

Letter

Air Pollution and Susceptibility to SARS-CoV-2 Infection: Evidence of Higher Incidence of Cases Due to Brazilian Variant of SARS-CoV-2 Associated to Long-term Exposure to PM2.5

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LETTER TO EDITOR

Air pollution has been considered as a factor to spread infections with SARS-CoV-2. It has been suggested that Particulate Matters (PM) may act as aerosol carrying the virus and spreading the ratio of contagions [1]. Other authors have suggested that long term exposure to air pollutants may sensitize individuals to be infectedmore easily with SARS-CoV-2 [2,3]. A recent study in Arequipa, Peru have demonstrated that an exposure with PM-10 of 15 daysprevious is enough for infection with SARS-CoV-2 [4]. Vasquez- Apéstegui, et al. [3] found that long term exposure with PM_{2.5} increase the rates of infections with SARS-CoV-2 in Lima, Peru.

Lima and Arequipa have the highest number of cases per million inhabitants in Peru. Arequipa is located at 2335 meters, and some authors refers that altitude protects against infection with SARS-CoV-2 [5], although this has been denied by other authors [6]. Lima is the biggest city with air pollution problems in Latin America [7,8].

In the urban area of the city of Arequipa, Peru, a recent study recorded values of PM2.5 ($72 \pm 23 \ \mu g \ m^{-3}$) and PM10 ($116 \pm 41 \ \mu g \ m^{-3}$) above the maximum limits established in the country (8). Wannaz, et al [4] observed a positive correlation between PM10 concentration and the number of people infected with COVID-19, with a delay of 15 days. Exposure to PM_{2.5} during these 15 days before infection were not related with infections with SARS-CoV-2. However, long-term exposure to PM_{2.5} was associated with higher rates of infections with SARS-CoV-2 in Lima. Results were observed after adjusting for age, sex, and number of food markets. These authors suggested that reduction of air pollution since a long-term perspective, and social distancing are needed to prevent spreads of virus outbreak [3].

The evolution of the SARS-CoV-2 new variants reported to be 70% more contagious than the earlier one is now spreading fast worldwide. The South African (K417N-E484K-N501Y), Brazilian (K417T-E484K-N501Y) variants are more lethal than the UK variant (N501Y) [9]. In Lima, Peru, the Brazilian Variant has been reported in the 40% of the cases of SARS-CoV-2 detected in March

2021 (Public Report of the Peruvian National Institute of Health). We have assessed the percent of cases with the Brazilian variant in Lima by zones and correlated with the concentration of the $PM_{2.5}$ in the years 2010-2016. The east zone with highest amount of $PM_{2.5}$ has the highest percentage of infections with SARS-CoV-2 due to the Brazilian variant, whereas the zone of Lima center with the lowest amount of $PM_{2.5}$ also showed the lowest percentage of cases of SARS-CoV-2 due to the Brazilian variant. The regression analysis for these data showed an R2=0.997, with a quadratic equation $Y=0.01X^2-0.36X+22.58$.

This is an important finding to be considered based in the high contagious of the. Brazilian variant. Efforts should be done to reduce $PM_{2.5}$ concentrations in these zones with highest levels of $PM_{2.5}$. The highest levels of $PM_{2.5}$ in the east zone of Lima could be due to the high vehicle density.

An association between vehicle density and $PM_{2.5}$, PM_{10} , and CO have been observed and these high values could be reduced during a traffic control period. It has been estimated that, $PM_{2.5}$ emissions from every doubling of vehicle density can lead to over 8000 excess deaths per year, 66% of which were caused by cardiopulmonary diseases [10].

Further studies are needed to confirm the association between air pollution and susceptibility to SARS-CoV-2 just when different variants are circulating worldwide.

In conclusion, we have observed that SARS-CoV-2 infections are higher in places in which long-term exposure $PM_{2.5}$ is high. This seems to increase more easily the contagions with new variants of SARS-CoV-2 as the Brazilian variant.

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