

# VIEWPOINT: TURNING THE AIR BLUE

## Respiratory Health and Cities

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We practice medicine in an ever-changing world. An increasing proportion of the global population lives in cities and other urban areas. What does this mean for the respiratory health of those living in cities and their clinicians?

The challenges of living in rural areas have been well described and center on poor access to expert health care (1) because of fewer providers; workforce shortages; greater travel distances; and, therefore, increased costs. The greater likelihood of proximity to expertise in cities masks several problems that are particularly relevant to respiratory health. These need specific consideration if we are to advocate for appropriate health care for all. Some of these problems are shared across high-income countries and low- and middle-income countries (LMICs), but the greatest challenges relate to rapid urbanization in LMICs.

In this Viewpoint, we discuss the challenges of urban respiratory health. We argue that our community must lobby for better respiratory health in cities to reduce the future burden of disease.

### Demographic Transitions

The World Health Organization (WHO) has reported that 55% of the world's population currently lives in urban areas, with an increase to 68% expected by 2050 (2). The proportion of the population in rural compared with urban settings varies by country. In an

examination of the two most populous countries, for example, the urban:rural split yields 64% rural in India but 64% urban in China. Population growth in cities is mostly driven by migration to seek economic opportunities, with migrants in LMICs often living in informal settlements (3). Urbanization can bring economic benefits, but uncontrolled growth brings challenges in the provision of housing and basic services such as sanitation and electricity, health care and transportation. Health inequity may, therefore, be greatest in urban areas (2).

### The WHO “Triple Threat”

The WHO describes a triple threat to health in urban environments comprising noncommunicable diseases (NCDs), infectious diseases, and injuries and violence (2). Major drivers include poor air quality, lack of clean drinking water, poor sanitation, overcrowding and poor housing, wide availability of junk foods, and poor transport infrastructure without safe spaces for physical activity. With susceptibility to natural disasters and climate change, the health of our cities is also intimately linked with planetary health. How do the WHO triple threats relate to respiratory health?

### Chronic Respiratory Disease

Poor air quality in urban areas is a major driver of chronic respiratory disease in cities, including contributions from traffic pollution,

industry, and domestic use of solid fuels. However, individual exposures and behavior transcend simple classification of chronic respiratory disease risk by urban compared with rural environments. Exposure to indoor tobacco smoke remains a contributor in cities where this is not banned. Air pollution also contributes to the increased risk of other NCDs, such that respiratory disease is a frequent component of multimorbidity. Addressing urban air quality is critical to progress toward achieving United Nations Sustainable Development Goal 3.4 to reduce premature mortality from NCDs by one-third by 2030.

To take chronic obstructive pulmonary disease (COPD) as an example, the prevalence varies markedly by setting. U.S. data suggest a higher prevalence in rural areas (4), perhaps associated with increased use of solid fuels. In general, the prevalence of COPD is higher in rural areas of LMICs, too (5), but the importance of local context is illustrated by the particularly high prevalence of COPD in urban industrial workers (6). Relationships between urban and rural environments with asthma prevalence and control are similarly complex.

### Respiratory Infections

Urban living is often associated with crowding and poor sanitation, both of which contribute to the excess incidence of infectious diseases. The interplay between NCDs and acute infections is a neglected area, relevant to

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**NEW YORK CITY – NYC:** NYC has a long history of poor air quality, particularly evident in smog events related to temperature inversions in 1953, 1963 and 1966. Initial efforts to combat air pollution included the 1955 Air Pollution Control Act, which supported research within the Department of Health. The 1966 smog event was a catalyst for the national 1967 Air Quality Act and the 1970 Clean Air Act. The 1995 NYC Smoke-Free Air Act prohibited smoking in workplaces and public spaces. Under these regulations air quality in NYC has improved, although it remains suboptimal. The impact of transportation and building emissions continue to prove challenging. More recent events include the World Trade Center terrorist attack that exposed thousands of first responders and inhabitants of Manhattan to tremendous air quality challenges with long-lasting health effects. Hurricane Sandy in 2012, and the COVID-19 pandemic highlighted the disproportionate impact of poor air quality as a function of race/ethnicity and socioeconomic disadvantage.

**SAO PAULO - SP:** In the 1980s, SP faced a serious air pollution crisis and, in response, introduced measures to control industrial emissions, promote use of cleaner fuels and inspect vehicles for compliance. In 1996, a permanent restriction on traffic was implemented during peak travel times, effective for one day per week. More recently, a multi-sectoral and multi-level approach has been introduced. SP banned smoking in indoor public spaces from 2009. Since 2018, public transport vehicles must use cleaner fuels and use of electric vehicles has been encouraged. SP has been working to promote sustainable urban planning and reduce reliance on private vehicles (by supporting bike and scooter-sharing programs, bike lanes and expansion of the metro); and to reduce the use of wood and charcoal for cooking. Despite such initiatives, SP still faces significant challenges and interventions have often favoured more affluent neighbourhoods. The city remains heavily reliant on private vehicles and remains a major industrial hub.

**LONDON:** Following the ‘Great Smog’ of 1952 which killed thousands, a Clean Air Act was introduced in 1956 that limited (mostly industrial) air pollution. More recent initiatives have focused on transport emissions, with introduction of a central London congestion charge from 2003. This was associated with improvements in air quality. ‘Cycle Superhighways’ and a shared Bike Scheme were introduced in 2010, and more recent public transport schemes including electric buses, and infrastructure for electric vehicle charging have sought to make alternative forms of transport more attractive. 2019 saw introduction of an ‘Ultra-Low Emissions Zone’ which charges vehicles that do not meet modern emission standards to enter central London. The UK banned smoking in indoor public spaces from 2007.

