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How cities can begin to address the health inequities of air pollution

Air Quality | Governance, Collaboration and Engagement | Inclusive and Equitable Climate Action

Author(s): **C40 Cities Climate Leadership Group, C40 Knowledge Hub**

Marginalised and clinically vulnerable residents are more affected by air pollution than other groups.[1] Poorer air quality in areas where these residents live, work and play, coupled with a lack of access to home air-purifying systems and quality healthcare, poorer overall health and many other factors, result in greater exposure to air pollution and more profound health impacts among these groups. By focusing on those communities most affected by air pollution, tackling inequities in exposure to air pollution and lowering air pollution-related health disparities, cities can maximise the benefits of their investments in cleaner air and health. Building on *How to set standards and monitor outdoor air quality*, this article looks at how cities can collect new data and collaborate with new stakeholders to reduce these inequities. It explores how setting specific objectives and targets to reduce pollution-related health inequities, alongside more general air quality targets, could help to achieve better health for all.

Health disparities describe observable, avoidable differences in health outcomes among different groups of people. Some groups may have higher rates of hospital admissions for asthma and lung conditions, or higher rates of preterm births, for example.

Health inequities explain the reasons for those differences between different groups of people. Health disparities are often driven by underlying social and economic inequities such as limited financial, educational or employment opportunities. However, other vulnerabilities, such as age and other biological factors, or spatial injustices, also play a part in shaping health disparities.

Create a multidisciplinary team and facilitate interagency collaboration

Reducing health inequities associated with air pollution requires cities to identify the environmental, social and economic factors that influence exposure and vulnerability to air pollution locally and take an integrated approach to addressing these factors. The data needed to develop an integrated approach to air quality management are often collected and held by multiple city, regional and/or national agencies. Often, there are silos and institutional barriers that will prevent easy collaboration and data sharing. Therefore, a first step to reducing health inequities from air pollution is to establish a multidisciplinary team and/or structure for interagency collaboration, with a mandate for shared objective setting, data collection and analysis.

Barcelona's open data resource

Barcelona's public agencies are driving a 'public-sector information openness' movement to share the data they generate and/or hold. Historically, departments had resisted data sharing out of fear that they would be used incorrectly. The information openness drive has led to the creation of an open data resource, allowing access to and use of the data by any entity within the city administration and beyond. This is helping the city government to work as a single entity and overcome departmental silos. For example, Barcelona is now mapping income distribution with air pollution data, finding that low-income residents are more exposed. Academic and research institutions also have access to the data, helping to facilitate studies that can reveal new patterns of health disparity and find causes of health inequity.

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Find opportunities to connect health objectives with air quality

A city's air quality affects its ability to meet many local and national public health objectives, but the connection is often not made. Making the link can help cities to develop and allocate resources to effective health and air quality policies and programmes, and ultimately prevent negative health outcomes from air pollution. Ideally, the responsibility for setting shared targets, tracking progress and meeting new linked objectives will be shared between relevant departments or agencies.

Cities could begin by reviewing public health documents that set health objectives and targets, and identifying those associated with the negative health outcomes that have compelling evidence linking them to air pollution. Impacts of air pollution across the life course, an independent analysis by the Environmental Research Group at Imperial College London, outlines the health outcomes most strongly linked to air pollution with a focus on implications for policymaking in London. Many air quality management plans contain health impact analyses that form the basis for health targets and objectives, such as the San Francisco Bay Area Air Quality Management District's 2017 Clean Air Plan.

Using the cross-agency connections described above, agencies could come together to discuss how action to improve air quality can support them in meeting their existing targets, create or reinforce linkages between existing priority health objectives and air quality targets, and set new objectives and targets related to both health and air quality. This might mean amending priority objectives to identify air

pollution as a key influencing factor and/or identifying air quality policies as key to the delivery of those objectives. An objective to decrease hospital admissions from asthma, for example, could identify an air quality objective (such as reduction in air pollutants and exposure to those pollutants) as key to delivery. Efforts to raise awareness of the health impacts of air pollution among colleagues in city departments may help to start these discussions.

