Brief Report

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Less air pollution did not explain the decline in admissions for AMI during the first wave of COVID-19 pandemic in Sardinia, Italy

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Abstract

During the COVID-19 pandemic, hospitalizations for acute myocardial infarction (AMI) decreased worldwide. We compared the admissions for AMI in the four regional 24/7 cath lab during the national lockdown, the 8 weeks before the lockdown, the 8 weeks after the e lockdown, and the corresponding time period in 2019 and we analyzed the average level of pollution in the studies areas. A marked decline in AMI admissions was observed during the lockdown period in comparison with the 8 weeks before the lockdown ($p < 0.0001$) and a significant increase in the 8 weeks after the lockdown ($p < 0.00001$). No significant change in air pollutants density were highlighted. Since air pollution did not change substantially in our region, the environment factor cannot explain the decline in the number of admissions for AMI we recorded during the lockdown. Fear of contagion is the most plausible reason for the drop of hospitalizations during the lockdown period.

Keywords

Acute myocardial infarction, air pollution, COVID-19 pandemic, lockdown, acute cardiovascular events

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While public health interventions focused on countering the spread of coronavirus disease 2019 (COVID-19) pandemic, several reports from all over the world described parallel decreases in hospital admissions for acute myocardial infarction (AMI) during the first lockdown period.[1–4] The precise mechanism for the sudden reduction in AMI admissions is not clear but many plausible theories can be advanced. Among them, as the restriction measures to contain COVID-19 pandemic have resulted in improvement in air quality worldwide, the abatement of air pollution with the reduction of road traffic and industrial emissions may be a possible explanation. There is a wealth of evidence indicating that air pollution exposure is associated with adverse health effects. In particular, short-term exposure to particulate and gaseous pollutants is known to elicit acute cardiovascular events, including myocardial infarction.[5–8]

Therefore, to test the hypothesis that the sudden drop in air pollutant emissions following the mobility restrictions may have contributed to reduce the incidence of AMI during

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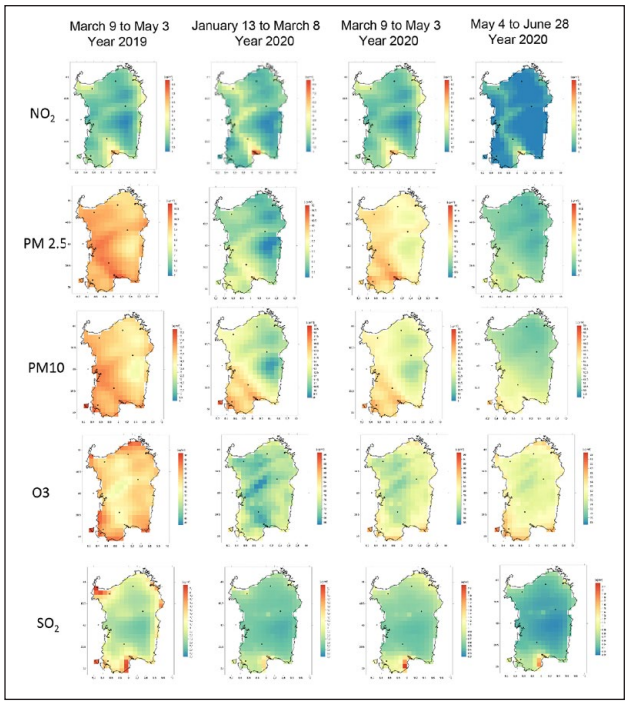

Figure 1. The figure shows the maps of the average level of pollution in the study area (NO2, PM2.5, PM10, O3, SO2) from the "Atmosphere Monitoring Service" of the "Copernicus" program of the "European Space Agencies during four different observation periods.

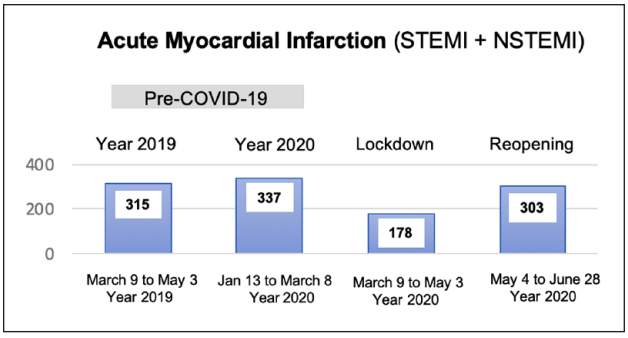

Figure 2. The graph shows the rate of AMI admissions during the the 8 weeks before the start of the lockdown, during the lockdown, during the corresponding periods of the 2019 and in the early phase of reopening.

