

# AIR QUALITY DURING SARS-COV-2 EPIDEMIC LOCKDOWN: PM<sub>2.5</sub>, PM<sub>10</sub> AND NO<sub>2</sub> ASSESSMENT IN CITIES OF SPAIN AND ITALY

<sup>1</sup>Patricia Aguilera Benito, <sup>2</sup>Carolina Piña Ramírez, <sup>3</sup>Sheila Varela Lujan, <sup>4</sup>Ester Lepore

<sup>1</sup> Polytechnic University of Madrid, Higher Technical School of Building, Department of Building Technology, Spain

<sup>2</sup> Polytechnic University of Madrid, Higher Technical School of Building, Department of Architectural Construction and its Control, Spain

<sup>3</sup> PhD Polytechnic University of Madrid, Higher Technical School of Building

<sup>4</sup> University of Salerno, via Giovanni Paolo II, 132, 84084 Fisciano, Italy



## 1. INTRODUCTION

The first infections have been registered in Europe at the end of January. Since the first 100 infections appear, it is counted as day zero, which corresponds to February 27 in Italy and March 5 in Spain [1]. The COVID-19 Pandemic has forced the largest quarantine or self-isolation in human history and led global lockdown [2]. With this closure, transportation was restricted both by train, plane and vehicles, it also caused the temporary closure of industries and other primary and secondary services of economic activities. These activities are directly proportional to air pollution.

Then, a hypothesis is made about what can affect our quality of life, considering air pollution in the city. According to some studies, it has been recognized that air pollution can act as a vector of the coronavirus favoring the spread of the virus through the air which both are risk factors associated with the development of the disease in elderly people or people with lung diseases.

The exposition to air pollutants such as the ozone (O<sub>3</sub>), the nitrogen dioxide (NO<sub>2</sub>) or carbon monoxide (CO) may be responsible for the alteration of host resistance to viral and bacterial infections [3]. According to current data, the Autonomous Communities in Spain with the highest presence of COVID-19 infections, updated to October 20, 2020, are: Madrid (283,130), Cataluña (179,552) and Andalucía (96,224) [4]; while in Italy, considering the update to October 21, 2020, the most affected regions are: Lombardy (134,604), Piemonte (48,118) and Emilia-Romagna (42,588) [5].

## 2. METHODOLOGY

With the help of the World Air Quality Index (WAQI) [6] it has been possible to obtain the historical information of the air quality data during the quarantine and afterwards [7], and to calculate the trend of the quantities of NO<sub>2</sub>, fine particles PM<sub>2.5</sub> and PM<sub>10</sub>, that are mostly present in the polluted capitals most affected by COVID-19 in Spain and Italy.

## 3. RESULTS

It is confirmed that in these months of confinement an optimal mean NO<sub>2</sub> concentration of less than 26.5 µg/m<sup>3</sup> has been registered in all the chosen cities, and for the particles of PM<sub>2.5</sub> it has reached less than 14 µg/m<sup>3</sup>. Regarding 10 µg/m<sup>3</sup> per year, and regarding PM<sub>10</sub>, the highest concentration is found in Turin, with 22.02 µg/m<sup>3</sup> compared to the maximum level of 20 µg/m<sup>3</sup>.

