



COVID19 and the city; from the short term to the long term[☆]

ARTICLE INFO

Keywords

COVID19
Air pollution
Physical activity
Accidents
The economy and public health

The current COVID19 pandemic cause an enormous number of cases of diseases and premature deaths (EPIWIN, 2020). The number of cases tests health care systems and has led to dramatic actions in many countries e.g. China, Singapore, Japan, Italy, Spain and many other countries. The actions had considerable success in some countries such as China, South Korea and Japan, but still led to a large impact in others like Spain and Italy.

Prevention is currently the key through first of all of the stay at home programmes, and also hygiene measures, social distancing, and wearing masks in indoor public spaces and has led to a large reduction in the number of potential cases that otherwise would completely overwhelm the health care systems (Ferguson et al., 2020; Covid19Risk, 2020).

The drastic prevention measures, particularly the stay at home, also caused a large reduction in traffic (70–80% or more) and industrial activities, which may have resulted in large reductions in CO₂ emissions and air pollution, up to 20–30% in China (WEF, 2020a; Romei and Burn-Murdoch, 2020). A similar reduction is seen in Italy (Space, 2020), larger in Barcelona (75%) (@contaminacio_2020) and other places (Watts and Kommenda, 2020; Carrington, 2020; Baldasano, 2020). NO₂ levels have seen larger reductions in general than particulate matter levels.

Worldwide, every year an estimated 8.8 million people die prematurely of air pollution, which causes an average reduction of 2.9 years in life expectancy (Lelieveld et al., 2020), 3.2 million die prematurely because of lack of physical activity and 1.35 million because of traffic accidents (GBD, 2017; WHO, 2020). Furthermore, the climate crisis results in an increasing number of premature deaths (Costello et al., 2009).

In China, where they are now beyond the peak and for which there is data available, a quick back on the envelope calculation showed that a 25% reduction in air pollution levels for one month may have prevented more than 9000 premature death^{*}, which is higher than the number of

deaths due to COVID19 (nearly 4000). And some suggested this may be as high as 77,000 (McMahon, 2020; Aufhammer et al., 2020). However, increased indoor air pollution from smoking may have increased the number of premature deaths.

In countries like Italy and Spain, the air pollution levels were much lower to start with than in a China and therefore less premature deaths can be prevented by lower air pollution levels. The number of deaths caused by the COVID19 is likely to be higher than the reduced number caused by lower air pollution levels.

However, lower levels of air pollution may reduce the transmission and fatality rate of COVID19 as was suggested from some SARS research (Barbiroglio, 2020; Cui et al., 2003) and is now suggested for COVID19 (Zhang et al., 2020).

So what are the likely impacts of the measures. The impacts are not only on air pollution but also other exposures and factors that are important for health.

The stay at home programmes may cause a significant reduction in physical activity during that time and lead to an increase in premature mortality. Some preliminary data suggest a reduction in physical activity of 20–30% (Fitbit, 2020). Physical activity is very important for physical and mental health, including the immune system. Home exercise may mitigate some of the effects, and there are calls to allow outdoor exercise as part of stay at home programs to keep up fitness, which would prevent disease (Wyke et al., 2020).

In China, the reduction in car traffic has led to a large reduction in accidents (Insurance journal, 2020). In 2016, 256,180 people were killed by car accidents in China (WHO, 2020). This works out to more than 20,000 fatal accidents per month, which could have been avoided. Reduction in car accidents are likely in other countries, where the stay at home programmes are implemented, but the number of accidents is normally lower, and fewer could be avoided.

The largest impact on public health may come from the economic

[☆] *There are 2,203,704 premature preventable deaths due to air pollution each year in China (Lelieveld et al., 2020), and assuming a linear relationship between air pollution and deaths, a 1 month reduction of air pollution by 25% and a 5 year exposure period needed to cause premature death, the expected reduction in premature deaths is 9182. It may be an over estimation due to the linearity assumptions and that the estimated reduction may not be for 1 months and equally everywhere.

downturn, including job losses, although the evidence from, for example, the 2007 crisis was quite mixed and it all may depend on the mitigation measures taken (Parmar et al., 2016; Portes, 2020). The current crisis though looks to be much more severe and may lead to a whole collapse of certain sectors such as aviation, entertainment and tourism, and therefore have much more pronounced consequences on the economy and health. A strong health system needs a strong economy, and what we know now is that a strong economy needs a strong health system.

Cities are hotspot of the outbreaks because of e.g. the high population density, close contact of people, high mobility, shared transport and they are gateways, but rural areas have been hit hard too (Bliss and Capps, 2020). The advantage though for cities is that they often have better and easier accessible health care systems in place.

Cities are also the solution, as they are centres of innovation, and can be drivers of public health improvement e.g. through better urban and transport planning e.g. by moving away from our car centred approach towards walking and cycling transportation (Nieuwenhuijsen, 2020, 20trends 2020). Walking and cycling have the advantage that there is a low risk of contagion, and at the same time it strengthens the lungs and immune system.

