WHO Urban Health Initiative in Accra, Ghana

Summary of project results
Abstract

Ambient and household air pollution are a major cause of death and disease globally. This public health threat is being increased due to the rapid urbanization process and environmental degradation that characterises the 21st century and that have a higher impact in developing countries. The World Health Organization (WHO) Urban Health Initiative (UHI) is implemented as a response to the World Health Assembly (WHA) Resolution 68.8 from May 2015, which requests WHO to build health sector capacity to work with other sectors, support countries to identify effective policy measures, track progress, and update the evidence for health impacts of air pollution. WHO conducted a pilot project in the city of Accra (Ghana) to address air pollution and related health effects in cities in low- and middle-income countries (LMICs). The Initiative provides a health-based implementation framework to reduce deaths and diseases associated with air pollutants, and realize climate and other health benefits (e.g. less injuries and safe physical activity). Particular attention has been given to assessing the impacts of policies in sectors responsible for air pollution, specifically household energy, land-use, waste and transport activities. This report includes discussions on the main results and impacts of the pilot project conducted in Accra. And it provides guidance and available tools that can be adapted to similar initiatives around the world to assess the health impacts of air pollution, promote policies to reduce it and plan healthier environments.
WHO Urban Health Initiative in Accra, Ghana

Summary of project results
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FOREWORD

Health is the foundation of a strong and resilient society, and the planning, design and governance of our cities impact social and environmental determinants of health. Air pollution is the biggest environmental risk to health and is closely linked to policy choices around land-use, energy, waste management and transport. Human settlements in low- and middle- income countries (LMICs), with less resilient infrastructure, are also more vulnerable to climate change, further impacting the health of residents and putting additional strain on health systems.

This report summarizes key results of WHO’s Urban Health Initiative pilot project in Accra, providing an overview of the wide engagement with local and international stakeholders to assess the impacts of air pollution on health in Accra, and to identify multi-sector policy solutions which would yield the most health benefits. The report shows how a practical epidemiological approach to air pollution, combined with health impact assessment tools, can inform decisions to win health gains from other sectors, make local links to the Sustainable Development Goals, and manage the city in a holistic manner. The Initiative revealed that valuable synergies can be achieved by equipping the health sector to work across sectors.

WHO’s pilot project in Accra shows that with the right tools and processes cities can drive evidence-based policy changes which improve health and equity for all residents. Engaging the health sector to identify health arguments which drive policy solutions across multiple sectors is an opportunity to win a range of health, climate, and economic benefits under the administration of a single city or metropolitan area, or entire countries and regions. The Initiative in Accra also revealed that committing to attain the WHO Air Quality Guidelines can give direction to decision-makers to choose the policies which best promote health.

Unequivocally, Accra has developed into a hub from which to launch regional activities around urban public health strategies and to provide guidance to other cities to simultaneously address air pollution, climate mitigation and health while uncovering economic savings. This report offers urban health policy makers, and representatives of key health determining and energy intensive sectors, a glimpse of the available tools and a framework to deliver health-based policy solutions to address urban air pollution.

Dr Maria Neira
Director
Department of Environment, Climate Change and Health
World Health Organization
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The results of the analysis summarised in this report were presented in three different events in 2021: (i) an “Accra Science-Policy dialogue” meeting in January 2021, (ii) a “Policy Tracking” meeting in June 2021, and (iii) an “Urban Health Initiative: Discussion of Results and the Way Forward” meeting in October 2021. In addition, a series of WHO technical reports of the health and economic assessments of air pollution conducted by the Initiative are briefly outlined here.

This work was supported by the Climate and Clean Air Coalition through the grant provided for the Urban Health and SLCP Reduction project in Accra. Support was also provided by the Government of Norway through its financial contribution to advance WHO’s work on air pollution and health, which contributed to the completion of this product.
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<td>AMA</td>
<td>Accra Metropolitan Assembly</td>
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<tr>
<td>AQG</td>
<td>Air Quality Guidelines</td>
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<td>BAU</td>
<td>business-as-usual</td>
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<td>BC</td>
<td>black carbon</td>
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<td>CCAC</td>
<td>Climate and Clean Air Coalition</td>
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<td>CHEST</td>
<td>Clean Household Energy Solutions Toolkit</td>
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<tr>
<td>CH₄</td>
<td>methane</td>
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<tr>
<td>CO</td>
<td>carbon monoxide</td>
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<tr>
<td>CO₂</td>
<td>carbon dioxide</td>
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<tr>
<td>CO₂eq</td>
<td>carbon dioxide equivalent</td>
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<tr>
<td>COPD</td>
<td>chronic obstructive pulmonary disease</td>
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<tr>
<td>DEHOs</td>
<td>District Environmental Health Officers</td>
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<td>EPA-Ghana</td>
<td>Environmental Protection Agency Ghana</td>
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<td>GAMA</td>
<td>Greater Accra Metropolitan Area</td>
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<td>GAR</td>
<td>Greater Accra Region</td>
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<tr>
<td>GDP</td>
<td>gross domestic product</td>
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<td>GHG</td>
<td>greenhouse gas</td>
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<td>HAPIT</td>
<td>Household Air Pollution Intervention Tool</td>
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<td>HFCs</td>
<td>hydrofluorocarbons</td>
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<td>HIA</td>
<td>health impact assessment</td>
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<td>IHD</td>
<td>ischemic heart disease</td>
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<tr>
<td>iSThAT</td>
<td>Integrated Sustainable Transport Health Assessment Tool</td>
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<td>IT</td>
<td>Interim target</td>
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<td>LMICs</td>
<td>low-middle income countries</td>
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<td>LPG</td>
<td>liquefied petroleum gas</td>
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<td>NGOs</td>
<td>Non-governmental organizations</td>
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<td>NDVI</td>
<td>Normalized Difference Vegetation Index</td>
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<td>NOₓ</td>
<td>nitrogen oxides</td>
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<tr>
<td>pkm</td>
<td>passenger kilometers</td>
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<td>PM</td>
<td>particulate matter</td>
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<td>SE4ALL</td>
<td>Sustainable Energy for All Action Plan</td>
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<td>SDG</td>
<td>Sustainable Development Goal</td>
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<td>SLCPs</td>
<td>Short-lived climate pollutants</td>
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<td>SO₂</td>
<td>sulphur dioxide</td>
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<tr>
<td>SWEET</td>
<td>Solid Waste Emissions Estimation Tool</td>
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<td>SWM</td>
<td>solid waste management</td>
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<td>UHI</td>
<td>Urban Health Initiative (WHO)</td>
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<td>VSL</td>
<td>Value of Statistical Life</td>
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<td>VOLY</td>
<td>Value of a Life Year</td>
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<td>WHA</td>
<td>World Health Assembly</td>
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<td>WHO</td>
<td>World Health Organization</td>
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<td>YLL</td>
<td>Years of Life Lost</td>
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EXECUTIVE SUMMARY

About the Urban Health Initiative

Policies developed in cities have a critical influence on health. Cities may offer a range of opportunities for their residents, but they can also be a threat to public health due to higher exposure to environmental risks such as air pollution. Ninety-nine percent of people are exposed to polluted air, and in 2016, it was estimated that air pollution caused 7 million deaths per year globally. The Urban Health Initiative (UHI) aims to make health a priority in the design of air pollution-free cities. The Initiative aims to demonstrate available data, tools, capacity and processes to integrate health into policy-making in cities. Two pilot projects were carried in Accra (Ghana) and Kathmandu (Nepal).

Sectors that are important contributors to air pollution – energy, transport, waste, and land-use – also have other important influences on health, such as through traffic injuries, barriers to physical activity, noise and sanitation risks. Decisions about these relevant sectors need to include health as a key component. By working with governments and international and local partners, the Initiative aims to change the trajectory of air pollution and health in cities. It does so by influencing four particular areas:

- Developing a multidisciplinary approach, and building methodologies and tools to facilitate access to health evidence, highlighting the negative health impacts of inaction, and modelling the health and economic impacts of potential policy solutions.

- Dedicating particular attention to air pollution and the interplay between household energy, transport, waste and land-use sectors.

- Building health competencies, through ensuring health actors are equipped with the skills, knowledge and arguments to engage with key stakeholders and urban policy processes affecting health.

- Conducting health communications campaigns (e.g. BreatheLife) to raise public awareness on the connection between climate, air pollution and health, and catalyse action to reduce emissions.
The simplified model process to drive healthy urban transformation is illustrated below.

**Fig. 1.**
WHO’s Urban Health Initiative model process to integrate health in urban policy-making

![Diagram of Urban Health Initiative model process](image)

This model process helps build stronger health evidence and local political will to implement air pollution reduction strategies, responding to calls for action from a more aware health sector, and more health-aware stakeholders.

**WHO Urban Health Initiative pilot project in Accra**

This pilot project has highlighted the health implications of air pollution and strategies to reduce it in Accra, by assembling existing information on air pollution, mapping existing policies, developing alternative policy scenarios, and modelling the air pollution and health impacts of those scenarios. The Ghana Health Service has led efforts to train and build capacity in health workers, including community health workers, School Health Education coordinators and environmental health officers. Patient information materials on air pollution consequences for health have been discussed with health practitioners and distributed to health facilities.

In the BreatheLife Accra campaign, the communications strategy within the Initiative, target communities have been identified for outreach activities to raise awareness of the health impacts of air pollution and the cost of inaction, and to promote policies and behaviours to reduce it.
Key findings

This report summarizes the key results of the WHO-UHI pilot project in Accra. Full reports of this pilot project are available on the WHO website (https://www.who.int/initiatives/urban-health-initiative/pilot-projects/accra). Analysis of air pollution data indicates that pollutant concentrations in Accra are well above the WHO air quality guideline level. A series of scenarios were modelled to assess the impacts of alternative policy scenarios in specific sectors.

- In the Greater Accra Region (GAR), for ambient air pollution, a scenario in which the 2021 WHO Air Quality Guidelines (interim target 4) were met, would lead to 1790 annual premature deaths avoided, and years of life lost would be reduced by nearly 70,000 over 10 years. However, health gains would even occur in less stringent scenarios.

- For the Greater Accra Metropolitan Area (GAMA), modelling of household energy scenarios that shifted towards cleaner fuels were analysed. Business as usual (BAU) would only lead to small reductions in air pollution exposure and associated health effects (801 annual premature deaths avoided), with larger benefits seen in the moderately progressive (1256 annual premature deaths avoided) and aggressive scenarios (1848 annual premature deaths avoided), in which greater shifts to clean fuels were assumed. Adding more efficient (tier 4) charcoal cookstoves to the moderately progressive scenario would lead to significant additional benefits (1922 annual premature deaths avoided), whereas adding them to the aggressive scenario would provide little additional benefit.

- In the transport sector, scenarios suggested that increasing safe, active transport (walking and cycling), and shifts from car to bus use, are likely to have large health benefits by addressing air pollution, increasing physical activity and reducing road injuries. In contrast, a scenario with increased motorcycle use led to increased deaths and disability from road injuries. Analysis found that the health-economic benefits generated by controlling air pollution in transport make investments in improving air quality highly cost-effective.

