# The legacy of COVID-19: lessons and challenges for city-scale air quality management in the UK

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The lockdown enforced by the UK Government to prevent the spread of the SARS-CoV-2 virus has led to an unparalleled reduction in traffic volumes and significant drop in nitrogen dioxide concentrations in most cities, although the picture emerging from residential emissions of particulate matter ($PM_{10}$ and $PM_{2.5}$) is more complex. The scale and degree of the intervention have exposed the level of change required to reduce pollution. Learning from the COVID-19 crisis, we identify three challenges that must be overcome to improve air quality in cities. First, what measures would be effective that balance civil liberties with enforcement action on air pollution? Second, how do we consolidate the cultural change needed to retain and normalise the social practices driving the observed pollution reduction? Third, how do we tackle these challenges in a way that breaks current patterns of socio-economic, health and environmental inequality?

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## The effect of the COVID-19 crisis on UK air quality management in cities and the scale of the challenge

Traffic- and domestic-related emissions are both key sources of nitrogen oxides ($NO_x$) and particulate matter ($PM_{10}$ and $PM_{2.5}$) in the UK urban areas. Concentrations of these pollutants vary significantly by area and proximity to source, however, nationally, transport is responsible for approximately 80% of NOx emissions and domestic wood and coal burning contribute 38% of primary emissions of $PM_{2.5}$ (Defra, 2019). During an enforced lockdown period in which people were asked to remain at home and avoid all but essential travel, traffic volumes fell significantly. According to the UK Government, road transport use has fallen by 60-70% (Prime Minister's Office, 2020). Whilst predominantly traffic-related pollutants, such as nitrogen dioxide ($NO_2$), may have fallen at roadside sites, reductions in $PM_{10}$ and $PM_{2.5}$ have been less significant due to possible increases in other sources, e.g. domestic heating and garden waste combustion, as a result of the time of the year and people spending more time at home, and transboundary agricultural emissions due to meteorological conditions, which may have offset reductions from traffic sources (AQEG, 2020). The return to either a 'business as usual' or a 'new normal' should consider the degree to which policies and citizen behaviour impact air quality from the perspectives of regulatory compliance and local public

health, as well as the long-term behavioural changes that may result from learning to live with the virus.

The effects of the measures to contain the spread of the SARS-CoV-2 virus on air quality have exposed the scale and degree of the change required to reduce transport-related pollution. The urgency created by the pandemic required the implementation and enforcement of restrictive top-down lockdown measures in a way that is not sustainable in the long term, nor acceptable on deliberative decision-making grounds in a non-emergency scenario. The SARS-CoV-2 has affected different people differently, thus exacerbating some elements of inequality in our societies, with evidence suggesting that Black, Asian and Minority Ethnic (BAME) communities and those living in more deprived areas, which are also exposed to higher levels of pollution concentrations (Barnes et al. 2019), are experiencing higher mortality rates (ONS, 2020). Also, the measures to contain the spread of the virus have had a disproportionately negative effect on people from lower socio-economic backgrounds and those in more precarious employment (Banks et al, 2020).

Yet, during this period we have also witnessed $NO_2$ pollution reductions from traffic resulting from a radical and widespread change of citizen behaviour; a change that air quality management policies in the UK have failed to achieve since the initiation of the Environment Act, 1995 (Longhurst et al. 2016). To date, clean air policies in the UK have been based on incremental approaches, which largely relied on soft law, voluntary actions and weak enforcement which, have been undermined by a lack of common purpose and shared priorities between levels of governments (Barnes et al. 2018). Additionally, policy measures have been very techno-centric, focussing on improvements to technology, e.g. European vehicle emission standards (European Commission 2019) rather than influencing the daily practices and activities of the driver (e.g. commuting to work, leisure, shopping, etc). More recently, the Clean Air Strategy 2019 (Defra, 2019) envisioned a more joined-up and ambitious approach but there remains a gap between strategies and policies.

Preliminary evidence is emerging that COVID-19's impact is more severe in highly polluted areas and that SARS-CoV-2 virus can be found on particulate matter (Setti et al. 2020), thus highlighting potentially close links between these issues. Interventions to tackle the COVID-19 crisis provide an opportunity for policy learning and for advancing our understanding of how to frame future air quality approaches. We need to reflect on the challenges that these top-down policies – albeit effective in changing citizen behaviour, as they resulted in car-free roads which encouraged cycling and walking – have raised in terms of democratic and deliberative decision-making, governance arrangements and social justice, as well the potential to increase other polluting practices, as highlighted by some councils in England which urged citizens not to burn garden waste or light bonfires during lockdown (AQN, 2020).