The social distancing programs are likely to stay in place for the foreseeable future and we need to prepare our cities for this, for example by providing quickly sufficient and safe infrastructure for walking and cycling to work, which provides opportunities for daily physical activity without causing high air pollution levels, and sufficient and safe public spaces like parks, beaches and other outdoor places, where people can meet and exercise without a high risk of contagion.

In a city like Barcelona 60% of public space is used by cars and this is not the best and most effective way to use public space, if you need a lot of space for people due to social distancing. Innovative approaches on the use of public space are urgently needed.

New urban models like the Barcelona Superblocks (Mueller et al., 2020), the Paris 15 Minute city (Sisson, 2020) or the Hamburg Car free city (Nieuwenhuijsen and Khreis, 2016) are likely to lead to more resilient cities that are also more sustainable, liveable and health (Nieuwenhuijsen, 2020) and therefore should be promoted.

Social distancing and home containment may lead to loneliness and poor mental health, which are already an issue in cities. How can cities use public space and their services to reduce the impacts? Furthermore, for many of these issues there is an unequal distribution in society with e.g. the more deprived and elderly left behind, and it is important to take measures to mitigate the impacts for these groups and reduce inequalities.

The COVID19 pandemic put public health at the centre of policy making, and shows that drastic actions are possible to reduce the potential number of deaths. Could we have a similar approach to our other large problems that we have such as air pollution, traffic accidents and the climate crisis that cause millions of premature death each year, but without the unwanted side effects on the economy? Can we place prevention rather than treatment at the centre of our policy and decision making?

The COVID19 pandemic is a wakeup call, as our world won't be the same, and a chance to build better and more sustainable societies and cities. Currently it may give us time to reflect and think about solutions for the long term, while addressing a short term problem. But can we have a permanent paradigm shift and prevent us falling back into bad old habits?

One of the victims of the COVID19 pandemic may be the European green deal (EC, 2020) as it may compete with the financial resources needed for both. But if we make any financial stimulus package for the COVID19 pandemic adhere to the green deal principles, the benefits for society would be much greater.

In the short term we need to focus on the burden on the health care systems. For the medium to long term, we should analyse the data that become available, take a more holistic view of the pandemic, and

evaluate, build and implement policies that address health care system requirements, including surveillance, environmental and climate impacts, and governance and can prevent premature death in the short and long term.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The author declares no conflict of interest. The work was conducted without specific funding.