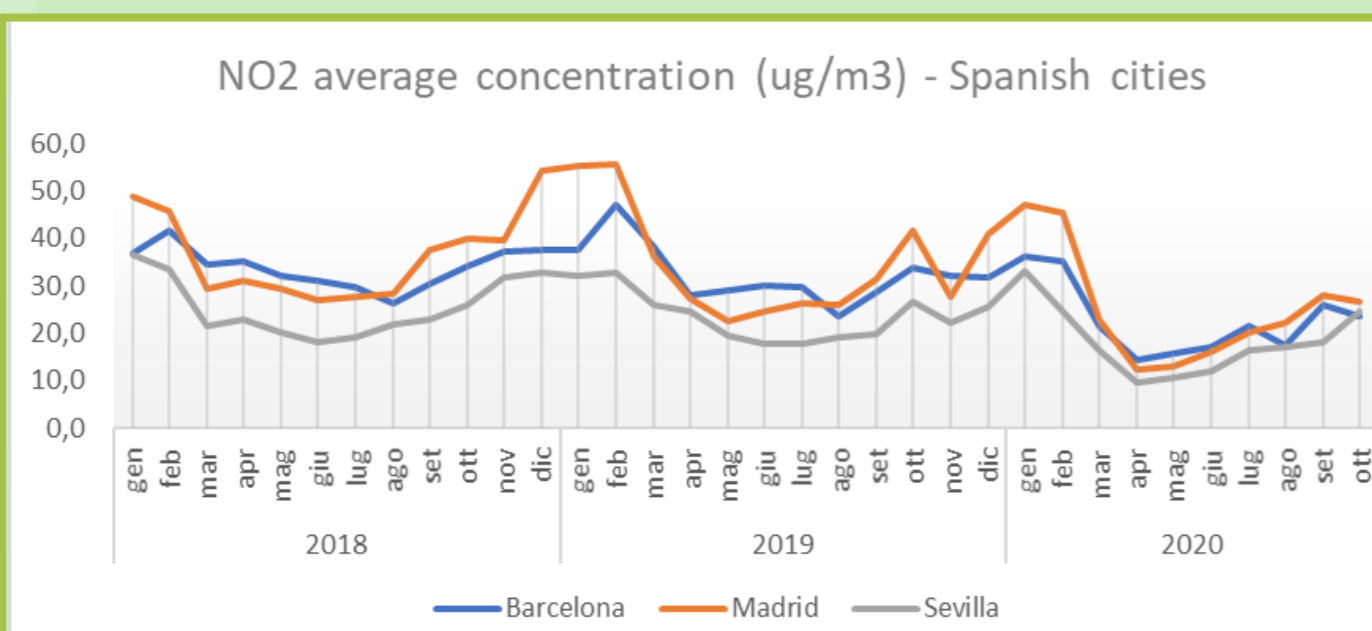


Figure 1. NO<sub>2</sub> average concentration (ug/m<sup>3</sup>) Spanish cities.

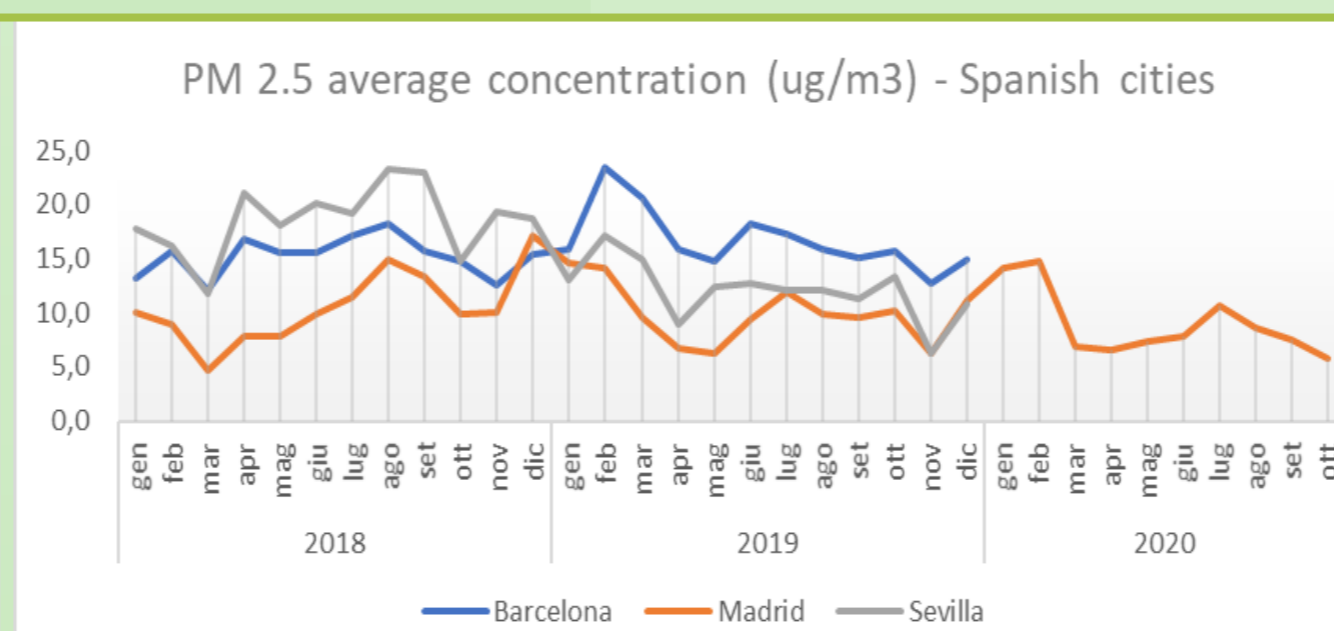


Figure 2. PM<sub>2.5</sub> average concentration (ug/m<sup>3</sup>) Spanish cities.