We need to be aware that we are at a crossroads as we approach the post-lockdown transition. On the one hand, there is the strong risk that many cities may already be sleepwalking towards a recovery based on the old Business-as-Usual. This could be aggravated by citizens' reticence to use public transport because of health concerns or a continuation of social distancing. On the other hand, cities, and particularly those that were

already taking a lead on other existential issues such as climate change and social inequality, are starting to pave the way towards a more sustainable future. For instance, cities like Milan, Paris, and Brussels are reimagining commuting patterns and investing in active travel to compensate for the reduction in daily metro use, to avoid returning to severe pollution levels of the pre-lockdown periods (O'Sullivan, 2020). Some cities in the UK, such as Brighton, are trying to follow the same example by widening cycle lanes and by allocating roads for walking and cycling to encourage upkeep of active travel in the long run (Brighton and Hove City Council, 2020).

While a detailed analysis of the pros and cons of lockdown measures across all pollutants is beyond the scope of this commentary, we contribute to this debate by identifying three interrelated and multidisciplinary research and policy challenges that must be overcome using lessons learnt during the COVID-19 crisis to enable a long-term, radical and sustainable shift.

First, a **governance and political challenge:** why have some cities taken the opportunity offered by the lockdown to encourage and prioritise active travel while others still lag behind? Lockdown approaches in some countries for example Taiwan, New Zealand or Germany seemed to be more effective if supported across all levels of governments and if they included wide-ranging, comprehensive and coordinated interventions. This should encourage stakeholders to identify mechanisms for ambitious clean air policies that can be implemented locally with the support of national governments, and which are based on ambitious targets and effective implementation mechanisms and also enjoy broad citizens' and stakeholders' consensus. The new air quality policy mix can and should be bold and underpinned by a radical vision; yet decision-makers will need to find the right balance between a swift, sustainable transition and open, transparent and meaningful citizen involvement. Examples of innovative governance are already underway in the UK and internationally. For instance, Bristol developed the One City Approach, which as well as identifying a city-level sustainability pathway, is also directly shaping city-level environmental and climate change governance and supporting evidence-informed and participatory policymaking, through city-wide initiatives such as the Bristol Forum or the Bristol Advisory Committee on Climate Change. A more direct inclusion of post-lockdown air quality management within broader city-level frameworks could support the achievement of these radical visions.

Second, a **cultural challenge:** how do we consolidate the cultural change and individual intrinsic motivators needed to retain and normalise the more desirable social practices? In the early part of 2020, many people have had to adapt to different working patterns, which emphasised online connectivity and remote working over commuting. A cultural shift centred on sustainability and health benefits is required to identify and normalise sustainable practices in the workplace, which would give people more flexibility and control over their travel choices, as well as creating potential for significant efficiency savings and congestion reduction (Giovanis 2018). As not all jobs allow this flexibility, innovative work practices would require employers to think strategically and beyond the short-term crisis about the longer-term adjustments that the current crisis could bring about, and grasp potential unintended benefits of remote and flexible working.

This cultural change could also reduce the negative impact of less desirable practices such as increased biomass burning for domestic heating – a risk with increased home working. Cities and employers will have a crucial role in ensuring the success of the cultural change as they step up efforts to supply critical services, including improved waste management to reduce garden waste combustion accompanied by wide-scale retrofit schemes to improve domestic energy efficiency and district energy systems, strong support for public transport and active travel, remote working arrangements and flexible hours. Research projects such as the Horizon2020 ClairCity project (www.claircity.eu) explored the potential of citizen-led air quality solutions, which could enable such a cultural shift and lead to effective and comprehensive policy mixes based on consensus.

Third and underpinning the other two, **a socio-economic, health and environmental inequality challenge:** how do we tackle these challenges in a way that is sustainable, democratic and consensual and that, crucially, does not perpetuate current patterns of inequality and social injustice in exposure to air pollution or the measures to reduce it (Barnes et al. 2019)? As we pointed out earlier, the COVID-19 crisis is exposing and even exacerbating health and socio-economic inequalities, which are coupled with existing patterns of environmental injustice related to air pollution (EEA, 2018). As solid fuels are cheaper, there is the risk that they will become the default option in a context of inequality and looming economic crisis. Therefore, non-transport polluting sources might undermine progress in reducing transport-related concentrations. It is therefore essential that we explicitly recognise and address these inequalities as we deal with current and future health and environmental crises if we want new approaches to succeed.

## Concluding remarks

The key lesson from the COVID-19 crisis is that policies that are radical, ambitious and are accompanied by consistent implementation strategies are effective in delivering the intended environmental outcomes. There are many possible post-COVID-19 pathways: for a sustainable shift to happen it is crucial that cities seize the opportunity to replace old practices with sustainable interventions underpinned by progressive and radical sustainability and health narratives. As we are still learning how to manage life after the lockdown, future research will need to identify and assess the long-term consequences of the COVID-19 crisis on commuting, travels, leisure and shopping behaviours. We believe that tackling the governance, the cultural and the socio-economic, health and environmental inequality challenges is a precondition for a green and fair recovery.