- Modelling of solid waste management scenarios suggested that expanding composting and recycling can reduce climate pollutant emissions, but the greatest emission reductions come from ending waste burning.

- Modelling of land-use and green spaces scenarios suggested that increasing the levels of green spaces can significantly reduce premature mortality, as well as the risk of mental health disorders such as depression.

These findings provide indications of the potential health gains from different policy scenarios. They can help inform the development of action plans to reduce pollutant emissions, and improve health, for different sectors.
1. THE URBAN HEALTH INITIATIVE

1.1. Background

Ambient and household air pollution are a major cause of death and disease globally (WHO, 2016a). In 2008, the Libreville Declaration1 was adopted by 52 African countries to address health and environment in Africa and, although progress was achieved, it was estimated that in one year air pollution costs Africa US$ 447 billion, a third of its gross domestic product (GDP) (Roy, 2016). The WHO Urban Health Initiative (UHI) is implemented in response to World Health Assembly (WHA) Resolution 68.8 from May 2015, which requests WHO to build health sector capacity to work with other sectors, and support countries to identify effective interventions and track progress, while continuing to update the evidence for health impacts of air pollution.2

The Initiative addresses air pollution by increasing the knowledge of the health co-benefits of reducing emissions, and by mobilizing the health sector to scale up action, reinforcing evidence-based strategies with innovative policy measures to achieve emissions reductions. By highlighting the health co-benefits of these strategies, the Initiative provides compelling arguments to promote action. In many policy making contexts, health arguments, incentives and linkages are often not used sufficiently to unleash sustainable policies. To overcome barriers to promote sustainable policies, the health sector often requires capacity strengthening and awareness raising on the linkages between air pollution reduction and the realization of health co-benefits. The health sector also plays a vital role as an influencer in decision-making to address emission reductions across sectoral policies.

The Initiative focuses on assessing health impacts and decision-making processes that can influence air pollution reduction and short-lived climate pollutants (SLCP) mitigation at urban level. This means to address both climate change and air pollution with coordinated actions. Cities have been identified as the particular focus for this project since they are places with high concentrations of both population and air pollution, and they are a primary target for many measures to mitigate air pollution, as the responsibility for managing and controlling several sources fall within their authority. Furthermore, cities are (and will continue to be) in the spotlight of policies that tackle public health issues because of the rapid urbanization process that characterises the end of the 20th century and the beginning of the 21st century (WHO, 1993; WHO, 2016b). This will inevitably be linked with public health threats (e.g. increased risk of infectious and non-communicable diseases, more mental health problems, or an increase in inequalities) due to higher exposure to environmental risks. Air pollution is the environmental exposure that has the biggest impact on urban dwellers and thus actions to reduce it and to mitigate its health effects are urgently required.

WHO has a long tradition of urban health work that developed in the 1970s (WHO, 1976) and progressed with the Healthy Cities Network activities since 1988,3 a resolution of the World Health Assembly on Urban Health Development (WHA44.27 approved the 15 May 1991) and a call for action at global level (WHO, 2010). The Initiative builds on a tradition of scientific development of health

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1 The Libreville Declaration available at: https://www.afro.who.int/sites/default/files/2017-06/decLibrevilleDeclaration.pdf
2 WHA resolution available at: https://apps.who.int/iris/bitstream/handle/10665/253331/68_R8-en.pdf
impact assessment (HIA) methods, and a long experience of projects that in some cases have seen WHO participation, development of tools, in collaboration with experts and scholars mainly from the European Union and the United States, such as Externee (Friedrich, Rabl and Spadaro, 2001), Hearts (Mudu et Martuzzi, Alm et al., 2006), INTARESE (Briggs et al., 2008), ISHTAR (Negrenti et al., 2006), PASTA (Gerike et al., 2016), URGENCHE (Sabel et al., 2016). The development of the scientific methods and involvement of cities in case studies has assisted the political work to push the international agenda for the reduction of air pollution, in particular the May 2015 WHA Resolution on “Health and the environment: addressing the health impact of air pollution,” the 2016 WHA Road map for an enhanced global response to air pollution, and the 2018 WHO Conference on air pollution and health.

1.2. The Urban Health Initiative in Accra

Ninety-nine percent of the world’s population lives in areas exceeding WHO Guidelines for air pollutant levels⁴, and Accra, the capital of Ghana, is no exception. However, there are opportunities for change. More than 4 million people live in Accra (17% of all Ghana) and the population is expected to grow to 9.6 million by 2050. Accra is a sub-Saharan coastal city and one of the fastest growing cities in Africa, with an annual population increase of more than 2%. It is characterized by urban sprawl, with migrants comprising 47% of its population.⁵ In 2016, as one of the responses to the WHA Resolution 68.8 from May 2015, the WHO headquarters and the WHO Country Office for Ghana, in collaboration with local and international partners, launched the UHI pilot project in Accra to integrate health into policies that may have an impact on air pollution. This pilot project (developed between 2016 and 2021) aims to be the blueprint for other projects to address air pollution and related health effects in cities in low- and middle-income countries (LMICs).

In the next sections, this report describes the outcomes of mapping policies and stakeholders in Accra, the air quality in the city, and its impact on the health of the population, and summarizes the main results of the activities carried out for each priority area for action within the pilot project in Accra.

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⁴ WHO Air quality database: https://www.who.int/data/gho/data/themes/air-pollution/who-air-quality-database
⁵ For elaboration of the Accra region see: Ambient air pollution and health in Accra, Ghana (Mudu P, 2021). The Greater Accra Region (GAR) is one of the 16 administrative regions that compose Ghana, and it is divided in 29 districts that include the Accra Metropolitan District. Over the years, the City of Accra has been referred to as the Greater Accra Metropolitan Area (GAMA) due to the fast-expanding characteristics of the urban area beyond the central and coastal part of the city. GAMA includes the Accra Metropolitan Assembly (AMA) and the surrounding districts of Ga East, Ga West and Tema.
2. MAPPING POLICIES AND STAKEHOLDERS

The Initiative started by mapping policies and identifying key stakeholders. Conducted by UN-Habitat and ICLEI Local Governments for Sustainability, the Initiative built on the initial mapping through iterative consultations within the sector working groups. The policy mapping aimed at:

1. Depicting all relevant policies, regulations and bi-laws at all levels of government (national, sub-national and local),

2. Establishing knowledge of, and a link to all related relevant stakeholders,

3. Identifying policy gaps as well as potential entry points for engagement in the field of mitigation of SLCPs and air quality improvement.

The policy mapping identified four main sectors impacting air quality: energy (household energy for cooking and lighting), transport (including walking and cycling), solid waste management (including open burning of household and e-waste), and urban land-use and spatial planning. This mapping identified pertinent institutions and agencies, distinguished institutional functions, selected key informants to be contacted, outlined the relevant time frame and scales of analysis, and facilitated policy tracking training activities with the project steering committee and stakeholders.

Approximately 100 stakeholders and experts were involved directly in the analysis and assessments conducted during the Initiative, with the support of hundreds of local stakeholders supporting the project indirectly during events and public activities.

Key partners of this project have been the Ghana Health Service Health Promotion Department, Accra Metropolitan Assembly (AMA), Ghana Environmental Protection Agency (EPA), Ghana Education Service, and Ghana Coalition of NGOs in Health (GCNH).

2.1. Ambient air pollution policies

At the national level, Ghana has been implementing several policies to improve air quality, reduce greenhouse gas (GHG) emissions and support economic development. The Sustainable Energy for All (SE4ALL) Action Plan identified and prioritized the policy options that the government can adopt...
to reduce or avoid emissions of SLCPs from key economic sectors. Importantly, in 2018 EPA Ghana, the national agency with the primary mandate to prescribe pollution standards and programs to improve environmental quality, launched a comprehensive Air Quality Management Plan for the Greater Accra Metropolitan Area (GAMA). The plan aims to:

1. Reduce ambient concentrations of air pollutants to comply with national air quality standards for PM$_{10}$, PM$_{2.5}$, sulphur dioxide (SO$_2$), nitrogen dioxide (NO$_2$), carbon monoxide (CO), and tropospheric ozone in the Metropolitan Area;

2. Promote the governance and implementation of the air quality management plan across sectors;

3. Inform decision-making with sound air quality and health research;

4. Build capacities, and improve tools and systems for air quality management in the region; and

5. Increase knowledge and understanding of air quality issues among decision makers, stakeholders, and the general public.

Along with the plan, EPA Ghana also initiated a public review of Ghana’s vehicle emissions standards and ambient and point source Air Quality standards, installed 2 additional air quality monitors at Adabraka and University of Ghana, and deployed additional low-cost air quality sensors in strategic areas of GAMA as part of an effort to provide real-time air quality information to the public and also monitor air pollution mitigation efforts going forward (e.g. abatement of open waste burning and other measures).

2.2. Household energy policies

At the national level, policies to address the health impacts of household air pollution are within energy and environmental policies and programmes. Household energy programmes in Ghana include policies to transition to clean cooking, promote electrification and boost energy efficiency, and have been established with the objectives of addressing issues of deforestation, socioeconomic development, and climate change. Cleaner fuels can significantly improve health and quality of life and create additional economic benefits. The Ghana greenhouse gas inventory, a standalone report for monitoring sources of climate emissions, in 2014 cited shifts from biomass use to liquefied petroleum gas (LPG) for energy in the residential sector resulting in reduced methane emissions.

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The AMA has also made commitments and conducted actions to address air quality and climate change issues including: the 2020-2025 Accra Climate Action plan, with health featured as a key area for action across sectors to ensure sustainability, 2019 Resilience Strategy, and the 2016 Accra Greenhouse Gas Inventory. AMA also committed to the Deadline 2020 Climate Action Plan setting a science-based roadmap to deliver the high ambition & urgency of the Paris Agreement and signed C40’s Advancing Towards Zero Waste Declaration, promising to reduce municipal solid waste generation per capita by at least 15 per cent by 2030 compared to 2015, and also reduce the amount of municipal solid waste disposed to landfill and incineration by at least 50 per cent by 2030 compared to 2015.

Accra was the first major city in Ghana to join the BreatheLife campaign in 2018. As part of its commitment, the city of 2 million people is supporting outreach in some of the city’s key districts to reduce waste burning and promote green space development. AMA is also promoting renewable energy within the city. For more information see: https://breathelife2030.org/breathelifecity/accra-ghana/
Key policies impacting the household energy sector in Ghana include:

- The 1990 National LPG Promotion Programme, which subsidized substitution of LPG for firewood and charcoal and improved LPG distribution.
- The Ghana SE4ALL Action Plan, which provides a framework for household energy activities at the national level.
- The 2018 National Energy Policy, which aims to address institutional and market barriers to LPG uptake.

