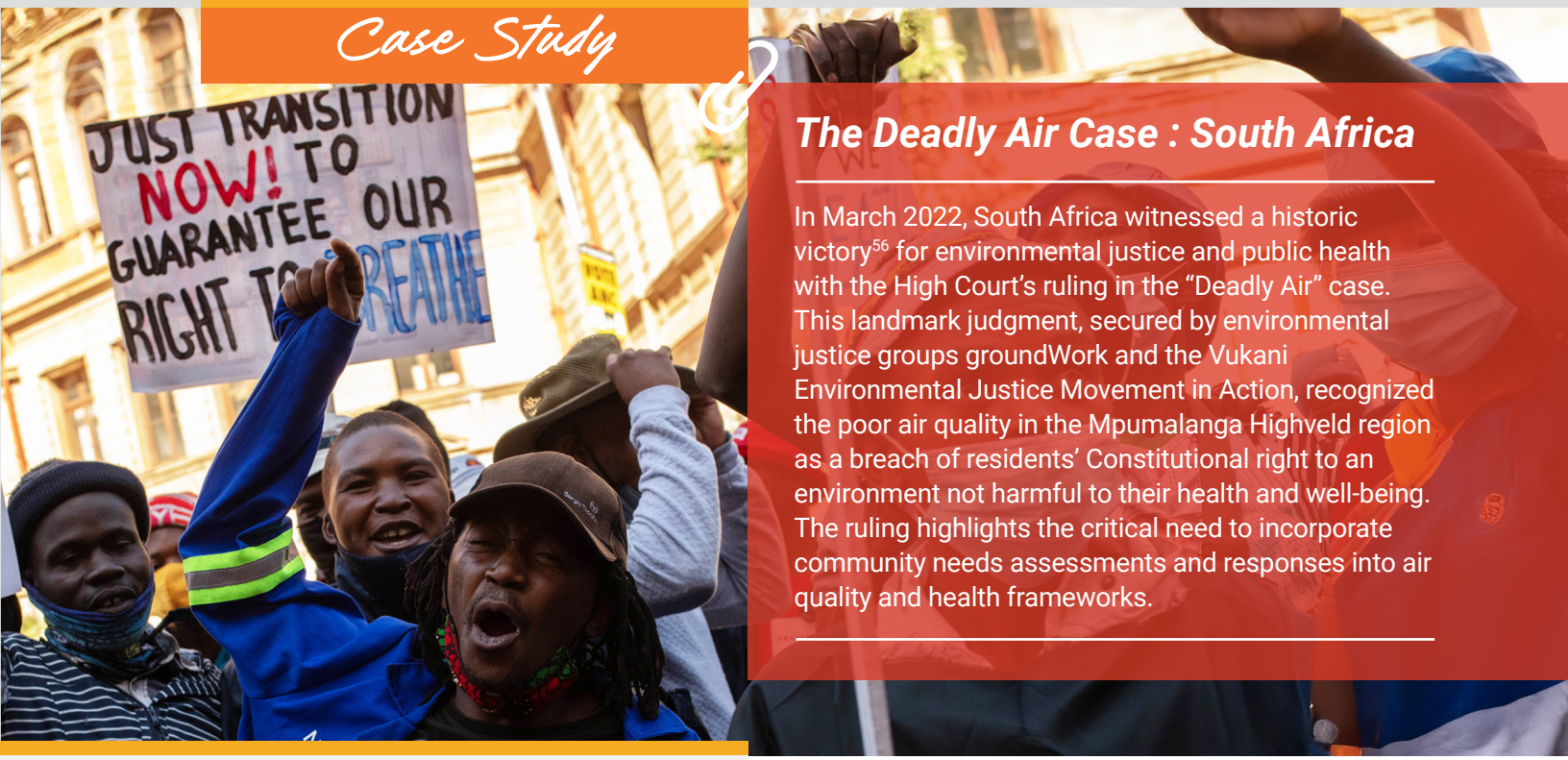
Frontline communities around the world are increasingly aware of their rights and are leveraging this understanding to demand stronger environmental health policies through legal action. This growing trend of litigation, particularly in response to climate change and air pollution, reflects a collective push to hold governments and polluters accountable for failing to safeguard public health and the environment. By taking legal recourse, communities are driving enforcement of clean air policies and pushing for systemic change. Involving these communities in the design and implementation of clean air initiatives is not only essential for ensuring equitable and effective solutions but also fosters a sense of ownership and empowerment, further strengthening advocacy for environmental justice.