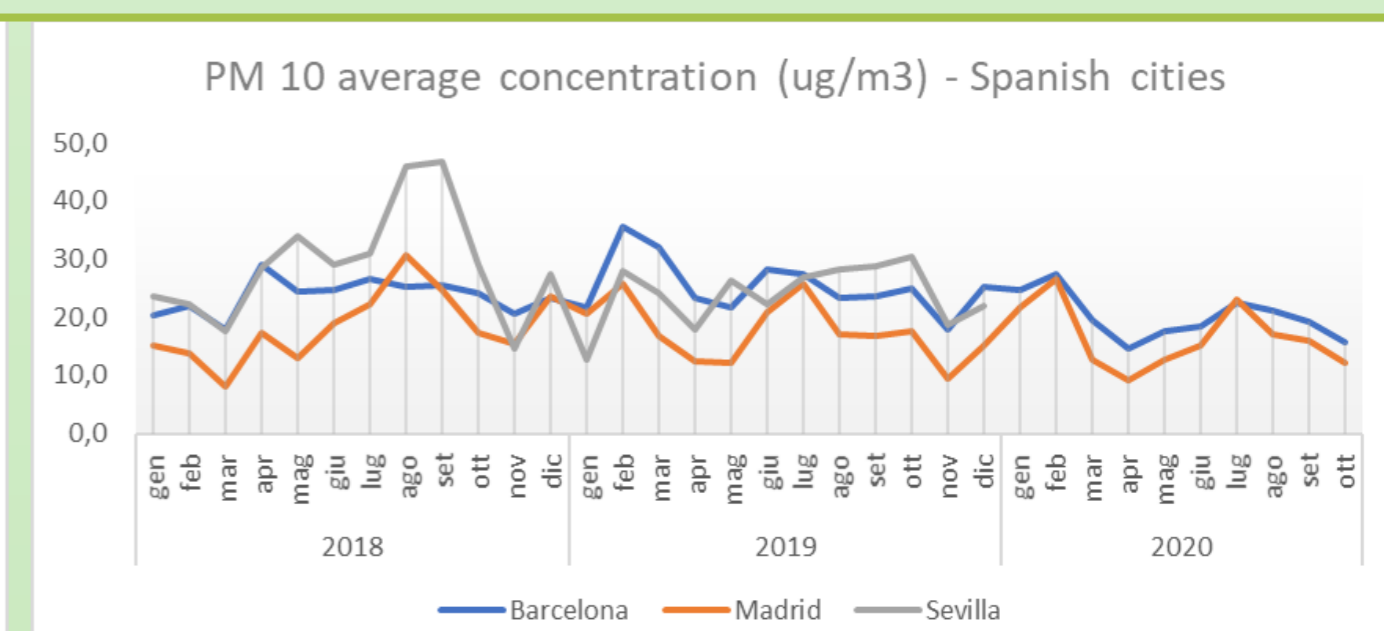


Figure 3. PM<sub>10</sub> average concentration (ug/m<sup>3</sup>) Spanish cities.