While the challenges have a global relevance, the way in which they play out and potential solutions must be tailored to the local context but also supported by national governments, the EU and international organisations, e.g. World Health Organisation. Researchers and decision-makers have an unprecedented opportunity to identify processes of systemic lesson learning and to work together to radically re-think the model upon which air pollution and other existential challenges such as climate change are tackled. Meanwhile, city leaders must be proactive within existing networks (e.g. C40, Covenant of Mayors, etc.) and work with other cities around the world to drive bottom-up innovation. While their experiences of the

COVID-19 crisis and the responses of respective governments will differ, cities will all face a governance and political challenge, a cultural challenge, and a socio-economic, health and environmental inequality challenge. In this regard, we envision a stronger role for research and practice aimed at transforming the UN Sustainable Development Goals (SDGs) into a localised and operational framework to address these challenges. As such, the SDGs would offer an opportunity to frame future clean air policies at all levels through a sustainability lens (Longhurst et al. 2018), building on global consensus and at the same time reflecting local circumstances.

**References**


Air Quality Expert Group (2000). Estimation of changes in air pollution emissions, concentrations and exposure during the COVID-19 outbreak in the UK. Available at https://uk-air.defra.gov.uk/assets/documents/reports/cat09/2007010844_Estimation_of_Changes_in_Air_Pollution_During_COVID-19_outbreak_in_the_UK.pdf [last access 08/07/2020].

Air Quality News (AQN) (2000). Residents urged not to light polluting bonfires during coronavirus crisis. Available at: https://airqualitynews.com/2020/04/01/residents-urged-not-to-light-polluting-bonfires-during-coronavirus-crisis/ [last access 09/07/2020].

Banks J., Karjalainen H., Propper C. (2020). Recessions and health: The long-term health consequences of responses to coronavirus. IFS Briefing Note BN281. Available at https://www.ifs.org.uk/uploads/BN281-Recessions-and-health-The-long-term-health-consequences-of-responses-to-COVID-19-FINAL.pdf [last access 01/05/2020].

Barnes, J.H., Chatterton, T.J. and Longhurst, J.W., (2019). Emissions vs exposure: Increasing injustice from road traffic-related air pollution in the United Kingdom. Transportation Research Part D: Transport and Environment, 73, pp.56-66.

Barnes, J.H., Hayes, E.T., Chatterton, T.J. and Longhurst, J.W., (2018). Policy disconnect: a critical review of UK air quality policy in relation to EU and LAQM responsibilities over the last 20 years. *Environmental science & policy*, *85*, pp.28-39.

Brighton and Hove City Council (2020). Madeira Drive first road to be allocated for walkers and cyclists. Available at: https://new.brighton-hove.gov.uk/news/2020/madeira-drive-first-road-be-allocated-walkers-and-cyclists [last access: 08/07/2020].

Defra (2019). Clean Air Strategy 2019. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/770715/clean-air-strategy-2019.pdf [last access: 04/05/2020].

European Commission (2019). Air pollution from the main sources - Air emissions from road vehicles. Available at https://ec.europa.eu/environment/air/sources/road.htm [last access 08/07/2020].

European Environment Agency, EEA, (2018). Unequal exposure and unequal impacts: social vulnerability to air pollution, noise and extreme temperatures in Europe. EEA Report NO 22/2018. Available at https://www.eea.europa.eu/publications/unequal-exposure-and-unequal-impacts/ [last access: 01/05/2020].

Giovanis, E., (2018). The relationship between teleworking, traffic and air pollution. *Atmospheric Pollution Research*, *9*(1), pp.1-14.

Longhurst, J., Barnes, J., Chatterton, T., De Vito, L., Everard, M., Hayes, E., Prestwood, E. and Williams, B., (2018). Analysing air pollution and its management through the lens of the UN sustainable development goals: A review and assessment. WIT Transactions on Ecology and the Environment, 230, pp.3-14.

Longhurst, J.W.S., Barnes, J.H., Chatterton, T.J., Hayes, E.T. and Williams, W.B., (2016). Progress with air quality management in the 60 years since the UK clean air act, 1956. Lessons, failures, challenges and opportunities. *International Journal of Sustainable Development and Planning*, *11*(4), pp.491-499.

O'Sullivan (2020). Europe's cities are making less room for cars after coronavirus. *CityLab*. Available at https://www.citylab.com/transportation/2020/04/coronavirus-reopen-cities-public-transit-car-free-bike-milan/610360/ [last access 01/05/2020].

Office for National Statistics (ONS), (2020). Deaths involving COVID-19 by local area and socioeconomic deprivation: deaths occurring between 1 March and 17 April 2020. 1 May 2020. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/bulletins/deathsinvolvingcovid19bylocalareasanddeprivation/deathsoccurringbetween1marchand17april [last access 01/05/2020].

Prime Minister's Office (2020). Slides and datasets to accompany coronavirus press conference: 2 April 2020. Available at https://www.gov.uk/government/publications/slides-and-datasets-to-accompany-coronavirus-press-conference-2-april-2020 [last access 08/07/2020].

Setti, Leonardo, Fabrizio Passarini, Gianluigi De Gennaro, Pierluigi Barbieri, Maria Grazia Perrone, Massimo Borelli, Jolanda Palmisani et al. (2020) "SARS-Cov-2RNA Found on Particulate Matter of Bergamo in Northern Italy: First Evidence." Environmental Research,188, 109754.

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