In this context, community needs assessments are indispensable tools for gaining a nuanced understanding of how air pollution disproportionately impacts vulnerable populations. These assessments enable the identification of specific health challenges faced by different groups, such as children, the elderly, individuals with pre-existing health conditions, caregivers or those living in low-income or marginalized communities. By engaging directly with these communities through surveys, focus groups, and participatory discussions, health leaders can incorporate local knowledge, lived experiences, and cultural contexts into the decision-making process.

Community needs assessments are indispensable tools for gaining a nuanced understanding of how air pollution disproportionately impacts vulnerable populations.

This collaborative approach ensures that proposed interventions address the root causes of health disparities, such as inadequate access to healthcare, housing near pollution sources, or occupational exposures. By factoring in the social determinants of health, such as income, education, and access to clean environments, these solutions can be tailored to meet the unique needs of the affected populations. Moreover, community-driven insights can inform policies and initiatives that are both equitable and impactful, particularly in regions with persistently poor air quality. Targeted interventions, such as deploying air filtration systems in schools, advocating for stricter industrial emissions standards, or providing healthcare access for pollution-related illnesses, become more effective when they are grounded in a thorough understanding of community-specific needs. Ultimately, this approach helps ensure that health interventions are equitable, inclusive, sustainable, and capable of improving the well-being of the most affected populations.

Case Study



The Deadly Air Case : South Africa

In March 2022, South Africa witnessed a historic victory[56] for environmental justice and public health with the High Court's ruling in the "Deadly Air" case. This landmark judgment, secured by environmental justice groups groundWork and the Vukani Environmental Justice Movement in Action, recognized the poor air quality in the Mpumalanga Highveld region as a breach of residents' Constitutional right to an environment not harmful to their health and well-being. The ruling highlights the critical need to incorporate community needs assessments and responses into air quality and health frameworks.

Photo Courtesy: Daylin Paul, Center for Environmental Rights

Background

The Mpumalanga Highveld region, encompassing parts of Mpumalanga and East Gauteng provinces, has long been recognized as one of the world's worst air pollution hotspots. Designated a "Priority Area" in 2007, the region remains plagued by dangerous air quality levels, exceeding both national and World Health Organization (WHO) standards. The primary sources of pollution include coal plants, oil refineries, and coal-to-liquid facilities, operated largely by Eskom, South Africa's state-owned electricity utility. Despite the declaration of the Highveld as a Priority Area and the development of an air quality management plan, government efforts to address the issue have been largely ineffective, leaving socio-economically marginalized communities exposed to severe health risks.

The "Deadly Air" Case[57]

In 2019, groundWork and Vukani Environmental Justice Movement in Action filed a case against the South African government, asserting that it had violated the Constitutional right to a healthy environment for residents of the Highveld Priority Area. The groups presented compelling evidence, including:

- A 2017 study[58] estimating 2,239 annual deaths attributable to coal-related air pollution.
- Reports detailing over 9,500 cases of bronchitis among children aged 6 to 12 in the region.
- Independent assessments highlighting the overwhelming contribution of 14 major facilities to air pollution levels.

The groups sought a court declaration that the poor ambient air quality constituted a violation of constitutional rights and an order for the government to enforce the Highveld Air Quality Management Plan (HPA AQMP).

Judgment and Implications

The High Court's ruling was a significant milestone in environmental and public health advocacy. The judgment reinforced the notion that clean air is a constitutional right and underscored the government's obligation to enforce air quality standards. By recognizing the systemic failure to address the air pollution crisis, the ruling demanded accountability and swift action from government agencies. Key outcomes included:

1. **Recognition of Air Quality as a Constitutional Right:** This sets a legal precedent for air quality management to be prioritized as a fundamental human rights issue.
2. **Call for Accountability:** The judgment emphasized the need for robust enforcement mechanisms to ensure compliance with air quality standards.
3. **Validation of Evidence-Based Advocacy:** The role of medical professionals, public health experts, and technical evidence was pivotal in strengthening the case.