Identify local health inequities associated with air pollution, why they exist and how they can be tackled

After connecting health and air quality objectives, explore air pollution-related health inequities. Conduct an assessment to advance your city's understanding of local health inequities associated with air pollution – in other words, the socioeconomic factors that shape exposure to and health outcomes associated with air pollution among different residents. An initial assessment might focus on a particular community, neighbourhood or industry with known poor health outcomes, or map existing data on health outcomes linked with air pollution city-wide. Partner with academic and research institutions to deliver this assessment.

Source and analyse a variety of data types. The *Environmental Benefits Mapping and Analysis programme tool* could support this. The most critical inputs needed are data on air quality (including pollution from stationary sources (waste/agricultural burning, power plants, commercial/residential emissions) and mobile sources (notably, transport)), as well as data on health and socioeconomic factors.

Health disparities linked to air pollution in New York City are closely linked to poverty

New York City health data show wide disparities in health and susceptibility to air pollution effects across the city. An analysis by New York City's Health Department combined neighbourhood health data with methods used by regulators to evaluate the risks of air pollution and benefits of control measures, finding that rates of ozone-attributable asthma hospital admissions were four times higher in high-poverty neighbourhoods than in affluent ones.[2] Another study of climate action plan scenarios estimated that, across all scenarios, there were likely to be 10 times more asthma emergency department visits avoided in low-income neighbourhoods than in the wealthiest neighbourhoods, even though declines in air pollution ($PM_{2.5}$) were similar.[3]

Air pollution contributes to Chicago's nine-year life expectancy gap between black and white residents

Analysis of community-level data on air quality, health and social factors by the Chicago Department of Public Health responded to the city's commitment to health and racial equity set out in Healthy Chicago 2025.

The resulting Air Quality and Public Health report provides the public health foundation to support the city's air quality agenda, identifying neighbourhoods that should be prioritised by air pollution and public health programmes. Visit the report's webpage to find details of the methodology used, indicators and more.

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Air quality data

To develop emission control policies that will reduce health disparities and protect disadvantaged communities from air pollution, city governments will need local air quality data. Air pollution will have many sources within and around the city. *How to set standards and monitor outdoor air quality* and *How resource-constrained cities can assess local air pollution* introduce ways to collect this data and provide links to a host of other resources. The spatial coverage of the air quality monitoring network will determine the type of analysis possible – cities with a network of monitors that estimate pollution concentrations across the city will be able to deliver much more detailed analysis than those working with data from just one monitor.

Low-cost sensing technologies provide new, effective ways of collecting these data. Compared with reference-grade technologies, which are expensive and difficult to move, these new sensing technologies

provide greater spatial coverage and produce more nuanced, hyperlocal information that enables the evaluation of exposure and risk among clinically vulnerable and marginalised communities. They can be used to identify hotspots, be placed near schools, youth centres, nursing homes, hospitals and other locations where clinically vulnerable residents spend time, and be placed in communities close to known stationary and mobile air pollution sources. While they are not as reliable as reference-grade monitors and require calibration and frequent checks for accuracy, low-cost sensors are a cost-effective complement to reference-grade monitors.

For example, to inform actions to reduce exposure to air pollution and address health impacts for clinically vulnerable individuals, Milan is using a set of near-reference-grade air quality sensors to inform policies at sites of special interest, as well as another set of mobile sensors to conduct specific assessments. In Houston, where neighbourhoods surrounding industrial plants are suffering the impacts of industrial emissions, the city is installing 'sensor pod monitors' to measure pollution levels within these areas. The city previously used mobile monitors to track the toxic pollutants released by industrial facilities after Hurricane Harvey and found concentrations of a toxic carcinogen at 38 times the threshold for 'acute' exposure. Industrial emissions in Houston are an environmental justice issue, as most residents near the plant are low-income and Latino.

More generally, these technologies also provide an affordable starting option for cities new to air pollution monitoring and can enable cities with existing monitoring networks to expand spatial coverage, measure the impact of interventions, identify hotspots, engage with communities and raise awareness. *Sensing change: How cities are using new sensing technologies to achieve air quality goals* explains more.

Health, demographic and socioeconomic data

Health data are important for understanding the prevalence of health conditions related to air pollution, who experiences the health conditions and where those suffering from these conditions live. Cities can source healthcare records on the incidence of asthma, lung cancer, stroke, and heart and lung disease from health departments, general practitioner networks and hospitals, for instance.