the first lockdown period, we analyzed the trend of hospitalizations for AMI in Sardinia, Italy, as well as the state of air pollution in the 8 weeks before the start of the first national lockdown (from January 13 to March 8, 2020), during the lockdown (from March 9 to May 3, 2020), in the corresponding period of the year 2019 (from March 9 to May 3, 2019), and during the reopening phase starting May 4, 2020 to June, 28, 2020. AMI data were collected from the four regional 24/7 cath lab, while the dataset used to obtain an estimate of the average level of pollution in the study area (NO_2, $PM_{2.5}$, PM_{10}, O_3, SO_2) comes from the "Atmosphere Monitoring Service" of the "Copernicus" program of the "European Space Agencies." This service provides the analysis of the air quality of the European territory through the processing of information from the sensors of the satellites of the Sentinel constellation. The data, for each pollutant, are organized in pixels that describe the image of the Sardinian territory. The images are available every hour for each time interval of interest. The data of each pixel referring to the time periods of interest have been averaged over time and they shows the pollutant distribution maps in the regional territory (Figure 1). To obtain an overall indicator of the pollution level of each pollutant, the values of the different pixels of the image have been averaged in space and are shown in the table for the different time intervals of interest. Overall, each image is made up of 26 rows and 21 columns for a total of 546 pixels of which 252 fall on land and 294 on the sea. The size of each pixel is equal to one tenth of a degree of latitude and longitude (about 11 km).

There was no significant difference between the AMI admissions observed during the pre lockdown period (n=337) and those of the corresponding period of the previous year (n=315, p=0.41). Similarly to previous reports from Italy and other countries,[1–4] we observed a marked decline in AMI admissions during the lockdown period in comparison with the 8 weeks before the start of the lockdown (number of hospitalizations 337 vs 178, percentage reduction 47.2%, $p<0.00001$). This drop in number was followed by a substantial increase in the next 8 weeks of community reopening (number of hospitalizations 178 vs 303, percentage increase 41.2%, $p<0.00001$, Figure 2). Importantly, the decline in AMI admissions occurred despite the relative change in air pollutants density during the time of lockdown was insignificant, as it was found within a range of very low baseline values (NO_2

Table 1. Descriptive analysis of the concentration of air pollutants in the time periods of interest.

Air pollutant	2019 corresponding lockdown	2020 pre-lockdown	2020 lockdown	2020 post lockdown
NO_2 (μg/m^3)	2.471 ± 0.89	2.43 ± 0.9S	2.25 ± 0.89	1.25 ± 0.57
$PM_{2.5}$ (μg/m^3)	10.04 ± 0.52	6.56 ± 0.79	8.90 ± 0.66	6.28 ± 0.53
PM_{10} (μg/m^3)	15.6 ± 1.00	13.07 ± 0.81	13.73 ± 0.21	11.9 ± 1.19
O_3 (μg/m^3)	85.67 ± 3.15	72.90 ± 3.14	77.24 ± 3.4	79.62 ± 3.12
SO_2 (μg/m^3)	0.93 ± 0.34	0.57 ± 0.17	0.69 ± 0.23	0.46 ± 0.21

2.43±0.95 pre-lockdown and 2.25±0.89μmol/m^3, lockdown, p=0.86; $PM_{2.5}$ 6.56±0.79 pre-lockdown and 8.9±0.66μmol/m^3, lockdown, p=0.084); PM_{10} 13.07±1.81 pre-lockdown and 13.7±0.21μmol/m^3, lockdown, p=0.67; O_3 72.9±3.14 pre-lockdown and 77.24±3.4μmol/m^3, lockdown, p=0.31; SO_2 0.57±0.17 pre-lockdown and 0.69±0.23μmol/m^3, lockdown, p=0.81) (Table 1). Since the low levels of air pollution remained consistently unchanged in our region, the environment factor cannot explain the decline in the number of admissions for AMI we recorded during the lockdown period. This observation supports the notion that different factors may have contributed to this worldwide phenomenon, including the benefit of forced stay at home with less physical stress and decreased workload, other than less air pollution. As Sardinia was one of the Italian regions with a minor number of infected individuals during the first wave of COVID-19 pandemic (total infected cases 1.319 as at May 3, 2020, end of lockdown) and both emergency medical system and hospitals were not overwhelmed with COVID-19 patients in comparison with other hardest hit regions, fear of contagion remains the most likely reason for the drop of hospitalizations for AMI during the first lockdown period.

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