The Role of Community Needs Assessment

The "Deadly Air" case demonstrates the fundamental role of community needs assessments in addressing air quality and health crises. Residents of the Highveld Priority Area, predominantly marginalized communities, were at the forefront of this advocacy. Their lived experiences, coupled with data on the health impacts of air pollution, highlighted the urgent need for equitable and targeted interventions.

Community engagement ensured that the case was not just about numbers but about real people suffering from preventable illnesses, reduced quality of life, and loss of livelihood due to pollution. Incorporating community input into health frameworks allows for:

- **Tailored Interventions:** Strategies that address the specific health and environmental challenges faced by local populations.
- **Inclusive Solutions:** Policies that reflect the needs and priorities of those most affected.
- **Increased Accountability:** Community participation ensures that governments and polluting entities are held accountable for their actions.

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Key Insights and Takeaways

1. **Community-Centered Approach:** Actively engaging affected populations ensures that health interventions are relevant, culturally sensitive, and widely accepted.
2. **Empowerment Through Education:** Equipping communities with knowledge and tools to monitor air quality empowers them to advocate for systemic change.
3. **Data-Driven Advocacy:** Robust community health data strengthens policy reform efforts, ensuring accountability and long-term solutions.

The deadly air case among other advocacy efforts has catalysed the formation of South Africa's first ever National Department of Health's Air Quality and Health Focus Group - a multisectoral group which meets quarterly with the mandate of developing an Air Quality and Health Framework.

Photo Courtesy: Daylin Paul, Center for Environmental Rights

Embedding Community Needs in Policy Planning

The Deadly Air case serves as a powerful example of how integrating community needs assessments into air quality management strategies can lead to more effective and equitable outcomes. The case underscores that addressing air pollution's health impacts requires a holistic approach that places communities at the center of planning and implementation. Failing to adequately consider and address community needs not only undermines public trust but can also lead to legal challenges, as affected populations increasingly demand accountability through litigation. To replicate this success, health plans must incorporate the following key elements:

1. **Systematic Evidence Gathering:** Comprehensive and accurate data is the foundation for effective air quality management. This involves:
   - Collecting detailed information on the health impacts of air pollution, including respiratory illnesses, cardiovascular conditions, and premature mortality, while also assessing health equity impacts. This includes identifying disproportionately affected communities, key pollution sources, and targeted actions that maximize health benefits for vulnerable populations.
   - Identifying pollution sources, whether from industrial activities, vehicular emissions, or other contributors, to target interventions effectively.
   - Monitoring air quality over time to assess progress and adapt strategies as needed.

Such evidence provides a scientific basis for decision-making and strengthens advocacy efforts for stricter policies and enforcement.

2. **Community-Centric Frameworks:** Policies are more impactful when they are co-designed with the active involvement of affected populations. This approach ensures that:
   - Community voices are heard, particularly those of vulnerable groups such as children, the elderly, caregivers and marginalized communities disproportionately affected by air pollution.
   - Interventions are culturally appropriate and address specific local needs, enhancing acceptance and sustainability.
   - Empowered communities take ownership of air quality initiatives, fostering trust and long-term collaboration.

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3. **Integrated Health Responses:** Air pollution is a multifaceted issue requiring cross-sectoral collaboration to address its root causes and health effects. This includes:

- Bringing together environmental agencies, public health authorities, legal experts, and social service organizations.
- Tackling social determinants of health, such as poverty, housing, occupational risks, informal work, and access to healthcare, which exacerbate vulnerability to pollution.
- Ensuring that health responses, like early warning systems and accessible healthcare, are aligned with environmental and policy goals.

