

What is your proposal? (cut and paste from the submitted proposal, to remind us all.)

We aim to extend our study published in *The Lancet Planetary Health*, identifying global city typologies based on artificial intelligence. COVID-19 provides an unprecedented opportunity to identify which city designs (and associated activity patterns) have the greatest potential to reduce emissions. For 1667 cities, we will overlay data on air pollution, industrial activity and city mobility levels, as impacted by COVID-19 restrictions.

What were the approved deliverables for this support? (i.e. the last question from the submitted proposal.)

This support will fund the research efforts required for a pilot study on the impacts of urban design on air pollution outcomes, informed by data collected before and during the COVID-19 outbreak, globally. Results of this pilot study will be published as an article in the University of Melbourne's Pursuit online magazine. A further deliverable is the preparation and submission of a grant application (ARC Discovery project).

Have there been any significant changes to your proposed work and deliverables above? If yes, please specify briefly.

High-resolution (ground-based) pollution data is not available for all 1667 cities, so the work will concentrate on a subset of more than 700 cities. Further, country-based analysis led to similar results as using the city typology clusters, while requiring fewer assumptions. The work has been expanded to a full-length journal publication. We will not be pursuing a research grant from this research work.

What is the current status of your proposed work and delivery against these deliverables?

Ground-based pollution data (NO_2 , PM_{10} , $\text{PM}_{2.5}$, O_3), weather observations, COVID-19 restrictions and mobility patterns have been sourced for more than 700 global cities. Machine learning XGBoost models captured the local relationship between weather and air pollution, based on 2015-2019 data. This was used to predict city-specific pollution levels for 2020 in absence of a pandemic, and compared to actual pollution measurements in 2020. Residual pollution was linked to lockdown stringency measures and the mobility level of city residents to assess country-level impacts of the pandemic on air pollution. The paper has been submitted to the Elsevier journal *Atmospheric Pollution Research* (impact factor 4.4) and funding support by the Melbourne Energy Institute has been acknowledged in the paper. To maximise exposure, the highlights of the paper will be submitted as a Pursuit article once the paper is accepted for publication. Please refer to the attached submission for full details of the study (please do not share, as it is undergoing peer-review).

What is the expected completion date of your project?

The project has been completed.