2.3. Transport policies

In Ghana, the National Urban Transport Policy provides the broad policy framework for the transport sector. Its overall goal is to make Ghana a transport hub and gateway for the West Africa region. Strategies in this plan include the development of a more efficient and sustainable public transportation system to alleviate urban congestion; promotion of road-based public transportation, including extended bus rapid transit corridors; and the development and promotion of non-motorised transportation infrastructure in congested central business districts. However, to date, implementation has fallen short of initial expectations.

Other transport policies that have an impact on air quality in Accra include:

- Import penalties in place for vehicles older than 10 years, although substantial numbers of older vehicles are still imported.
- A 2010 policy to promote bus fleet renewal and replace older, polluting mini-buses which has been followed by substantial imports of high-occupancy vehicles. However, air quality benefits have been offset by poor vehicle maintenance and use of high-sulphur fuels.
- A 2016 low sulphur fuel strategy that aimed to reduce fuel sulphur content substantially by 2020.

2.4. Solid waste management policies

The Local Government Act 1994 is the most recent regulation on waste management in Ghana:

- Preserves and maintains the waste management districts already in existence.
- Includes “the disposal of waste on land, including the discharge of effluent into a body of still or running water” as part of the definition of “physical development”.
- Re-centralizes the “Waste Management Department” at metropolitan assembly level, removing its counterparts at municipal and district assembly levels.

Prior to this, different acts and regulations to solid waste management have been implemented at the national and local level in Ghana and Accra, respectively (Fobil et al., 2008).
Currently, waste disposal and collection are important priorities in Accra. Open dumpsites and illegal disposal have been problems, and the AMA aims to close all illegal dumpsites within Accra. Waste collection services, 90% of which are currently outsourced to private providers, are also targeted for improvement. Planned activities include new waste transfer stations, developing more sustainable treatment and disposal options, review of waste management bylaws and increasing compliance through public education and enforcement. The Sanitation Court, important for prosecution and deterrence, will also be reviewed, and systems for public reporting of sanitation problems improved. Capacity will be built among District Environmental Health Officers (DEHOs), who have responsibility for ensuring proper sanitation, and the practice of daily sanitary inspection by DEHOs promoted.

2.5. Urban land-use policies

The existing institutional and legal framework mandates the Metropolitan, Municipal and District Assemblies or local governments as the main agents of local development in Ghana, including land-use planning and development planning in general (Government of Ghana, 2012). In metropolitan regions like Accra, the AMA and other municipal governments are mandated to undertake land-use planning and the protection of green spaces within their areas of jurisdiction. However, operating under the current system of decentralized planning, city governments are weak in terms of their financial resources, technical capacity and the political will to plan, implement and enforce development control (Owusu, 2015; ICF Consulting Services, 2017). The fragmentation of GAMA into several independent municipal governments, and these local governments/authorities’ failure to cooperate to undertake joint integrated planning, as directed under the provisions of Act 480 (Government of Ghana, 2012) has also hindered sustainable development planning. AMA and the Municipal Assemblies have documented plans in place for maintaining and conserving green spaces in their respective jurisdictions, but rely on the Department of Parks and Gardens for their execution. The sub-metros, however, do not have these plans.

**Take-home message**

In Ghana and Accra, existing legislation and policies allow to implement a sustainable agenda, but the governance has still to improve as well as the coordination of decentralized institutions that is still weak.

Working at the city level provides opportunities for collaboration and coordination between national and urban areas, achieving vertical integration of policies at both levels as cities move to quantify their contribution of air pollution and climate emissions. The health sector should be equipped to work with a wide range of stakeholders across sectors to effectively address air pollution and identify opportunities to integrate health into urban policies.
3. TRAINING AND CAPACITY BUILDING

Capacity building and stakeholder engagement activities were implemented along the whole project period (2016-2021) to facilitate the use of identified tools and guidance, reporting analysis results and actions, by local stakeholders in a cohesive way.

In 2017, in Accra, a training on health impact assessment was carried out with participants from the AMA, the EPA Ghana, the Ghana Health Service, the Ministry of Transport, the National Development Planning Commission, the School of Public Health (University of Ghana), and the University of Cape Coast. In July 2018, a workshop to encourage the use of local data to conduct analysis on the health and economic impacts of identified policy sectors against air pollution was carried out. This was followed by a workshop on stakeholder engagement in August 2018. In 2022, a new series of workshops were conducted in Kumasi (Ghana), including “train the trainers” activities. The work carried out allowed the refining of modules, which target clinicians and public health professionals. Training activities on air pollution and health should take a holistic view of that topic, because exposure to air pollution is closely linked to other environmental threats like climate change and it has an impact beyond the health sector. A clear guidance on the training and how to follow up should be provided, as well as the adequate resources to complement the course content.

Through series of training activities, technical capacity should remain in the local department after the project period, so that Accra can keep measuring, assessing, reporting and comparing the impacts of their strategies in the mid and long term.

7 The on-going activity of WHO on air pollution and health capacity building materials for the health workforce include basic modules, modules for clinicians and special epidemiological modules. A set of interactive clinical case scenarios that can be used as part of the training toolkit and a manual for trainers complement the materials. Contributors to the modules include international experts, WHO Collaborating Centers, Governmental agencies, medical societies, Universities, hospitals.
4. AIR QUALITY IN ACCRA

In Accra, air quality information is provided from (i) local monitoring sites, (ii) satellite data, and (iii) modelling based on available data (Table 1). Local monitoring sites are located in a mixture of land-use types, including adjacent to roadways, as well as commercial, industrial and residential areas. In addition, several research studies have undertaken air quality measurements for specific periods and locations within Accra (Odoi and Kleiman, 2021).

Satellite data is collected and analysed by the Copernicus Atmosphere Monitoring Service. These satellite observations are combined with ground-based data and used to estimate and forecast air quality for different locations. The limited spatial resolution of this system means it can be used for larger areas, such as the Greater Accra Region (GAR), but not for smaller geographical areas. One of the main features of the Initiative has been the work with available data rather than the design of research activities for the collection of data, if not for complementary investigations. The use of available data is a way also to invite environmental and public health experts to work with available information and not excuse inaction due to scarcity of data. Where data at the city level is not available, national data can be modelled and adapted to make local estimates.

Table 1. Air pollution estimates from 2014–2015 in Accra (residential monitoring station) and Greater Accra Region (satellite data)

<table>
<thead>
<tr>
<th></th>
<th>Residential monitoring station (Accra)</th>
<th>Satellite data (Greater Accra Region)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PM$_{2.5}$</strong></td>
<td>49.47 µg/m$^3$ (*)</td>
<td>36.02 µg/m$^3$</td>
</tr>
<tr>
<td><strong>PM$_{10}$</strong></td>
<td>81.10 µg/m$^3$</td>
<td>41.45 µg/m$^3$</td>
</tr>
</tbody>
</table>

(*) Concentrations of PM$_{2.5}$ were estimated from PM$_{10}$ using a conversion factor of 0.61.

Major sources of ambient air pollution in Ghana include smoke from cooking using polluting household fuels and appliances, vehicle emissions (especially from old, poorly maintained vehicles that use diesel and gasoline engines), industrial sources, open burning of waste and other materials, road and wind-blown dust, and Harmattan winds which blow desert dust from the Sahara across the continent.

4.1. Health impacts of air pollution in Accra

**Methodology**

The exposed population was profiled using 2010 census data stratified by age and gender. The 2010 population was 1 848 614 for the city of Accra, and 4 010 054 for the GAR (Ghana Statistical Services, 2012). An annual growth rate of 2.3% was used, based on UN DESA and WHO data. A life table was built applying the age specific death rates per 1000 mid-year population using Ghana Health Service data. The AirQ+ tool was then used to estimate changes in deaths and years of life lost (YLL) for a range of target air quality values.  

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6 WHO’s AirQ+ tool is a health risk assessment and modelling tool that calculates the health effects of long-term exposure to air pollution. AirQ+ allows you to estimate the reduction in life expectancy, and health effects as air pollution levels change.
To assess the number of premature deaths currently attributable to air pollution in Accra, the target PM$_{2.5}$ values used were from the 2005 WHO AQG (and its interim targets) and a reduction by 10% of current levels.

**Avoidable premature mortality by different air quality scenarios**

Five scenarios were modelled for the long-term effects of reducing PM$_{2.5}$ concentrations in Accra and in the GAR (Figure 2).

Results showed that compliance with 2005 WHO Air Quality Guidelines (interim target 4 for PM$_{2.5}$ in updated 2021 Guidelines) would reduce annual premature deaths by 1790 for the GAR, and 1204 for the city of Accra (Figure 2). Although the estimated baseline annual average PM$_{2.5}$ is lower in the GAR (36.02 µg/m$^3$) than the city of Accra (49.471 µg/m$^3$), the greater population of the GAR would lead to a greater number of deaths avoided by air quality guideline compliance. However, achieving the interim target of 35 µg/m$^3$ (scenario 4) would lead to fewer annual deaths avoided in the GAR (76) than in the city of Accra (475) because the latter would involve a greater reduction in PM$_{2.5}$ concentrations, due to the higher baseline. Similarly, a 10% reduction of current PM$_{2.5}$ levels (scenario 5) would lead to fewer deaths avoided in the GAR than in the city of Accra. Over 10 years, compliance with WHO Air Quality Guidelines would reduce the number of YLL from air pollution by 69,746 for the GAR.

![Fig. 2](image_url)

**Estimated annual deaths prevented by reducing PM$_{2.5}$ levels, in Accra and the GAR**

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Description</th>
<th>Accra</th>
<th>Greater Accra Region (GAR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AQG (PM$_{2.5}$ = 10 µg/m$^3$)</td>
<td>1790</td>
<td>1204</td>
</tr>
<tr>
<td>2</td>
<td>IT-3 (PM$_{2.5}$ = 15 µg/m$^3$)</td>
<td>1468</td>
<td>1067</td>
</tr>
<tr>
<td>3</td>
<td>IT-2 (PM$_{2.5}$ = 25 µg/m$^3$)</td>
<td>780</td>
<td>792</td>
</tr>
<tr>
<td>4</td>
<td>IT-1 (PM$_{2.5}$ = 35 µg/m$^3$)</td>
<td>475</td>
<td>351</td>
</tr>
<tr>
<td>5</td>
<td>Reduction of 10% of current PM$_{2.5}$ levels</td>
<td>76</td>
<td>236</td>
</tr>
</tbody>
</table>

Note: Scenario 1 represents compliance with 2005 WHO AQG for PM$_{2.5}$, which were updated in 2021.

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9 Averted deaths of air pollution were estimated considering the 2005 AQG, which were updated in 2021.
Key findings

Air pollutant levels in Accra are high. The city of Accra has estimated annual average PM$_{2.5}$ concentrations of almost 50 µg/m$^3$, well above 2005 WHO AQG, and even further from 2021 WHO AQG value of 5 µg/m$^3$.

Reaching the 2005 AQG could potentially prevent 1790 annual premature deaths in the GAR, which corresponds to an estimated economic burden of US$ 247 million$^1$ (379–790) and a reduction of nearly 70 000 YLL over 10 years. Although compliance with AQG would lead to the greatest health gain, meeting less stringent interim targets would also lead to substantial health gain.