Socioeconomic inequities are key drivers of health disparities, shaping exposure to air pollution as well as clinical vulnerability. Marginalised communities facing social, economic, political or geographical disadvantages or exclusion, such as low-income and informal residents, may face a higher health burden and more hospital admissions for health conditions linked to air pollution. Marginalised people may be more exposed because they live in a highly polluted area, such as by a busy road, or work in a high-pollution environment, such as construction. Certain groups may have greater clinical vulnerability to air pollution because of their age, poor overall health linked to inadequate access to healthy foods, negative healthcare experiences, lack of access to home air-purifying systems, and many other reasons.[4] This means that, for example, health outcomes for wealthy people who enjoy a healthy indoor air environment at home and work may face a lower health burden than lower-income neighbours

living in the same area.

To ensure that those residents most at risk can benefit from the implementation of clean air and climate solutions, cities can collect demographic and socioeconomic data on income, informal versus formal work status, and other locally relevant indicators of social, economic, political and geographical exclusion. Analyse this information together with that on health outcomes and air pollution levels to identify patterns and associations.

Research into the health impacts of air pollution helped London to make the case for bold action, including the expansion of the Ultra-Low Emission Zone to outer London

London commissioned Imperial College London to research the health impacts of air pollution and disparities of impact. Researchers used multiple databases, including air quality data from the London Atmospheric Emissions Inventory, health data and population data. The analysis estimated that, in 2019, between 3,600 and 4,100 premature deaths in Greater London were attributable to air pollution, and that areas home to the city's most deprived residents had an annual average $PM_{2.5}$ concentration that was 6% higher than the least deprived areas. The highest number of deaths was shown to be in outer London, mainly due to the higher proportion of elderly people living there.[5] Further research on air pollution exposure showed that black communities, diaspora immigrant communities and the most deprived areas of the city were the worst affected by air pollution, and that the gap between the most and least deprived areas for exposure to nitrogen dioxide (NO_2) had already narrowed by up to 50% thanks to measures implemented to improve air quality, such as the Ultra-Low Emission Zone and other road pricing policies.[6]

Bogotá's socioeconomic equity index has informed the city's clean air zone programme

The Zonas Urbanas Por Mejor Aire (ZUMA, or Urban Clean Air Zone) programme is a flagship measure of Bogotá's Unidos por un Nuevo Aire (United for Clean Air) air quality plan. It aims to improve air quality in areas that are highly polluted and where marginalised communities live. To prioritise city districts for the implementation of these zones, Bogotá created a socioeconomic equity index informed by metrics including population density, density of marginalised residents, loss of life associated with poor air quality, facilities used by clinically vulnerable residents (schools, nursing homes, hospitals and so on), per capita income, land and house value, and a multidimensional poverty index. The index used information from Bogotá's Health and Mobility Secretariats, the city's public information resource (Ideca), the National Administrative Department of Statistics, Andes University and other sources. The city overlaid this analysis with a mapping of existing and planned mobility programmes and identified 14 priority areas before selecting Bosa, a low-income, high-pollution neighbourhood, for the first ZUMA.

The goal: set local air pollution-related health equity targets using the assessment

Developing air pollution-related health equity objectives and/or targets could help cities ensure their air quality and health policies benefit communities that are disproportionately burdened by air pollution. Without them, cities run the risk of creating policies that are ineffective or even widen existing health gaps.

To date, few cities (that we are aware of) have set objectives or targets on health equity linked to air pollution, but many are interested in doing so. One regional example is the San Francisco Bay Area Air Quality Management District's goal to 'eliminate disparities among Bay Area communities in cancer health risk from toxic air contaminants'. Learning from cities' experience with setting broader air pollution and health equity targets, the points above may help cities to get started in linking the two. If your city is setting, or has set, health equity targets for air pollution and would like to share examples and experience with peers in other cities, please contact us.

Air quality targets can be health based or exposure based. The World Health Organization's Air Quality Guidelines provide health-based air quality targets that any city can adopt. Exposure-based air quality targets aim for a percentage reduction in the average exposure of pollutants by a defined date compared with a baseline. Health equity targets on air pollution could also be health and exposure based and/or be based on demographic, socioeconomic and sector-specific information.

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