

Air pollution impacts of Covid-19 response (Wales): A public health opinion

Summary

An analysis of data from continuous air quality monitoring sites across Wales suggests that concentrations of some air pollutants – notably nitrogen dioxide – have fallen since the Covid-19 pandemic interventions. More data are required over a longer period to confirm and quantify this.

Establishing the impact of the lockdown on air quality, and people's exposure to it, is complex and challenging. Measured reductions in transport-related air pollutant emissions (resulting from more people staying at home and travelling less) may be offset by increases in other outdoor pollutants as well as potential increases in exposure to indoor air pollutants.

What role air pollution may have played in the causes and spread of covid-19 is the subject of much speculation right now. Current research offers no definitive answers about the links between air pollution and incidence and severity of the disease. It may be many years before the answers to these issues are clear.

Did air pollutant concentrations reduce during lockdown?

An analysis undertaken by air quality consultants, Ricardo¹, for the period 16th March to 31st May, showed pronounced decreases in concentrations of nitrogen oxides (NO_x) during lockdown due to the reduction in road traffic emissions. The mean reduction in nitrogen dioxide (NO₂) was 36% with the greatest reduction at roadside locations. Substantial diurnal changes were also apparent as travel patterns and behaviours changed.

However, ozone (O₃) increased by 18%, on average. This is not unexpected since ozone reacts with NO to produce NO₂, so less NO means less ozone is depleted. This is demonstrated by the noticeable local increases in ozone at traffic and urban sites. However, the warm sunny weather during this period will also have contributed to this increase as ozone is formed from photochemical reactions between other air pollutants and sunlight. This makes it difficult to quantify the effect of lockdown.

The impact on particulate matter (PM) concentrations (PM_{2.5} and PM₁₀) is complex and more variable. Preliminary analysis suggests that, overall, PM concentrations did not substantially change during lockdown and may have risen in places. Some evidence of local decreases was seen but these were very modest. During much of the lockdown there was an unusually prolonged easterly air flow from continental Europe and this had a substantial influence on measured concentrations. It is also unclear whether the lockdown led to changes in particle size and composition.

The analysis did not look at indoor air quality. However, it is possible that people spent more time indoors on activities such as cooking and cleaning. This may have increased exposure to PM_{2.5}, NO_x and volatile organic compounds (VOCs).

¹ [Ricardo/ED62041/Final_Issue2](#)

What do these changes mean for public health?

Air pollution can adversely affect health. Short-term exposure to high concentrations of air pollutants can lead to symptoms such as cough, throat irritation, chest tightness and asthma, as well as more medication use and GP and hospital visits. Long-term exposure to PM_{2.5} and NO₂ can result in poor lung development and function and increase risks from chronic heart and lung diseases. Ozone is a respiratory irritant and can aggravate lung conditions.

Quantifying the health impact of lockdown air pollution changes is challenging. Any reductions in NO_x and NO₂ will benefit health and if such reductions continued over months or years population-level health improvements, and less contact with healthcare services, may be seen. However, this cannot currently be quantified due to the relatively small NO₂ dataset available and the high level of uncertainty associated with linking air pollution and health data to estimate impacts.

Understanding the impact on PM is more complex. Where changes in PM concentrations were reported, they were typically small and had a high degree of uncertainty. While there is no safe level of PM, such changes are unlikely to have had a measurable health impact over the short term. Continued analysis of the long-term impact of changes in PM due to lockdown is needed to help better understand the potential health impact.

While ozone increased, concentrations did not exceed current health-based guidelines. If the current reduction in NO_x continues into the summer, it is possible that we may continue to see further increases in ozone in parts of Wales, particularly during hot weather.

Quantifying the effect of such changes is therefore difficult because;

1. Any improved health outcomes linked to lower NO_x concentrations could be offset by increases in PM and O₃ concentrations. Current methods for estimating the long-term impacts of air pollutants recognise the overlapping health effects of NO₂ and PM_{2.5} and this makes interpreting the impact of changes to individual pollutants very difficult.
2. Any analyses using NHS service-use data would be of limited value. Evidence suggests that during lockdown fewer people sought treatment for non-covid-19 conditions. This is unlikely to have any link to changes in air quality.
3. These analyses aggregate measured data from across Wales. They do not describe the pollution or experience of any specific part of Wales.
4. Changes in air pollution concentrations do not necessarily translate to similar changes in exposure. Lockdown may have reduced exposure to traffic related pollution but increased exposure to air pollution at home.

Did air quality have an impact on covid-19?