Due to the seasonal variability of air pollution and the effects of dust from sand and desert storms in the Harmattan season, air pollution reduction plans that aim at protecting public health should not allow exceedance of WHO 2021 AQG interim target 4 values for PM for 70% of the days in a year in non-Harmattan months. Permitted exceedances should be no more than 30% of the days in a year. Measures should be taken to reduce air pollution, that for 70% of the year is due to anthropogenic sources. More details can be found in the UHI report of ambient air pollution and health in Accra, Ghana (Mudu, 2021).

4.2. Economic impacts of air pollution in Accra

Air pollution causes substantial economic costs. It has been estimated that, without preventive action, air pollution will cost 1% of global GDP by 2060 (OECD, 2016).

In Africa, the estimated economic cost of deaths attributable to ambient particulate matter pollution is US$ 215 billion, and the cost attributable to household air pollution is US$ 232 billion, based on projected changes in air pollution from 1990 to 2013 (Roy, 2016). Assessing the economic costs of air pollution, hospital donations in time and money, and the impacts on household budgets can help support the decision-making process for promoting measures to reduce air pollution. However, most economic studies of air pollution have been conducted in high-income countries, and the economic burden of air pollution in Ghana is not known.

Methodology

An analysis was undertaken to assess the economic costs of conditions associated with air pollution. A sample of hospital patients (n=239) at the Korle Bu Teaching Hospital in Accra (including patients with lung cancer, ischaemic heart disease, stroke, chronic obstructive pulmonary disease (COPD), and childhood pneumonia) were interviewed about the costs associated with their illness accessing care. Relevant costs included direct out-of-pocket costs related to hospitalisation (e.g. transport, tests), as well as indirect costs such as loss of income. In addition, hospital records were used to assess health system costs due to use of resources associated with hospitalisations for illnesses related to air pollution.

Cost of medical conditions associated with air pollution

The annual average cost per hospitalization to the health sector of a patient with a given disease was highest for lung cancer (US$ 15 973), followed by COPD (US$ 6549). Significant expenses were also related to stroke (US$ 4364), IHD (US$ 3411), and road traffic injuries (US$ 2362). The lowest cost was for child pneumonia (US$ 908). The financial costs were estimated by through an ingredient approach where the use of each input (e.g. medical and non-medical time, medication, tests, equipment, overheads, etc.) was estimated - from admission to discharge of patients - and inputted as a price.
Patients also faced substantial medical expenses when accessing care. Although 75% of patients reported being covered by health insurance, most patients reported needing to pay part of their health care costs. Among uninsured patients, the highest medical costs were reported by those with lung cancer and stroke; medical costs for patients with stroke averaged US$ 1979 per person. On average, uninsured individuals paid US$ 1090 per hospitalization, depending on their health condition. But even for those who were insured, co-payments were required.

Patients spent, on average, 18 days hospitalized, per referral, with the number of days varying by health condition. Sampled individuals and their families lost, on average, US$ 355 in work income per hospitalization. On average, uninsured individuals paid US$ 1090 per hospitalization, depending on their health condition. But even for those who were insured, co-payments were required.

For those with chronic conditions (e.g. cancers or severe cardiovascular and respiratory diseases), average medical costs were estimated at US$ 2146, per hospitalization. With an average of four hospitalizations per year, these medical costs corresponded to 67% of their annual net income.

There were also substantial indirect costs related to loss of days of work associated with these conditions. The highest indirect costs were reported for people with ischaemic heart disease (US$ 5952) and lung cancer (US$ 1909). Patients with COPD had the lowest indirect costs. Costs were substantially higher for patients with lower socio-economic status, compared with more affluent patients.

In Accra more than 80% of the economically active population (15 years old and over) are in the informal sector, with an average annual income of US$ 612–857. This means that for some patients medical costs alone could represent double their annual earnings. In our sample, patients also refer to loans and selling assets in order to cover hospital costs. Further information is in the discussion of the report on economics (Santos et al., 2020).

For the formal sector, an average salary of US$ 2040 per year (public and private sector), but this depends on educational level, type of work, and other characteristics (e.g. a professor at the University can have an average salary of approximately four times the national average salary).

Key findings

This analysis provides new information about the costs associated with medical conditions related to air pollution in Accra. The new information includes health sector costs, medical expenses and indirect costs (loss of income, days off school or work due to hospitalization) of air pollution.

- Sampled individuals and their families lost, on average, US$ 355 in income per hospitalization.
- For those with chronic conditions, average medical costs were estimated at US$ 2146, per hospitalization.
- The average annual income of the active population in Accra (considering both, formal and informal sector) ranges from US$ 612 to US$ 2040

Overall, air pollution leads to high medical and non-medical costs for individuals and their families dealing with health conditions associated with air pollution.

More details can be found in the UHI report on Economic costs of air pollution in Accra (Santos et al., 2020).

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10 The cost of hospitalization in Ghana is very high (in relative terms) compared to the costs in Europe because the average stay in hospital of sampled individuals in Ghana is more than double that in Europe (OECD/European Union, 2020).

11 The cost of hospitalization in Ghana is very high (in relative terms) compared to the costs in Europe because the average stay in hospital in Ghana is more than double that in Europe.
5. SECTORS RELEVANT TO ADDRESSING AIR POLLUTION AND HEALTH

Multisectoral policies and strategies are required to reduce air pollution levels in specific areas. This section describes the main results of the analysis conducted for each of the key sectors identified as priority areas of action that should be considered to reduce air pollution.

5.1. Household energy sector

Globally, exposure to smoke from cooking fires causes almost 4 million premature deaths each year. Almost 3 billion people cook using polluting open fires or simple stoves fuelled by kerosene, biomass (wood, animal dung and crop waste) and coal in inefficient stoves or open hearths, exposing primary cooks and other household members to health-damaging pollutants, including particulate matter (WHO, 2018).

Women and children disproportionately bear the greatest health burden from polluting fuels and technologies in the home, particularly in developing countries, typically being responsible for collecting firewood and spending more time exposed to pollutants from inefficient technologies and polluting fuels in the home. Shifting to clean cooking solutions can have a domino effect – improving air quality and freeing up time spent by women and girls gathering fuel.

Household air pollution is a major contributor to ambient air pollution in GAMA, accounting for an estimated 45% of outdoor air pollution in Accra, during the non-Harmattan season (April to October) when there is less desert dust (Zhou et al., 2013). In GAMA, charcoal and LPG are the primary household fuels. Affordability, accessibility and perceptions of associated risks are factors challenging uptake of clean household energy (Edwards and Agbevivi, 2021).

Assessment of household energy

Using the Household Multiple Emission Sources (HOMES) tool from the WHO Clean Household Energy Solutions Toolkit (CHEST)\(^1\), exposure concentrations for the primary cook were estimated for each stove and fuel combination, and then weighted by the prevalence of each combination in the GAMA region to estimate average population exposures. The HOMES model can be used to estimate pollutant concentrations in the cooking area and personal exposures to PM\(_{2.5}\).

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\(^1\) CHEST provides tools that public health professionals and policy-makers in countries can use in their programmes to develop policy action plans for expanding clean household energy access and use. CHEST assists in implementing the recommendations found in the WHO Guidelines on indoor air quality: household fuel combustion. CHEST includes six modules that provide resources for mapping key stakeholders; conducting a situational assessment; identifying technological and policy intervention options; setting standards; performing monitoring and evaluation; engaging the health community; and improving communications and raising awareness.
The **Household Air Pollution Intervention Tool (HAPIT)**, developed by the Clean Cooking Alliance, was also used to estimate disease impacts from each of the household energy scenarios.

**Scenarios**

Modelling the impact of household energy use on human health requires a detailed picture of energy usage in the GAMA region. Considerable efforts have been made to include assessment of household energy use in censuses and large-scale surveys in Ghana, on which the 2014 baseline energy usage is based. Like many other countries, however, questions have focused on the primary fuel used for cooking, rather than collecting data on the overall mixture of household fuels used, which is the typical situation in households in GAMA. As a result, the UHI Household Energy Working Group had to assign household fuel mix and the relative time allocation for each fuel based on expert judgement and knowledge of cooking habits across GAMA (Figure 3). For example, the homes that usually use biomass fuels were reported to be those that still had livestock in the household compound, likely used to cook animal fodder.

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The tool is designed to estimate health outcomes from policies and strategies to reduce household air pollution, including the introduction of more efficient technologies, cleaner fuels and behaviour changes. This integrated set of models provides a framework for rapid assessment of relative benefits using Global Burden of Disease (GBD) metrics, important for modelling the impacts of urban policies on disease outcomes in settings where data on disease incidence may be scarce and sparse. With the HAPIT tool, users can input population data, and expected changes in pollutant exposure levels due to interventions to estimate averted negative health outcomes.
Average population exposures estimated for the GAMA region are based on these assumptions, and are thus not predictive of actual exposures across GAMA, rather they represent a range of modelled scenarios to evaluate the health impacts of policies that seek to modify fuel and technology choices and time allocations for each technology.

In the BAU scenario there were modest decreases in charcoal as a primary fuel and charcoal with LPG as a secondary fuel, consistent with current trends. LPG only and wood (and charcoal as a secondary fuel) penetration will not change much; however, LPG as the main fuel with secondary use of charcoal increases by about 30%. Given the recognition of the health impacts of kerosene, kerosene as a primary cooking fuel will be eliminated (Figure 3).

In the moderately progressive scenario, unprocessed biomass and household use of kerosene were eliminated as primary cooking fuels, although charcoal remained as a primary and a secondary fuel with LPG use. Overall, the fraction of LPG use as a primary fuel increases to approximately 80% (Figure 3), premised on the government policy of increasing LPG penetration to 50% nationwide by 2030. Given the current trajectory in GAMA, we assume this penetration will translate to a deeper penetration in the GAMA area.

In the aggressive scenario, primary use of charcoal was dramatically reduced with only 4% remaining with secondary LPG use with reduced time allocation. In addition, the fraction of households using charcoal as a secondary fuel was reduced, along with the time fraction of secondary charcoal use. Finally, there were modest increases in electricity use (Figure 3) based on a premise of economic modelling of electricity price structures to promote greater use in households.

What did we find?

BAU showed small reductions in population PM$_{2.5}$ exposure that will likely be eliminated with increased population growth during the next 10 years. The moderately progressive approach showed increased exposure reductions which are reduced further by a factor of 1.7 by adoption of Tier 4 for emissions charcoal stoves$^{14}$ in addition to current policies. The more aggressive scenario resulted in more than double the exposure reductions of the moderately progressive scenario and 5.6 times the exposure

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$^{14}$ ISO Tier 4 for emissions refers to laboratory testing standards and voluntary performance targets developed by an ISO technical committee approved and published in 2018, with results for each indicator rated along 6 tiers (0: lowest performing to 5: highest performing) (https://www.cleancookingalliance.org/technology-and-fuels/standards/iwa-tiers-of-performance.html).
reduction of BAU. In contrast with the moderately progressive scenario, Tier 4 charcoal stoves had limited additional benefit and would not warrant implementation under the more aggressive scenario, as a much larger fraction of fuel use had shifted to cleaner fuels (Figure 4 above). Thus, promotion of slightly improved transitional technologies may be counterproductive when clean fuels are cost competitive or there are national frameworks to rapidly expand adoption (Edwards et al., 2021).