References

- Aufhammer, et al., 2020. <http://www.g-freed.com/2020/03/covid-19-reduces-economic-activity.html>. (Accessed 21 March 2020).
- Baldasano, J.M., 2020 Jun 20. COVID-19 lockdown effects on air quality by NO₂ in the cities of Barcelona and Madrid (Spain). *Sci. Total Environ.* 741, 140353.
- Barbiroglio, E., 2020. <https://www.forbes.com/sites/emanuelbarbiroglio/2020/03/20/people-living-in-polluted-cities-are-at-higher-risk-from-covid-19/#6fe9e04a4b9921/03/2020>.
- Bliss and Capps, 2020. <https://www.citylab.com/life/2020/03/coronavirus-data-cities-rural-areas-pandemic-health-risks/607783/>. (Accessed 20 March 2020).
- Carrington, 2020. <https://www.theguardian.com/environment/2020/mar/27/coronavirus-uk-lockdown-big-drop-air-pollution>. (Accessed 27 March 2020).
- @contaminacio. <https://twitter.com/contaminacio>. (Accessed 14 March 2020).
- Costello, A., Abbas, M., Allen, A., et al., 2009. Managing the health effects of climate change: *lancet* and university college london institute for global health commission. *Lancet* 373, 1693–1733.
- Covid19Risk, 2020. <https://covid-19-risk.github.io/map/>. (Accessed 21 March 2020).
- Cui, Y., Zhang, Z., Froines, J., et al., 2003. Air pollution and case fatality of SARS in the People's Republic of China: an ecologic study. *Environ. Health* 2, 15. <https://doi.org/10.1186/1476-069X-2-15>.
- EC, 2020. https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf. (Accessed 27 March 2020).
- EPIWIN, 2020. WHO Information Network for Epidemics. Update #18. 20-03-2020.
- Ferguson, N.M., Laydon, D., Nedjati-Gilani, G., Imai, N., Ainslie, K., Baguelin, M., Bhatia, S., Boonyasiri, A., Cucunubá, Z., Cuomo-Dannenburg, G., Dighe, A., Dorigatti, I., Fu, H., Gaythorpe, K., Green, W., Hamlet, A., Hinsley, W., Okell, L.C., van Elsland, S., Thompson, H., Verity, R., Volz, E., Wang, H., Wang, Y., Walker, P.G.T., Walters, C., Winskill, P., Whittaker, C., Donnelly, C.A., Riley, Ghani AC., 2020. Impact of non-pharmaceutical interventions (NPIs) to reduce COVID19 mortality and healthcare demand. <https://www.imperial.ac.uk/media/imperial-college/medicine/sph/ide/gida-fellowships/Imperial-College-COVID19-NPI-modelling-16-03-2020.pdf>. (Accessed 14 March 2020).
- Fitbit, 2020. <https://blog.fitbit.com/covid-19-global-activity/>. (Accessed 26 March 2020).
- GBD, 2017. Risk Factor Collaborators. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet* 392 (10159), 1923–1994, 2018 Nov 10.
- Insurance journal. 2020 <https://www.insurancejournal.com/news/international/2020/03/12/560943.htm>. Accessed 13/03/2020.
- Lelieveld, J., Pozzer, A., Pöschl, U., Fnais, M., Haines, A., Münzel, T., 2020 Mar 3. Loss of life expectancy from air pollution compared to other risk factors: a worldwide perspective. *Cardiovasc. Res.* <https://doi.org/10.1093/cvr/cvaa025>.
- McMahon, 2020. <https://www.forbes.com/sites/jeffcmahon/2020/03/11/coronavirus-lockdown-may-save-more-lives-from-pollution-and-climate-than-from-virus/>.
- Mueller, N., Rojas-Rueda, D., Khreis, H., Cirach, M., Andrés, D., Ballester, J., Bartoll, X., Daher, C., Deluca, A., Echave, C., Milà, C., Márquez, S., Palou, J., Pérez, K., Tonne, C., Stevenson, M., Rueda, S., Nieuwenhuijsen, M., 2020. Changing the urban design of cities for health: the superblock model. *Environ. Int.* 134, 105132.
- Nieuwenhuijsen, M., 2020 Jul. Urban and transport pathways to carbon neutral, liveable and healthy cities. *Environ. Int.* 140, 105661.
- Nieuwenhuijsen, M.J., Khreis, H., 2016 Jun 5. Car free cities: pathway to healthy urban living. *Environ. Int.* 94, 251–262.
- Parmar, D., Stavropoulou, C., Ioannidis, J.P., 2016 Sep 6. Health outcomes during the 2008 financial crisis in Europe: systematic literature review. *BMJ* 354, i4588.
- Portes, 2020. <https://www.theguardian.com/commentisfree/2020/mar/25/there-is-no-trade-off-between-the-economy-and-health>. (Accessed 26 March 2020).
- Romei, V., Burn-Murdoch, J., 2020. <https://www.ft.com/content/d184fa0a-6904-11ea-800d-da70cffe4d3> Accessed 22/03/2020.
- Sisson, 2020. https://www.bloomberg.com/news/articles/2020-07-15/mayors-tout-the-15-minute-city-as-covid-recovery?cmpid=BBD071620_CITYLAB&utm_medium=email&utm_source=newsletter&utm_term=200716&utm_campaign=citylabdaily Accessed 20/07/2020.

Space, 2020. <https://www.space.com/italy-coronavirus-outbreak-response-reduces-emissions-satellite-images.html>. (Accessed 14 March 2020).

20Trends. <https://20trends.isglobal.org/> Accessed 14/03/2020.

Watts, J., Kommenda, N., 2020. <https://www.theguardian.com/environment/2020/mar/23/coronavirus-pandemic-leading-to-huge-drop-in-air-pollution>. (Accessed 23 March 2020).

WEF, 2020. <https://www.weforum.org/agenda/2020/03/chinas-pollution-coronavirus-lockdown-covid19-environment/>. (Accessed 14 March 2020).

WHO, 2020. https://en.wikipedia.org/wiki/List_of_countries_by_traffic-related_death_rate Accessed 14/03/2020.

Wyke, et al., 2020. https://docs.google.com/document/u/1/d/e/2PACX-1vR5AdOmF2effrg-lpBXtVh0stbxM0W6xTDwV2J-xlgHB8rPzI5bLVR5eL7VV2m_W9xx5PgH26TB0vq/pub. (Accessed 20 March 2020).

Zhang, Z., Xue, T., Jin, X., 2020 Jun 15. Effects of meteorological conditions and air pollution on COVID-19 transmission: evidence from 219 Chinese cities. *Sci. Total Environ.* 741, 140244.

Mark J. Nieuwenhuijsen^{a,b,c,d,*}

^a ISGlobal, Barcelona, Spain

^b Universitat Pompeu Fabra (UPF), Barcelona, Spain

^c CIBER Epidemiología y Salud Pública (CIBERESP), Madrid, Spain

^d Mary MacKillop Institute for Health Research, Melbourne, Australia

* ISGlobal, Dr. Aiguader 88, 08003, Barcelona, Spain.

E-mail address: mark.nieuwenhuijsen@isglobal.org.