4. **Proactive Enforcement:** Ensuring compliance with air quality standards is essential to protect public health and prevent further harm. This involves:
   - Establishing robust mechanisms (both reference grade and low cost monitors) to monitor and enforce regulations, with penalties for non-compliance. Ensure community participation and oversight to ensure that vulnerable and underprivileged areas are covered through monitoring.
   - Holding polluters accountable through legal action, fines, or mandates to implement cleaner technologies.
   - Encouraging transparency and public reporting of air quality data to empower communities to demand action.

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Conclusion

The profound and far-reaching health impacts of air pollution demand an urgent, coordinated, and strategic response. To address this crisis effectively, it is crucial to reframe air pollution not merely as a challenge of emissions reductions or technology but as a critical threat to the public health and well-being of populations worldwide, demanding holistic public health based intervention. From respiratory and cardiovascular diseases to miscarriages, neonatal mortality and neurological disorders, the human toll of air pollution is staggering, and governments must prioritize building the capacity of their health systems to confront these challenges head-on.

This policy brief highlights the essential components of a comprehensive strategy: empowering health leadership, investing in resilient health infrastructure, fostering cross-sectoral collaboration, and engaging communities. Case studies from India, Singapore, the Philippines, the ASEAN region, the UK, and South Africa demonstrate the transformative potential of integrating health considerations into air quality management, leveraging data to inform patient care, driving policy advocacy, and enabling community-led interventions.

Each case study reflects a different starting point, demonstrating that action can be taken at multiple levels concurrently. Some countries prioritize strengthening health sector capacity, while others focus on integrating air quality data into healthcare or advancing policy interventions. Ministries and agencies can use these insights to assess their own national and local contexts, identifying the most impactful entry points for their communities. The key is to adopt a phased, adaptable approach, ensuring that health-driven air quality interventions align with existing infrastructure, priorities, and capacities.

Investing in the health sector so that it can better respond to air pollution achieves multifaceted benefits.

Investing in the health sector so that it can better respond to air pollution achieves multifaceted benefits. It equips health professionals with the tools and resources needed to mitigate impacts, conduct research, and implement public health initiatives. This allows health ministries to take a leading role, working alongside environmental agencies to ensure a comprehensive and coordinated response. Furthermore, these investments generate valuable health data, strengthening the evidence base for policy advocacy and providing concrete proof of air pollution's systemic impacts.

Beyond medical care, directing resources to the health sector creates a ripple effect. Enhanced healthcare services improve recovery outcomes for those affected by air pollution-related illnesses and empower individuals through education. Communities equipped with knowledge of the links between health and environmental factors are more likely to show strong public support for stronger clean air policies. By fostering public awareness and building advocacy networks, governments lay the foundation for robust social engagement that supports accountability and accelerates systemic change.

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Partnerships between health institutions and academic or research organizations amplify these efforts. Such collaborations provide data-driven advocacy tools that support public awareness campaigns and give policymakers the scientific justification needed to enact regulatory changes and invest in clean air technologies. These initiatives not only reduce the economic burden of treating air pollution-related illnesses but also enhance workforce productivity and contribute to national economic development.

Addressing air pollution as a public health issue also highlights its implications for social equity. Vulnerable populations, who bear the brunt of air pollution's effects, must be central to policy considerations. Health-centered approaches ensure that responses are inclusive and equitable, protecting all citizens and addressing critical social justice concerns.

Improved health outcomes lead to stronger public support, driving better policies and further health improvements.

Ultimately, integrating health-focused strategies with technological and environmental solutions creates a virtuous cycle. Improved health outcomes lead to stronger public support, driving better policies and further health improvements. Such health improvements reduce health costs and improve economic productivity and community thriving. This continuous feedback loop fosters healthier, more informed, and resilient communities capable of championing clean air initiatives rewarding decision-makers that implement them.

Health systems must act as catalysts for systemic change, providing care for those affected while driving the structural transformations needed to combat air pollution at its source. This is a defining moment for health leadership to rise to the challenge. With the right tools, strategies, and partnerships in place, governments can transform air pollution from a daunting challenge into an opportunity to advance public health, social equity, and sustainable development. Together, we must create a future where clean air is not a privilege but a fundamental right, ensuring healthier lives, stronger communities, and a more equitable and just world.

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Published by

GLOBAL CLIMATE & HEALTH ALLIANCE

March 2025