The impact of household air pollution on health showed health benefits to be increased over the BAU scenario (Figure 5). Exposure reductions in the household energy sector in the GAMA region result in approximately 10 000 averted DALYs with 283 averted deaths under BAU; 30 000 averted DALYs with 801 averted deaths under the moderately progressive scenario; 47 000 averted DALYs with 1256 averted deaths under the moderately progressive scenario with Tier 4 charcoal stoves; 68 000 averted DALYs with 1848 averted deaths under the aggressive scenario; and 71 000 averted DALYs with 1922 averted deaths under the aggressive scenario with Tier 4 charcoal stoves.

Take-home message

Analysis of household air pollution found over 1900 averted deaths and a reduction of 35% in exposure under the most ambitious scenario through the promotion of LPG, biogas or electricity as substitutes for wood and charcoal.

Reductions in air pollution in this sector alone will be insufficient to address the overall impacts of air pollution in the GAMA region and an integrated strategy across all sectors is required. Only the aggressive scenario was able to keep pace with the increase in health burdens due to population growth in the short term, but by 2030 also shows an increase in DALYs attributable to air pollution. However, reductions in other sectors which decrease ambient burdens of air pollution will significantly impact average population exposures and reduce health burdens so that a decrease in overall health impacts as a result may be observed for the GAMA region. It is clear, however, that a decrease in human health burden from air pollution will require a switch to cleaner household fuels and technologies.

More details can be found in the UHI report of Evidence-based strategies to reduce the burden of household air pollution in Accra, Ghana (Edwards et al., 2021).
5.2. Transport sector

Motorisation and urbanisation have occurred rapidly in LMICs in recent years (Dora et al., 2011; Thondoo et al., 2021). Consequently, transport-related GHG emissions have increased rapidly in many developing cities (Hosking et al., 2011). Increases in air pollutant emissions associated with motorisation have also led to substantial deterioration in air quality.

Accra is an example of rapid urbanisation, with annual growth rates of 2–3% in recent decades. The population in GAMA exceeds 4 million according to the 2010 census (Ghana Statistical Services, 2012). In terms of mobility, there are over 1.2 million cars registered in Accra, accounting for over 60% of national car registrations, which have grown at 8% per annum over the last decade. The majority of trips in Accra (57%) are undertaken on small- to medium-sized buses (known locally as trotro), mainly providing paratransit services. Other trips are made by privately-owned cars, taxis, motorcycles and large urban buses (Essel and Spadaro, 2020).

Assessment of transport and health

The Integrated Sustainable Transport Health Assessment Tool (iSThAT) was used to model transport data to evaluate the health effects of air pollution from urban transport in Accra. The report, Health and economic impact of transport interventions in Accra, Ghana (Essel and Spadaro, 2020) details the two different approaches taken. In the first approach, a linear no-threshold (LNT) risk function was applied to all-cause mortality. In the second approach, used for sensitivity analyses, it was assumed that air pollution affected only cardio-respiratory diseases, such as cardiovascular disease, lung cancer and childhood pneumonia.

Economic outcomes were taken from the iSThAT model, and applied a discount rate of 5%, with alternative rates of 3% and 7.5% used in sensitivity analyses. Mortality benefits were valued in two ways. The primary method used the Value of a Statistical Life (VSL) to monetise each postponed premature death, while in a second approach, changes in life expectancy were calculated using a life table analysis and then the life years gained were multiplied by the Value of a Life Year (VOLY). The VSL is derived endogenously in iSThAT using the benefit-transfer methodology of the OECD (2012). The VOLY is calculated as the ratio of the VSL and the average remaining lifetime expectancy at the time of death in the population at risk (typically 30 to 40 years). Values for the VSL and VOLY are age-independent and are adjusted over time for changes in the real income growth. More on the application of iSThAT can be found in the WHO report Health and economic impacts of transport interventions in Accra, Ghana (Essel and Spadaro, 2020). A final version of the iSThAT tool is forthcoming and will be available by following the link on http://www.who.int/initiatives/urban-health-initiative/guidance-and-tools. Results are presented including changes in air pollutant and carbon emissions.16

15 iSThAT evaluates the health and economic consequences of measures to reduce GHG emissions from urban transportation. It assesses the effects of changes in transport patterns on particular outcomes: health impacts from changes in air quality and physical activity; changes in carbon emissions; and economic impacts from changes in the cost of illness and death, productivity and welfare loss. A range of transport, air quality, demographic and health data were used for Accra as inputs for iSThAT. Trip distance and occupancy were estimated from the Transport Fare Model, which provides average trip distance and occupancy rate parameters for taxis and urban buses in Ghana. Fuel consumption and emission values were taken from the Fuel Economy Report, which provides European Union default data on fuel consumption and emissions. For health impact calculations, iSThAT includes default data for Ghana on historical and projected socio-economic trends (out to year 2050), including projected mortality statistics and unit health costs (cost per incidence of illness or premature death).

16 Additional modelling was undertaken using the Integrated Transport and Health Impact Model (ITHIM). This tool estimates the impacts of changes in transportation patterns on physical activity, air pollution and road traffic injury, and consequently on combined health outcomes. The ITHIM modelling results suggest that road injuries are also an important contributor to the health impacts of transport policy changes. Policies that lead to increased motorcycle use are expected to lead to substantial increases in deaths, largely from road injuries, whereas shifts from car to bus use substantially reduce deaths, again largely due to road injury changes. Health benefits of active travel were assessed using the methodology of the WHO HEAT (Health Economic Assessment Tool for walking and cycling).
Scenarios

To analyse the future impacts of different transport policies, projections were made for the BAU policy scenario, and three alternative scenarios were developed for different future policies (Figure 6). Changes compared with a 2015 baseline were analysed.

BAU Scenario
Demand for transport is predicted to increase three-fold, personal car ownership is expected to double, and there will be greater utilization of the public transport system.

Alternative Scenario 1
Future transport demand is the same as in the BAU Scenario, though a slight decrease in passenger car use is expected due to measures outlined in the National Transport Policy. The demand for conventional buses is expected to be steady, but there is a slight shift to electrified mass transport.

Alternative Scenario 2
A 31% decrease in transport activity is forecast due to land-use and spatial planning reforms that focus on creating secondary “hub centres” of economic and social activity closer to where people live.

Alternative Scenario 3
A significant shift from passenger cars to electrified public transport (up to 10% of transport demand by 2050) is envisaged. Further, there will be an increase in walking and cycling (up to 45% of total pkm in 2050) and a switch to hybrid cars and battery electric vehicles. These assumptions are based on current national and city-level policy discussions (Figure 6).

Fig. 6
Percentage of mode share (i.e. % of pkm travelled, based on iSThAT estimation) for modelled scenarios in Accra

<table>
<thead>
<tr>
<th>Travel demand</th>
<th>% mode share (iSThAT: % pkm travelled)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BAU</strong></td>
<td>Bicycle 0.1%</td>
</tr>
<tr>
<td><strong>Scenario 1</strong></td>
<td>Bicycle 0.4%</td>
</tr>
<tr>
<td>(same as BAU)</td>
<td></td>
</tr>
<tr>
<td><strong>Scenario 2</strong></td>
<td>Bicycle 0.4%</td>
</tr>
<tr>
<td><strong>Scenario 3</strong></td>
<td>Bicycle 4.0%</td>
</tr>
<tr>
<td>(same as Scenario 2)</td>
<td></td>
</tr>
</tbody>
</table>

BAU: business as usual; iSThAT: Integrated Sustainable Transport Health Assessment Tool; pkm: passenger kilometres.
What did we find?

Urban air quality
For each of the urban air pollutants modelled (PM$_{2.5}$, SO$_2$ and nitrogen oxides (NO$_x$)) and CO$_2$ pollutant emissions are highest under BAU scenario, and lowest under alternative scenario 3 (Figure 7). Alternative scenario 3 leads to reduced emissions of all pollutants in 2050, whereas BAU leads to higher emissions in 2050, except for NO$_x$ for which emissions start to reduce around 2030. In particular for CO$_2$, under the BAU scenario, passenger transport carbon emissions more than triple by 2030. Alternative scenario 1 leads to a much smaller rise in carbon emissions, while there is a reduction in carbon emissions in the remaining scenarios, greatest in scenario 3 (Figure 7).

Fig. 7
Pollutant emissions in Accra under four alternate transport scenarios
In the iSThAT modelling, reductions in air pollutant exposure in the three alternative scenarios, compared with BAU, reduced premature deaths by 3221–5500 between 2015 and 2050 (Figure 8). In addition, increased physical activity reduced deaths by a further 3339–33 042. Alternative scenarios 1 and 2 have similar total deaths avoided, but different proportions due to air pollution and physical activity. The total premature deaths avoided in alternative scenario 3 are almost six times higher than the other two scenarios, with the difference largely due to physical activity benefits.

Economic outcomes
In the iSThAT model, the monetised benefits from mortality risk reductions to improved air quality for alternative scenarios 1–3 range from US$ 1509 million (scenario 1) to US$ 2577 million (scenario 3), assuming a 5% discount rate. Monetised physical activity benefits range from US$ 796 million (scenario 2) to US$ 13 452 million (scenario 3). The value of avoided carbon emissions, estimated using the social cost of carbon, range from US$ 3146 million (scenario 1) to US$ 4492 million (scenario 3).17

17 The social cost of carbon is the global damage cost per tonne of CO$_2$ emission due to the impact of climate change
Take-home message

The three alternative scenarios for transport in Accra led to substantial benefits in terms of air quality, carbon emissions, health and economic outcomes.

Measures to restrain traffic and improve fuel economy and emission factors (alternative scenario 1) led to health gains from both improved air quality and physical activity. In comparison, lower travel demand due to land-use and spatial planning (alternative scenario 2) in addition to the measures included in the first scenario, had smaller physical activity benefits (due to less active travel) but greater air pollution benefits. As a result, total health benefits were similar for these two scenarios. Alternative scenario 3, which in addition to the two other scenarios also shifted travel from cars to buses and cycling, and shifted bus technology to CNG, had slightly greater health gains from air quality than the other two scenarios, but much greater gains from physical activity. As a result, the total health gains from this scenario were almost six times higher than the other two scenarios. Alternative scenario 3 was also associated with greater air quality improvements, carbon reductions and economic benefits.