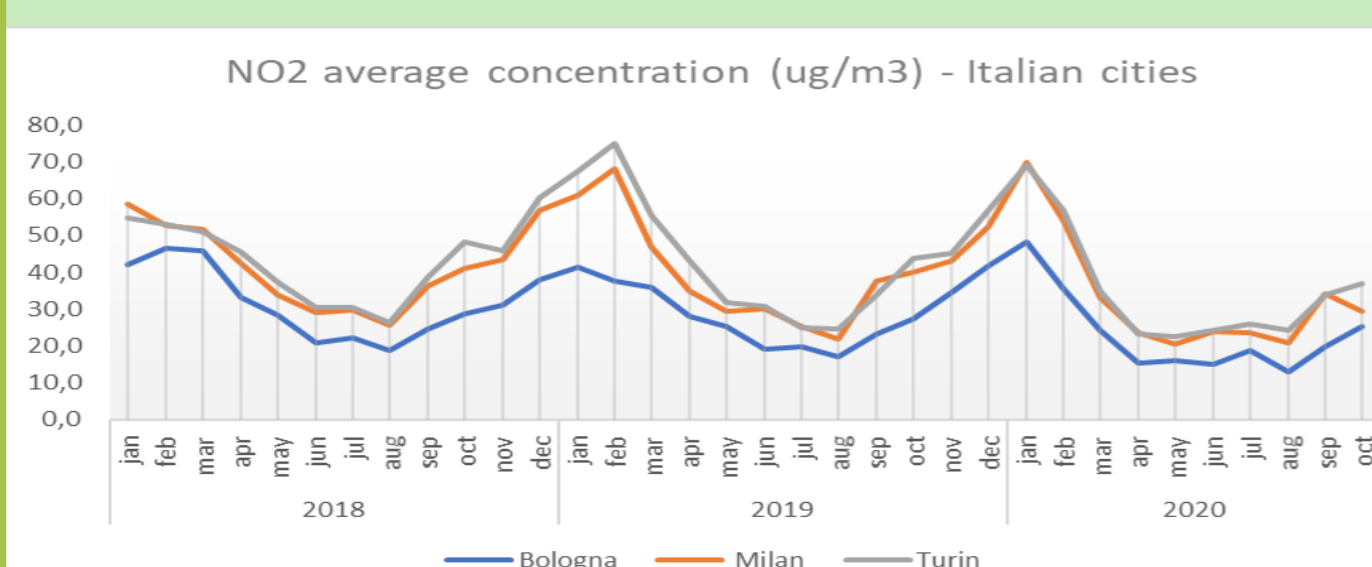


Figure 4. NO<sub>2</sub> average concentration (ug/m<sup>3</sup>) Italian cities.

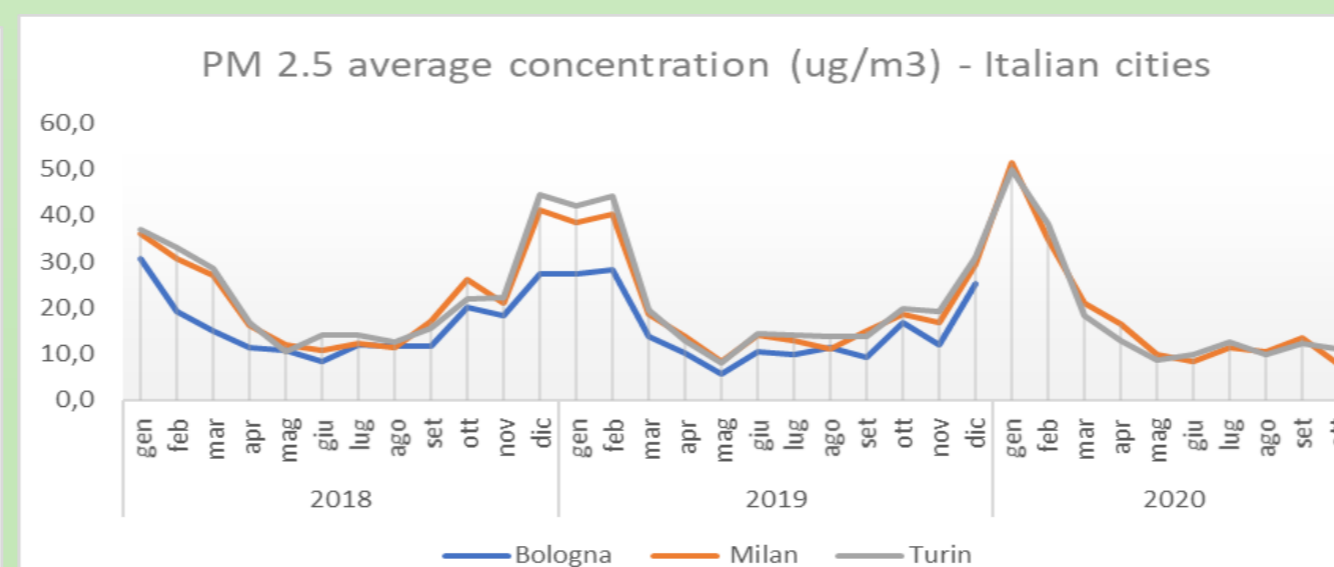


Figure 5. PM<sub>2.5</sub> average concentration (ug/m<sup>3</sup>) Italian cities.