**SHANGHAI:** In 2013 the Shanghai government launched the Shanghai Clean Air Action Plan, which set the goal of reducing annual average PM<sub>2.5</sub> concentration by 20% by 2017. In 2014, Shanghai introduced the strictest air pollution laws in China. A number of measures were taken, including real-time air quality readings, standards for vehicle emissions, banning more polluting vehicles from the Outer Ring Road, encouraging green vehicles by providing a subsidy, requiring 30% of government vehicles to be fuelled by renewable energy, reducing emissions of volatile organic compounds from Shanghai factories, and banning fireworks.

**DELHI:** Air pollution is responsible for tens of thousands of deaths per year in Delhi. In 1998, Delhi introduced Compressed Natural Gas as a cleaner alternative for public transportation and auto-rickshaws. For the 2018 Diwali festival, firecrackers were banned resulting in a reduction in PM<sub>2.5</sub>. Dust control measures have included sprinkling water on roads and construction sites, and construction waste plants. Central government initiatives included a 2019 National Clean Air Programme which aims to reduce air pollution in India by 20-30% over the next five years, and a Graded Response Action Plan (GRAP) in the National Capital Region. In GRAP, a set of emergency measures can be introduced when air quality is poorest. Community led initiatives include the ‘Green Delhi’ campaign, designed to encourage citizens to plant trees and reduce waste. Significant challenges remain, especially during the winter when the city experiences smog due to crop burning, industrial and vehicle emissions.

**KAMPALA:** Kampala is one of the most polluted cities in the world. The concentration of economic activity, poor urban planning, rapid population growth, informal settlements, congestion, and biomass use all drive poor air quality. Resource limitation has been a barrier to improvements. The National Environment Management Authority (NEMA) Act in 2004 aimed at regulating and managing the environment, including air pollution, faced slow implementation. A ban on the import of older vehicles in 2018 aimed to curb air pollution and reduce traffic accidents. Kampala established a pollution control task force in 2012 to monitor industrial compliance, and a Non-Motorised Transport policy to curb air pollution and improve road safety. Community-led initiatives such as the ‘Take Action for Clean Air’ campaign launched in 2022 aimed to raise awareness about air pollution and encourage citizens to take individual actions.

**Figure 1.** Air quality mitigation interventions for selected global cities.

chronic respiratory disease in relation to exacerbations.

Common cold viruses are the most common cause of airway disease exacerbations, and there are conflicting data on the incidence of the common cold and exacerbations in cities compared with rural regions. Both COPD (7) and asthma (8) exacerbations are associated with pollutants. Exacerbation risk in urban environments is likely dominated by transmission of respiratory viruses and air pollution.

In general, tuberculosis is more common in urban areas that are associated with overcrowding, poverty, and inadequate housing. A meta-analysis has reported that long-term exposure to airborne pollutants is associated with a higher risk of incident tuberculosis (9). Overcrowding also associates with increased transmission of influenza and coronavirus disease (COVID-19).

Mitigations to reduce the risk of acute respiratory infections in urban populations must focus on reducing risk factors relating to overcrowding, socioeconomic disadvantage across the life course, and improving air quality.

### Injuries and Violence

Although the WHO focuses on interpersonal violence and traffic accidents, cities are also a

target of terrorist activities. The attacks on September 11, 2001, highlighted the acute and long-term morbidity associated with respiratory exposures in these contexts (10). Urban areas can also experience industrial disasters, such as in Bhopal, India, leaving a legacy of chronic respiratory disease. Real or perceived risk of violence can limit the value of parks and green spaces in which to exercise. Improvement in the safety of such facilities is, therefore, an investment in respiratory health. Psychosocial stress may exaggerate the effect of pollutants and living with chronic respiratory disease. The absence of safe, unpolluted spaces in which to exercise makes it harder to remain active, and this is particularly important for those living with chronic respiratory disease.

### The Health of Our Cities and Planetary Health

Given that cities account for >60% of greenhouse gas emissions (2) and consume two-thirds of the energy, the health of cities is intimately linked with the health of the planet. The WHO has highlighted that urban populations are particularly vulnerable

to climate change (2), with temperatures 3–5°C higher than in surrounding areas because of ‘heat island’ effects resulting from expanses of concrete. This is relevant to chronic respiratory disease, with greater COPD exacerbation risk at extreme temperatures.

### Moving Forward: Healthy Planet, Healthy Cities, Healthy Lungs

The WHO has an increasing focus on urban health (2), including the Healthy Cities initiative, which is ‘conceived with the goal of placing health high on the social and political agenda of cities by promoting health, equity and sustainable development through innovation and multisectoral change’ (11). The emphasis on multisectoral change is critical, including healthcare professionals and policymakers working closely with those who work in the built environment, urban planning, transportation, environmental management, and emergency preparedness fields. Examples of air quality mitigation interventions from the cities in which we work are described in Figure 1 and include environmental legislation, societal

education, cleaner energy and transportation, and public green spaces.

## Conclusions

Urban living brings challenges to respiratory health. Air pollution, overcrowding with the transmission of respiratory pathogens, social

disadvantage, lack of ability to safely exercise, and heat islands all increase the risk of acute and chronic respiratory disease. With global warming and demographic transitions to more people living in urban areas, we cannot stand by. To reduce the future burden of lung disease in those living in urban environments, we urgently need a

response that is coordinated across sectors and sufficiently disruptive to transform the future respiratory health of cities while being sustainable and cost-effective to implement. ■

**Author disclosures** are available with the text of this article at [www.atsjournals.org](http://www.atsjournals.org).

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