The modelling results from iSThAT suggest that reducing private motorised travel can reduce premature deaths, both through reducing air pollution and also increasing physical activity. However, policies that both reduce car use and also increase public transport and cycling can lead to much higher benefits, as they lead to much greater increases in physical activity. Walking is a key asset for GAMA, accounting for 37.6% of all passenger-kilometres travelled, and an opportunity to integrate health by planning safe, active mobility in land-use and transport policies.

The economic costs of implementation of an intervention in transport, for example, the bus rapid transit, was estimated at US$ 117 million for Accra (2018 prices). The economic welfare benefits well outweigh the costs of the intervention, with a benefit-cost ratio of 2.1 (Santos et al., 2021). This means that the benefits generated by controlling air pollution are over two times the cost of the intervention, making investment in improving air quality highly cost-effective. More details can be found in the UHI report of Health and economic impacts of transport interventions in Accra, Ghana (Essel and Spadaro, 2020).

5.3. Solid waste sector

Solid waste management is an essential function in cities. However, it can be threatened by rapid urbanisation, which can put pressure on solid waste management when population growth in cities outpaces the planning and provision of services. This creates further risks to public health and hygiene, particularly in LMICs.

In general, economic development is associated with greater waste production, and urban residents tend to produce more waste than rural residents. In sub-Saharan Africa, waste generation ranges from 0.09 to 3.0 kg/person/day, with an average of 0.65 kg/person/day. Although waste generation in Africa is low compared to other regions, solid waste management is an issue. In Accra, waste production was 0.74 kg/person/day in 2013-2014, an increase of 75% over the preceding decade (Hoornweg and Bhada-Tata, 2012).

Collection rates for solid waste are influenced by both service provision level and waste generation rates. In Accra, 59% of solid waste is collected – a much higher proportion than for Ghana as a whole. The next most common means of waste disposal in Accra is by public container dump, at 31%, while nearly 3% of solid waste is burned by the household.

18 The amount of waste generation per capita in terms of kg/day is much higher outside Africa: 0.44–4.3 for the East Asia and Pacific region, 0.29–2.1 for Europe and Central Asia region, 0.11–5.5 for the Latin America and the Caribbean region, 0.16–5.7 for the Middle East and North Africa region, and 1.10–3.7 for the Organisation for Economic Co-operation and Development countries (Hoornweg and Bhada, 2012).
Many activities associated with solid waste management can contribute to emissions of SLCPs such as methane (CH\textsubscript{4}) black carbon (BC), and nitrous oxide (N\textsubscript{2}O), as well as CO\textsubscript{2} emissions. Emissions may come directly from landfills (particularly methane), but also the machinery involved in waste collection and processing, and specific processes such as combustion and composting.

These climate pollutants may also have health effects, by contributing to ambient levels of pollutants hazardous to health such as fine particulate matter (PM\textsubscript{2.5}) and ozone. Waste processing may also emit other hazards that contaminate air, water and soil. For example, people involved in informal recycling at the Agbogbloshie e-waste processing site in Accra experience health risks from exposure to heavy metals (Wittsiepe et al., 2019).

Assessment of waste management

The **Solid Waste Emissions Estimation Tool (SWEET)** was used to estimate emission scenarios of policy interventions to promote sustainable waste management, and to reduce air pollution levels and associated health risks in Accra. Emission scenarios included estimates of model the effects of different policy scenarios on emissions of pollutants including CO\textsubscript{2}, CH\textsubscript{4}, BC, organic carbon and NO\textsubscript{x}. Climate impacts were represented using carbon dioxide equivalents (CO\textsubscript{2}eq).

Scenarios

Three alternative policy scenarios were created (Table 2) and then compared with the BAU scenario, which projected changes in emissions due to solid waste management, without substantial changes in waste management policy. Alternative policy scenarios were developed based on a policy-mapping exercise describing current Accra waste management policy, as well as a review of other aspects of policy implementation in the sector. The baseline year for all scenarios was 2018.

<table>
<thead>
<tr>
<th>Policy scenarios</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 1</td>
<td>End waste burning</td>
<td>Municipal authorities stop residents from burning uncollected solid wastes at home.</td>
</tr>
<tr>
<td>Scenario 2</td>
<td>Expanded composting and recycling program</td>
<td>Starting in 2023, a greater proportion of organic waste is composted (composting capacity doubled to 60 000 metric tonnes) and recycling capacity is increased by 60% to about 54 000 metric tonnes.</td>
</tr>
<tr>
<td>Scenario 3</td>
<td>Two Landfills Upgraded</td>
<td>Landfills gas capture, starting in 2021, assumes all waste collected for final disposal is sent to sanitary landfills with methane gas capture.</td>
</tr>
</tbody>
</table>

The **Solid Waste Emissions Estimation Tool (SWEET)** was developed on behalf of the U.S. Environmental Protection Agency (EPA) and the Climate and Clean Air Coalition Municipal Solid Waste Initiative (Waste Initiative). The tool includes baseline waste production and waste composition, as well as changes in waste collection and transportation, landfills, burning and waste handling equipment. Inputs to the SWEET model included census data and other survey data, including estimation of the populations inside and outside formal solid waste collection zones (Climate & Clean Air Coalition, 2017).
What did we find?

Climate pollutant emissions for different policy scenarios, as projected by the SWEET model, are shown in Figure 9. Compared with the BAU scenario, net emissions reductions are seen for the scenarios expanding composting and recycling, but the greatest reductions are seen for the scenario ending waste burning. Results for individual pollutants suggest that the alternative policy scenarios do not substantially reduce methane emissions, but emissions of some pollutants such as BC are substantially decreased by these policies, and this is responsible for the net decrease in carbon dioxide equivalents.\(^{20}\)

The analysis estimated that there will be a reduction of 120 premature deaths in 2030 compared with the BAU if Scenario 1, with its ambitious but achievable target of ceasing open burning, is implemented by 2030 and there are no changes in the other polluting sectors.

Take-home message

Modelling results for alternative policy scenarios suggest that expanding composting and recycling can reduce climate pollutant emissions, but the greatest emission reductions come from ending waste burning. Stopping waste burning can lead to a reduction of 120 premature deaths in 2030 compared with the BAU. These findings may help prioritise activities in the waste management sector in Accra.

More details can be found in the UHI report of Solid waste management and health in Accra, Ghana (Mudu et al., 2021).

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\(^{20}\) Working with households near the Abokobi waste dumpsite between 2018 and 2019, the University of Ghana School of Public Health carried out research on waste management practices at the household level, household air pollution and cardio-respiratory health outcomes in urban informal settlements in the Ga East Municipal Assembly (GEMA). 400 households in the study communities were randomly selected. Residential garbage burning was common in exposed communities and most people burnt different combination of wastes. Mean personal 48-hr PM2.5 and CO were measured at high levels, and systolic blood pressure (SBP), diastolic blood pressure (DBP), Mean Arterial Pressure (MAP), and hypertension were recorded among urban slum dwellers, with significant gender differences identified.
5.4. Land-use and green spaces

Urbanization is a process that affects more than just populations, economies or cultures, it also transforms the environmental and physical landscape. The design of our cities shapes how urban dwellers access public services, economic opportunities, and social activities and therefore determines their health and well-being. On the other hand, barriers created through inadequate land-use planning can become structural barriers to health and social equity. Integrating health considerations into sustainable land-use and spatial planning policies can be an opportunity for cities to find synergies across sectors and address upstream determinants of health. For example, designing mixed land-use, public transit-oriented development, and green spaces for walking or cycling, could have the stated goal of increasing connectivity or driving sustainable development, but can also reduce air pollution, improve road safety, increase physical activity, and boost mental health (UN-Habitat and WHO 2020).

Accra has been suffering strong socio-economic inequities that are visible in the urban form, where the existence of slums and the concentration of homes and activities close to polluted areas is still an important issue to be tackled. The rapid and uncontrolled growth of GAMA has created several challenges, including traffic congestion, housing shortages, urban sprawl and slums lacking basic infrastructure. The colonial legacy segregated wealthy Europeans into certain neighborhoods, (e.g. fishing villages of Chorkor or Teshie). Today, these settlements are now part of Accra neighborhoods. This colonial economic segregation has persisted as an undercurrent in the city’s rapid growth. In some areas, polluting economic activity like fish smoking or informal e-waste recycling occurs within the residential community itself, and in addition to household cooking, offers no respite from the smoke of constantly polluting fires.

The presence of slums makes significant interventions for reductions of air pollution more difficult. Unsafe or unhealthy housing and insufficient income are two factors that require structural interventions. For air pollution reduction, there is a need to incorporate health impact assessments and monitor air quality, while also increasing public awareness on the potential harm of air pollution to health. People living in slums as well as people with lower socio-economic status and often migrant populations are most vulnerable to air pollution, exposed to the “double burden” of communicable and non-communicable diseases related to the poor conditions of the environment where they live, and the fact that their work often requires them to stay outdoors for long hours, close to pollution sources (Satterthwaite, Sverdlik and Brown, 2019).

Assessment of land-use and health

Qualitative data were collected by the University of Ghana and the University of Cape Coast on types of green spaces in Accra using key informant interviews and desk review of reports and published articles. Planning officers and Public and Environmental Health officers from AMA and three additional sub metro areas, as well as officials from the Department of Parks and Gardens in two sub metro areas were interviewed and supplied documentation of green spaces in the region. GreenUr tool was used for data input and analysis, covering the period between 2015 and 2021, to estimate the health impacts of green spaces in Accra, based on current land-use patterns. Using this tool, the Initiative analysed the general air purification effect of green spaces on ambient air pollution,
Scenarios

Different green spaces scenarios were modelled to estimate changes in “exposure”, in terms of distance from green spaces, and health impacts on the population. The scenarios examined what the effects on mortality would be if the city of Accra increases its green space areas by 3, 5 or 20%.

What did we find?

The interviews revealed that only a few of the green spaces were well maintained, most of which were privately owned. These included designated open spaces such as parks and playgrounds, major roundabouts and road intersections. The informant interviews also revealed that there is uneven management of green spaces, often not by the municipalities, but rather different public and private entities. Some barriers to accessibility were identified, including access fees, security concerns and a lack of toilet facilities or poor sanitation. Some green spaces such as fields in public schools were inaccessible and used for vehicle parking spaces. Overall, rapid uncontrolled urbanization and urban sprawl without effective spatial planning have led to a reduction in green spaces in Accra, despite government efforts to beautify the city.

The analysis of the health impacts of green spaces found limited availability of green spaces in the GAR. In fact, only 19.8% and 33.3% of the population lives within a distance of 300 and 500 meters (WHO Regional Office for Europe, 2016) from a green space, respectively. Benefits of green spaces (e.g. increased physical activity, improved mental health, ecosystem services such as the cooling effect, etc) are higher when these green spaces are closer and more accessible to the population. Therefore, the urban green spaces that are currently present in Accra have a limited overall impact on health.