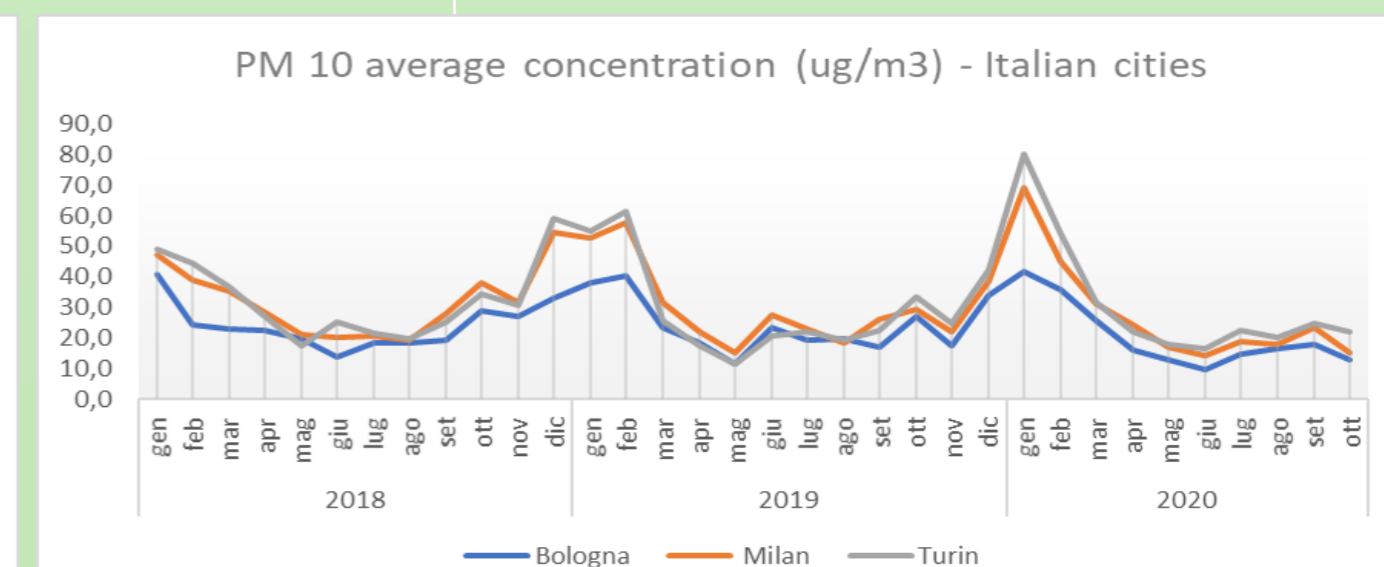


Figure 6. PM<sub>10</sub> average concentration (ug/m<sup>3</sup>) Italian cities.

## 4. CONCLUSIONS

Despite reductions caused by control measures taken against the spread of the virus, current levels of air pollution remain dangerous in much of the world likely contributing to the number of severe cases and deaths caused by COVID-19. The amount of NO<sub>2</sub> in Milan has dropped during the lockdown period, from a NO<sub>2</sub> (µmol/m<sup>2</sup>) level of 245 registered before February 24 to a level of 98 registered on March 22, 2020 falling from 60% NO<sub>2</sub> level, while on Madrid studies has confirmed that a 62% reduction in the amount of NO<sub>2</sub> contained in the air has also been recorded during the lockdown.

### References:

- [1] D. H. Glass, "Mathematical Biosciences European and US lockdowns and second waves during the COVID-19 pandemic," *Math. Biosci.*, vol. 330, no. September, p. 108472, 2020, doi: 10.1016/j.mbs.2020.108472.
- [2] Q. Li et al., "Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia," *N. Engl. J. Med.*, vol. 382, no. 13, pp. 1199–1207, 2020, doi: 10.1056/NEJMoa2001316.
- [3] M. A. Zoran, R. S. Savastru, D. M. Savastru, and M. N. Tautan, "Assessing the relationship between ground levels of ozone (O<sub>3</sub>) and nitrogen dioxide (NO<sub>2</sub>) with coronavirus (COVID-19) in Milan, Italy," *Sci. Total Environ.*, vol. 740, Oct. 2020, doi: 10.1016/j.scitotenv.2020.140005.
- [4] S. General and D. E. S. Y. Consumo, "Centro de Coordinación de Alertas y Emergencias Sanitarias," *Minist. Sanid. - Gob. España*, pp. 1–2, 2020, : [https://www.mscbs.gob.es/profesionales/saludPublica/ccayes/alertasActual/nCov/documentos/Actualizacion\\_223\\_COVID-19.pdf](https://www.mscbs.gob.es/profesionales/saludPublica/ccayes/alertasActual/nCov/documentos/Actualizacion_223_COVID-19.pdf).
- [5] "Dati aggregati quotidiani Regioni / PPAA - Ministero della Salute - Istituto Superiore di Sanità," p. 2020, 2020.
- [6] European Environment Agency, "Air quality and COVID-19." <https://www.eea.europa.eu/themes/air/air-quality-and-covid19>.
- [7] D. Rodríguez-Urrego and L. Rodríguez-Urrego, "Air quality during the COVID-19: PM<sub>2.5</sub> analysis in the 50 most polluted capital cities in the world," *Environ. Pollut.*, vol. 266, p. 115042, 2020, doi: 10.1016/j.envpol.2020.115042.