Several research papers have started to look at the possible link between air pollution and covid-19 (Wu *et al.*, 2020², Liang *et al.*, 2020³) and whether air pollution exacerbates the severity of the disease (Conticini *et al.*, 2020⁴). As many air pollutants can affect lung development and function, it is certainly plausible that air pollution could play a role in the aetiology of the disease. As yet it is unclear what role air pollution has had in influencing the

² <https://www.medrxiv.org/content/10.1101/2020.04.05.20054502v2>

³ <https://www.medrxiv.org/content/10.1101/2020.05.04.20090746v1>

⁴ <https://doi.org/10.1016/j.envpol.2020.114465>

incidence and severity of disease in the UK. There are reports that incidence is higher where air pollution is greater, but these areas also tend to be the most densely populated, are more deprived and have large multi-ethnic populations. Current evidence is inconclusive and, at best, suggestive of a link as it is mainly derived from research that has not yet been subject to scientific peer reviewed. The research methods used are of variable strength, struggle to adjust for confounding and are unable to identify causal relationships. Over time, with more research to test and verify hypothesis, more robust understanding and conclusions will emerge.

What impacts did the lockdown have on travel?

Motorised travel, including electric vehicles, is a well-documented source of air pollution. Quantifying the effects of lockdown on travel is important to understanding factors that may have contributed to changes in air quality. Traffic data does appear to show a significant drop in vehicle numbers and a strong correlation with the reduction in NO_x . Based on aggregations across all 22 local authorities in Wales, pre-lockdown week saw more travel for grocery and pharmacy, but less for transit, workplace and retail and recreation (Figure 1). During lockdown all travel decreased, but as it has begun to ease, travel has increased, particularly, to and from workplaces. However, these data show only travel, they do not show how people travelled and whether this changed between pre- and post-lockdown.

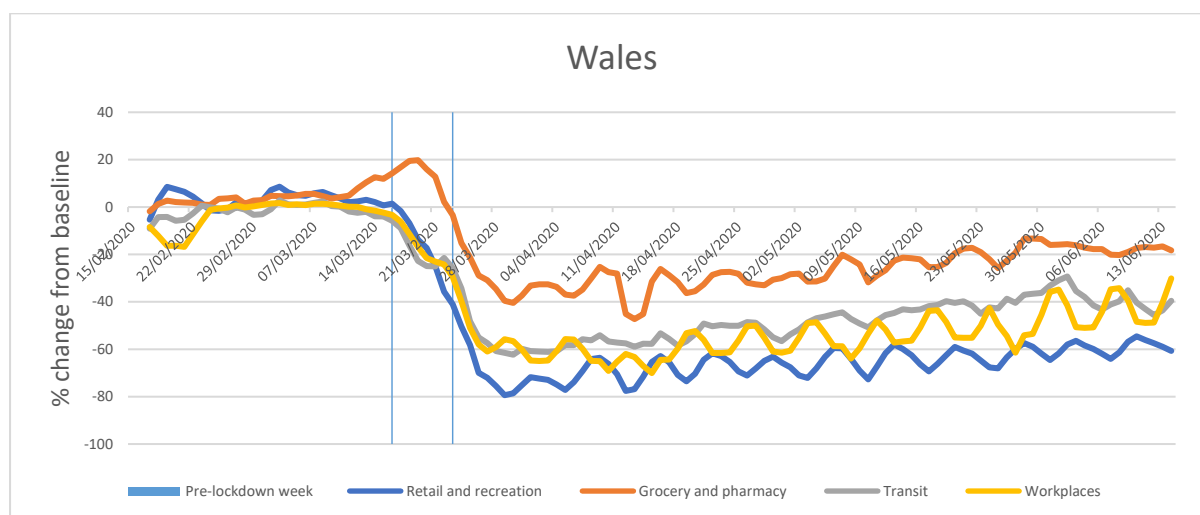


Figure 1. Trends in travel behaviours (three day rolling averages), all Wales, February to June 2020. Source: Google Community Mobility Reports⁵

What does this mean for policy?

Although it is very difficult to quantify the changes in air pollution and the resulting health effects because of lockdown, it possible to use this preliminary analysis to inform some pragmatic policy recommendations in relation to air quality improvement.

The impact of the lockdown on both NO_x and $\text{PM}_{2.5}$ provides valuable data to support the development of future, more stringent health-based air quality targets in Wales. A clear response in local NO_x concentrations was observed, due to the reduction in road transport; however, the situation with $\text{PM}_{2.5}$ pollution is far less certain because of relatively large

⁵ <https://www.google.com/covid19/mobility/>

regional, national and international contributions (which are difficult to manage locally). More PM_{2.5} data, over a longer period of time, are needed to inform future target-setting.

Travel and transport are significant contributors to local air pollution. This analysis not only demonstrated that achieving significant changes in travel need and mode are possible, but suggested that sustaining them can deliver environment, health and sustainability benefits. Policies that embed action to encourage and support active travel, and facilitate its integration with safe and sustainable public transport provision (along with flexible home working arrangements (where possible)), could make a positive difference to air quality, public health and wider environmental health in Wales.

Contact:

Dr Huw Brunt

Lead Consultant in Environmental Health Protection

Public Health Wales

Huw.brunt@wales.nhs.uk

Environmental Public Health Service in Wales

Publichealth.environment@wales.nhs.uk or Chemicalscardiff@phe.gov.uk