Current levels of green spaces consequently have a negligible capacity to prevent premature mortality, although this could be modified by a resolute policy of increasing quality, accessible and equitably distributed green spaces. Scenarios showed that a small increasing of green spaces can significantly reduce premature mortality (e.g. a 3% increase of green spaces in Accra will result in 77 annual prevented deaths among adults in the city, while a 5% increase will prevent 139 premature deaths). Mental health benefits have also been suggested. A scenario characterized by a greater availability of green spaces in Accra, would lead to 53 cases of depression incidence prevented among the adult population in the city.

On the other hand, the availability and use of green spaces is an essential aspect of land-use and urban planning. Green spaces in Accra are scarce, and the existing green spaces – consisting of parks, small sports fields or playgrounds, school yards, church lots and protected stretches of the coastline – are unequally distributed and usually inaccessible. In affluent areas, backyard gardens and private establishments offer residents or paying guests meticulously landscaped settings to escape from the bustling city. However, parks and monuments (such as Black Star square, a symbol of national pride), are among the few planned green spaces for residents and visitors in the city to relax – and even this public space is surrounded by a monolithic fence, embodying the inaccessibility of green spaces in the city. Policies promoting accessible, quality, and equitable green spaces could represent a significant step to create a more sustainable and healthier Accra.
Take-home message

Urban sprawl should be contained, favouring infill development approaches which build within underutilized lots in the urban environment, rather than expanding the margins of the city. New land-use models, improved regulation and holistic urban planning are needed to transform current landfills and dumpsites into green spaces.

Policy measures to increase green spaces should be considered for their expected co-benefits in promoting health and well-being. Green spaces can be integrated with land-use and planning activities to uncover multiple, immediate benefits in addition to reducing pollution.

More details in the upcoming WHO report on Land-use, green spaces and health in Accra.
6. COMMUNICATIONS STRATEGIES

Communications and outreach to mobilize and sustain support is a critical aspect of the UHI model process. Communication strategies can raise awareness, change public attitudes and support adoption of new policies. Communications is a central component to addressing air quality, a problem seen as part of the global commons where everyone can contribute to the solution. This involves conveying relevant data and information on the health impacts of air pollution to members of the public and stakeholders, and engaging communities to take action. Communications is the link between experts and community members, instilling a sense of agency and collaboration.

6.1. Communicating results of the Initiative

In Accra, the Initiative formed a multi-sector communications working group alongside sectoral technical working groups to plan a city-wide communications campaign. The campaign targeted policy-makers, health sector workers, key stakeholders, traditional leaders and the public to promote the health co-benefits, tools, and lessons learned from the Initiative. In 2018, Accra became the first African city to join BreatheLife, a global campaign to gain commitments to meet the WHO Air Quality Guidelines. The launch event delivered emerging data about the health effects of air pollution and helped raise the profile of Accra’s air pollution, climate mitigation and health efforts.

Health workers

Fifty-nine percent of an estimated 7100 childhood deaths from acute lower respiratory infections in Ghana is attributable to household air pollution (WHO and UNFCCC, 2015). Communicating the impacts of household air pollution on childhood pneumonia was therefore a high priority for the BreatheLife Accra campaign. Community health workers were engaged throughout the city to promote health messages and advise parents on the dangers of household smoke. Sensitization information for patients was shared in health facilities – engaging Ghana Health Service staff, along with community health workers, school health education coordinators, and environmental health officers.

WHO also produced a course for training the health sector on air pollution and health, including 19 modules for clinicians and public health professionals, a training for trainers, training on tools and adapted communications materials. The training was designed to equip health workers with the capacity and tools to educate patients and decision-makers, and to bring a health perspective to multi-sector policy interventions. With reliable evidence of the health and economic costs of inaction on air pollution, and the analysis of policy and intervention scenarios, health workers, urban leaders and stakeholders were equipped to inform patients and to advocate for sectoral actions to address air pollution.
Media

The AMA held a series of media training events to engage publishers, editors and reporters, which led seven media houses to make long-term commitments to amplify the air pollution, climate change and health story in Accra and abroad. Members of the media played an important role as purveyors of the technical information produced and the potential policy scenarios, helping to build trust between the technical experts and members of the public. Over 20 media houses, including newspapers, TV and radio stations were involved in the media activities, as regular press conferences were held throughout the Initiative to keep citizens of Accra up to date with developments of the project.

As part of the Initiative, the University of Ghana conducted an innovative media tracking study to examine coverage of air pollution issues in print and digital media from 2016 to 2021 (Agyei-Mensah et al., 2022). Coverage themes were distinguished into causes of air pollution, initiatives to drive policy action, and impacts of air pollution. The study found increasing coverage of air pollution during the period of the pilot project, drawing more public attention to the issue. However, the study identified that coverage of the causes of air pollution was underrepresented compared with coverage of policies and impact.

Community leaders

BreatheLife materials were distributed through existing networks, working closely with Ghana Coalition of NGOs in Health, to adapt communications materials at the community level. Several videos, exhibits, a poster series, social media infographics and health briefings were produced to tell a compelling story of air pollution to specific audiences including community health workers, civic leaders, NGO’s, community groups and the media.

Community outreach in eight sub-metro areas using popular education, theatre groups, school activities, town hall meetings, door to door canvassing and workshops led to joint efforts between public health workers and environmental regulators, working with traditional Chiefs and Queen Mothers who have stewarded the environment and natural resources for many generations, to address major air pollution sources. These leaders are often community elders whose role is to provide counsel for local decisions and address social problems in the community. This transformed air pollution messages into a two-way conversation, with other influencers including radio personalities and entertainers playing key roles as champions of the campaign alongside community leaders.

The campaign promoted green spaces, working with community schools to plant community gardens and greening pathways for schoolchildren to walk safely, and greening common spaces like traffic roundabouts. The Initiative also worked with communities to identify treasured community areas and institutional spaces for greening and ornamental plants, including replanting grass on eroded football fields and children’s playgrounds. Community members, students and youth were engaged throughout the process.

Informal sector workers

AMA has taken steps to engage informal waste collectors to improve waste collection, reduce emissions and modernize the waste management system. The city also launched a ‘stop waste burning’ campaign, promoting a WhatsApp based system to identify, report and shut down illegal waste burning sites, and donated coloured recycling bins to schools – sensitizing students, teachers and school administrators to the importance of sorting waste.
As part of the UHI pilot project, waste collectors and informal sector workers (including street vendors, fish smokers, and e-waste recycling workers) were engaged to learn about the health impacts of this high-risk types of work. In particular, the presence of respiratory and cardiovascular conditions from exposure to transport related air pollution for street vendors was highlighted (Amegah et al. 2022).

**Take-home message**

Cities should work toward a healthier, more equitable and sustainable future for urban dwellers by engaging the media, community members, traditional leaders and young people to highlight the personal stories of those experiencing the health effects of air pollution, identify and address local sources of pollution, and adapt scientific evidence into messages for vulnerable groups or individuals.

Analysis of media coverage of air pollution and health found that articles on air pollution have been increasing, with more reportage on impact and policy issues compared to causes of air pollution. A focus group conducted with members of the media confirmed efforts by the media to set the agenda of the political discourse around environmental and health issues.

Communications and community engagement can play a powerful role in affecting individuals’ everyday contributions and exposure to air pollution, including shifting from practices like waste burning, the choice of transport options, and minimizing exposure to pollution. On the other hand, communities facing first-hand impacts play an important role in advocating for policies to improve air quality and the adoption climate-friendly development strategies with improved health and equity outcomes.
7. POLICY TRACKING

Policies to address air pollution, mitigate climate change and improve health should be implemented with institutional mechanisms and predetermined indicators to monitor and track their outcomes, and measure how well the indicators were achieved. Policy tracking is the development and application of systematic approaches to identifying, monitoring and evaluating the planning, implementation and progress of a policy, plan, program or intervention over time and space, and between and across populations and sectors. Policy tracking mechanisms are important for deciphering the complexities of air pollution as a health risk factor, and support in designing the most effective policy frameworks and interventions.

Policy tracking should assist public health professionals to better understand the public health impacts of a given policy; evaluate the distributive function of a policy to ensure it does not exacerbate social inequalities; gain inputs from stakeholders in order to get a broader understanding of policy impacts; expand the evidence base regarding tracking of public health policies; track progress towards the intended outcome of the policy; and refine implemented policies.

Policies can take the form of rules, regulations, strategic plans or even task forces meant to drive the implementation of interventions to improve, for example, air quality and health. However, not all policies are created equal, and sometimes poorly designed policies can undermine the efforts they were intended to produce. Most legislative activity happens at the national level – often with an institutionalized policy tracking frameworks and dedicated agencies, with sub-national governments either implementing national plans at the local level or creating their own interventions. However, this can create difficulties in the allocation of resources, and leaving ambiguities, contradictions or duplication in the allocation of powers or functions between national and sub-national governments. Additionally, sectoral policy-making in urban settings may be siloed, or create overlapping mandates between responsible sectoral departments. This can weaken the capacity, resources and incentives for local governments to respond to urban health challenges such as air pollution.

In the implementation of any policy and to quantify its impacts there is the need to:

- Assess impacts of policies on changes in disease clusters or exposures
- Track progress towards the intended outcome of the policy
- Plan for subsequent policy cycles
- Refine or adjust implemented policies
- Enhance public health surveillance
- Improve access to quality data.
### Steps for policy tracking

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Key considerations</th>
</tr>
</thead>
</table>
| **Step 1. Policy identification** | Identify which policies exist, which authorities are involved, and the main goals of the policies. | - What is the impact of historic policies on present day urban design, environmental pathways, and health?  
- Has the current policy been adopted and implemented?  
- What is the geographical boundary of the policy?  
- What is the timeframe for policy? |
| **Step 2. Policy impact** | Conduct evaluations to determine the impact of a policy. | - Is the policy impact to health likely to be significant along the next years in terms of the number of individual affected, the magnitude, and/or immediacy of impacts?  
- What are the potential health impacts and tradeoffs of different policy scenarios or objectives?  
- What are the costs and benefits of a proposed policy?  
- What are the health and climate mitigation co-benefits of a proposed policy? |
| **Step 3. Policy monitoring** | Understand how the policies have changed over time. | - Is there a monitoring/surveillance process on-going?  
  - who was in charge of the monitoring/surveillance process?  
  - how was screening carried out?  
  - what are the objectives and expected completion dates?  
  - If not: which policy monitoring system can be implemented?  
  - What is the public perception or acceptability of the policy? |
| **Step 4. Data collection** | Identify information and data sources through qualitative and quantitative methods. | - Which qualitative or quantitative methods can be used to collect useful data for assessing policy quality and impacts?  
- What are the impacts of the policy on urban design, behaviour, pathways, and/or health?  
- Are the impacts of the policy on exposures or health distributed in an equitable manner?  
- What is the cost-effectiveness of the policy? |
| **Step 5. Policy quality** | Understand which policy solutions use the best available evidence, and if different demographic groups are considered. | - Were the potential health impacts outcomes evaluated?  
- Which specific health determinants will be assessed?  
- Were health inequities considered?  
- Are the health burdens from exceeding international, national, or local exposure guidelines for an environmental pollutant distributed equitably by social factors (e.g. race/ethnicity, economic income, etc.)? |

Source: Forthcoming Tracking urban health policies: A conceptual framework with special focus on air pollution in African cities (Mudu et. al., 2022).
Additionally, policy tracking can:

- Build infrastructure (for people, data, systems)
- Offer new information that can inform policy, programs, and initiatives
- Provide an educational role to the public and communities

Tracking policies can have various political indications based on the approach. For example, it can be done purposefully to drive public policy, and/or it can be performed purely as an evaluation of a policy process, or for research, training or awareness-raising. Interventions to improve urban health by addressing air pollution often necessitate actions which cross jurisdictions and administrative boundaries and require multi-level governance in order to be implemented.

