MORTALITY ATTRIBUTABLE TO COVID-19 AND AIR POLLUTION. AN ITALIAN CASE STUDY

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Introduction. Several evidences suggest an association between the air pollution and COVID-19 mortality. However, other factors might impact on COVID-19 mortality. The aim of present work is to explore association between air pollution and COVID-19 mortality in Emilia-Romagna region one of the Italian Region strongly involved in the initial phase of COVID-19 pandemic, taking into account other exogenous factors.

Material and methods. An ecological study is used: the official open data are aggregated at the municipality level, for a total of 328 municipalities in the Emilia-Romagna region (https://www.istat.it/). The cumulative-period COVID-19 deaths were the outcome of interest. The deaths attributable to COVID-19 occurred in the pandemic period January 1 – August 31, 2020 were estimated as the excess of all deaths registered in the pandemic period with respect to the average number of all deaths in the same period of previous 5 years. As main predictor of COVID-19 mortality the particulate matter (PM) with diameter less than 10 μm was chosen. As proxy of air pollution at municipalities level, PM10 emissions in tons/year was used (https://dati.arpae.it/dataset/inventario-emissioni-aria-inemar). Several potential determinants of COVID-19 mortality or confounding for the association between PM10 exposure and mortality were also investigated: Degree of urbanization index (DEGURBA), Italian multiple deprivation index (IMD), Ecoregions index (https://www.isprambiente.gov.it/it/attivita/suolo-e-territorio/) and the amount of soil consumed. Geographic distribution of COVID-19 deaths, air pollution and predictors were plotted in maps to describe graphically the spatial distribution. After assigning zero to response variable for those municipalities with a no COVID-9 attributable deaths, negative binomial regression was applied.

Results. In the 328 municipalities of Emilia-Romagna, the estimated number of deaths attributable to COVID-19 during the first 8 months of 2020 was in median around 6 deaths (IQR: 15.3). Nevertheless, 5 municipalities showed a number of deaths attributable to COVID-19 over 75th, ranging from 160 to 540; for 75 municipalities no death attributable to COVID-19 was estimated. The median PM10 emissions was around 23 tons/year (IQR: 20.7): 15 municipalities showed a PM10 over 75th. The great majority of municipalities had a thin population (about 60%) and were prevalently rich or very rich: only 7% deprived. The predominant ecoregion was that of central Tuscan and Marche Apennines (about 48%). In median the percentage of soil consumed was 8.5%. The municipalities with the highest number of COVID-19 attributable deaths had a quite high level of PM10 emissions. These were all rich or very rich urban or semi-urban municipalities. Conversely, the municipalities with the lowest tons by year of PM10 emission showed lower COVID-19 attributable mortality. These areas were also characterized by increasing level of deprivation and were mainly rural. The effect of PM10 emission on the COVID-19 attributable deaths estimated in the study period was confirmed by multivariate analysis.

Conclusions. The main findings from this work seems to confirm the effect of PM10 on the COVID-19 mortality, in agreement with published evidences. But, given the limit of the ecological study our results may not be conclusive. The latter should be integrated with further studies that analyse the single individual.