### 7.1. Policy tracking framework in Accra

Policy tracking can support governance choices, and prioritize particular actions and approaches by synergizing air quality and health policies at the intersection of energy, transport, land-use and housing. Given the interconnectedness of urban systems, it is important to approach policy making across sectors in a holistic way. This can uncover formerly hidden multiple health and economic benefits, and set clear indicators to measure health and the accomplishment of sustainable development goals. Policy tracking mainly through the collection of projects, reports, news and case studies, could be coupled with EPA Ghana’s ongoing air quality monitoring to understand the effectiveness of interventions and resultant reductions in pollutant levels. Also, actions laid out in the GAMA Air Quality Management Plan, including plans to strengthen data collection, can increase the likelihood of successful implementation of air quality policy measures in Accra.

Following the assessments of the identified sectoral policies, the Initiative in Accra designed a conceptual framework for tracking policies and their health impacts, which can be adapted to other LMICs settings, particularly in African cities. The Initiative laid out five steps for designing a policy tracking system, making specific recommendations for ambient and household air pollution policies as illustrated in Figure 10 above.
8. POLICY IMPACTS OF THE PILOT PROJECT IN ACCRA

The implementation of the UHI model process in Accra resulted in the incorporation of key policy recommendations and tools into Accra’s local strategies. The President of Ghana stated a vision to make Accra “the cleanest city in Africa”. The AMA subsequently released the Clean Accra Charter to guide progress towards that vision. Many of the priority areas for action of the AMA, including waste management, transportation and open space development and greening, have implications for improving ambient air quality and public health. The EPA Ghana developed an Air Quality Management Plan for the GAMA, and AMA has pledged to cut carbon emissions to zero by 2050. Furthermore, national government policies are in place to promote cleaner household energy, which has important implications for indoor, household air pollution.

Accra has become a global leader in addressing air pollution and mitigating climate change. Other cities in Ghana have expressed interest in applying the UHI model process, and representatives from other African cities have travelled to Accra to learn from the city’s approach. Specific impacts on sectoral policies, and examples of integration of health into planning and regulatory frameworks include:

- Providing the city with a wide range of analysis and scenarios across different sectors, developed with local stake-holders, to reduce air pollution impacts on health;

- enlarging the discussion on environmental policies to several actors that were never part of those discussions;

- creating a large network of people involved in training and capacity building activities than was never done before;

- giving international visibility to the ground-breaking work of local experts;

- paving the way for other projects and city activities that can benefit from the data collected and the analysis published; and

- demonstrating that in sub-Saharan cities, and African cities in general, a different approach can be taken on environmental problems, an approach that moves from a public health perspective.
9. KEY CHALLENGES

The challenges faced during the pilot project in Accra are common to many policy and research projects on environmental health around the world. Key challenges included the lack of reliable or comparable data on air pollution and health; little awareness of the positive link between air pollution reduction and health co-benefits; the lack of tools, capacity and knowledge, as well as the lack of awareness of the health sectors’ role in promoting air pollution reduction policies to prevent diseases. Furthermore, complex institutional arrangements in the health sector, and between local and national governments, often prevent cross-departmental cooperation to induce action.

Some key challenges faced during the UHI pilot project in Accra and the activities undertaken to overcome the challenges are outlined in Table 3. Specific challenges to the implementation of the pilot project and during the sectoral analyses can also be of interest and each UHI pilot project report provides information on limitations, critical gaps and challenges.

Table 3. List of key challenges faced during the UHI pilot project implementation in Accra

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Activities undertaken</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Need to adapt methodology and tools</td>
<td>• Policy and health impact assessment tools adapted for global use and tested locally during pilot project(^\text{23}).</td>
</tr>
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<td></td>
<td>• Ghanaian experts led research projects and publications, ensuring a locally adapted implementation process.</td>
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<tr>
<td>2. Difficult mapping of policies and stakeholders to assess relevant policy measures and strategies</td>
<td>• Collaboration with local partners including Ghana Coalition of NGOs in Health.</td>
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<td></td>
<td>• Ongoing stakeholder engagement throughout implementation to identify and fill gaps in knowledge.</td>
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<td></td>
<td>• Conduct HIA across sectors and policies related to air pollution.</td>
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<tr>
<td>3. Lack of data on environment and health, including improved definitions of health indicators across sectors</td>
<td>• Estimates were generated from mixed methods studies and used for modelling the impacts of urban policies on disease outcomes.</td>
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<td></td>
<td>• Surveys and exposure monitoring of sensitive groups. The presence of slums makes interventions for reductions of air pollution significantly more difficult. Also, data in informal settlements and slums is scarce and sparse.</td>
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<td></td>
<td>• Data collection on cost of hospitalizations.</td>
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<td>4. Collaboration across sectoral, institutional and jurisdictional lines</td>
<td>• Built on existing frameworks for vertical policy integration e.g. measures to reduce transport related air pollution, increase road safety and promote active mobility require collaboration across national, regional and local jurisdictions.</td>
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<td></td>
<td>• Promotion of partnerships between local universities and government agencies to produce high-quality policy, economic and academic research.</td>
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<td></td>
<td>• Working under a single administration, AMA was able to work across sectors to unlock available data for health assessments.</td>
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<td>5. Match the timing of scientific analysis and communications flow</td>
<td>• Regular meetings of the communications working group to update messages with new evidence.</td>
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<td>• Media engaged in an iterative way, with increasingly focused media training events.</td>
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<td>• Commitment from Ghanaian media editors and publishers to follow updates on air pollution and health.</td>
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<tr>
<td>6. Need to institutionalise UHI model process features in local and national policy-making</td>
<td>• AMA integrated health considerations into plans for climate resilience and sustainability.</td>
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<td>• Interest from the Ghana Ministry of Transport to incorporate health assessments into regulatory frameworks.</td>
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<tr>
<td>7. Ability to mobilize funds and resources to implement the policy scenarios</td>
<td>• Initial cost-effectiveness and cost-benefit analyses to make the investment case for air quality measures in Accra.</td>
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<tr>
<td>8. Need for stable national focal points</td>
<td>• Engaged a critical mass of local experts and decision-makers who could spend several years supporting the Initiative.</td>
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<tr>
<td>9. Difficulties in mobilizing the health sector</td>
<td>• Engagement of health workers through the BreatheLife Accra campaign.</td>
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<td></td>
<td>• Development of a training for the health sector on air pollution and health, to equip health workers with the capacity and tools to inform patients and to advocate for sectoral actions to address air pollution.</td>
</tr>
</tbody>
</table>

\(^{23}\) For more on the tools and approaches used in the implementation of the pilot project see: https://www.who.int/initiatives/urban-health-initiative/guidance-and-tools
Other challenges were discussed but not addressed within the scope of the pilot project, which should be considered for future analysis, including:

1) how to analyse the significant migrant populations (and other sensitive or vulnerable groups) living in Accra who have been exposed to polluted environments for a long period of their life;

2) analysis of commuters who come to the city daily or for short periods;

3) analysis of other environmental factors which impact health but were not considered as part of this study (including noise and climate impacts); and

4) the analysis relied on existing data. Future projects should consider research to uncover original data.
10. CONCLUSIONS

Current trends in many cities, in particular in LMICs, have clear significant consequences on the environment and health of their residents. The lack of regular and exhaustive data collection, the difficult implementation of policies and their monitoring cannot justify inaction or BAU scenarios. But actions towards air pollution reduction and promotion of healthier environments are needed. Building on the results of the analysis and activities carried out over four years, the Initiative has filled critical gaps and provided the knowledge and tools necessary to build strong arguments for the reduction of air pollutants - highlighting health co-benefits and presenting the cost of inaction. Failure to act on improving air quality is imposing very high avoidable health, well-being and economic costs. It is useful to summarize some suggestions that emerged to reduce air pollution from the various analysis and discussions:

- There is the need to keep and maintain a small network of fixed monitoring stations for long-term monitoring, in particular in residential areas.

- It is fundamental to dedicate resources to the collection of vital statistics (in particular for mortality) and health data (in particular for hospitalization).

- It is important to provide availability of data on air pollution and health for the public.

- Air quality standard should be protective for human health, also considering for PM interim targets to be achieved in the short to medium term.

- Measures should be taken to decrease exposure levels during dust events, in particular to reduce local emissions of pollutants that can exacerbate exposure during dust episodes.

- Sectorial interventions are needed, in particular to reduce traffic, waste, industrial and household air pollution.

- Land-use interventions should take into account the particular ecosystem situation of the city, and the lack of green spaces for the population.

The pilot project provided the evidence of the economic and health co-benefits that can be achieved through the reduction of air pollutants at a city level by adapting an existing set of tools and good practice guidance, customized to local requirements. The economic analysis provided important information for future analyses to estimate the economic benefits associated with measures that reduce air quality and associated diseases. The pilot project has demonstrated how air pollution poses a central risk factor to address several interrelated urban health conditions. The Initiative has shown how fundamental the engagement of the health sector is to drive alternative policies, the central role of local actors in producing knowledge to orient decision-making, and how collaborations that involve local, national and international experts can be efficiently managed. The Initiative also demonstrated how methodology and tools developed in Europe or North America can be adapted in different places.
Experience learned from using identified tools and guidance in Accra can equip stakeholders and decision-makers to further adapt the available tools and guidance to other initiatives and demonstrate the health impacts of air pollution reduction activities. Improved data could enhance estimates of the health impacts of air pollution and related policies in Accra. Priority should be given to PM$_{2.5}$ monitoring in residential areas, use of clean fuel and technologies, redesigning the mobility of the city, stopping waste burning and controlling waste production, and implementing holistic approaches to address the issues of land-use that are related to poor housing and degradation of the environment, including green spaces. Data collected and best practice studies developed from this project can support comprehensive communications strategies, benefiting from the examples included in the project that targeted sector-specific, and broad public advocacy through the BreatheLife campaign.

The Initiative has put air pollution higher in the agenda of local and national decision makers in Ghana. Through the mobilization and empowerment of the health sector, the pilot project catalysed implementation of air pollution reduction strategies at the local and national level. Considerable benefits can be attained if air pollution reduction policies come together with policies targeting climate pollutants, in particular SLCP responsible for up to 45% of current global warming. These benefits can be comprehended only if a dialogue and agreed action plan is established, that includes different institutions and sectors that usually work separately.
REFERENCES


