Practical implications of the SIMA studies on COVID-19 containment for the attention of the OSCE Parliamentary Assembly

17 November 2020

This document outlines the recent scientific findings of the Italian Society of Environmental Medicine (SIMA) on the correlation between the high concentration of atmospheric particulate matter and SARS-CoV-2 virus transmission, presented to the Bureau of the OSCE PA General Committee on Economic Affairs, Science, Technology and Environment during an Informative Briefing on 23 October 2020. As such, the OSCE PA makes no claims nor warranties of any kind, expressed or implied, about the completeness and reliability of the data presented.

KEY FINDINGS

- **Particulate matter (e.g. PM2.5 and PM10) serve as "carriers" for several chemical and biological pollutants, including viruses,** allowing long-term survival of viruses in the atmosphere for hours or even days. Thus, like many other micro-organisms and viruses, **the new coronavirus Sars-Cov-2 can also spread through the air over large distances** (the so-called airborne route transmission[1]).

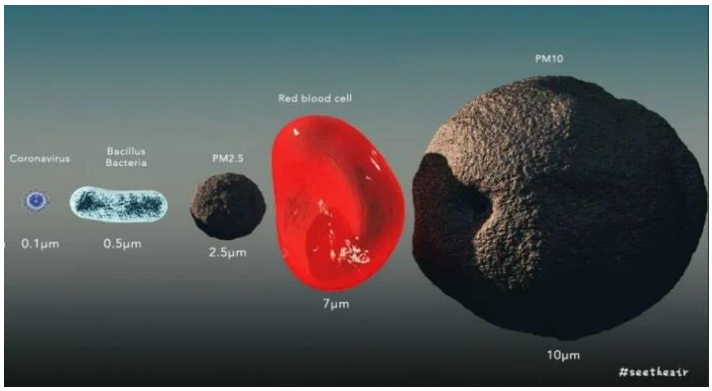

Figure 1. How Big Are Coronavirus Particles? Smart Air Filters, 4 February 2020, *https://smartairfilters.com/en/blog/can-masks-capture-coronavirus/*.

- **SIMA's innovative research** on the correlation between SARS-COV-2 virus transmission and the concentration of atmospheric particulate matter **suggests that PM should be regarded as a contributing factor to COVID-19 infections,** both in terms of airborne diffusion and health outcomes. A **positive correlation between exposure to significant levels of air pollution and higher fatality rates** has been signalled by various scientific efforts around the globe[2].
- As COVID-19 related deaths and the further spread of the coronavirus have been found to be associated with excess PM10 and PM2.5, **the abundance of particulate matter in the air represents a significant predictor of COVID-19 infection** - which reveals how the virus spreads more quickly in polluted areas, even when accounting for population density and the average number of daily travellers and tourists.

[1] At the end of September 2020, the Centre for Disease Control in the USA have recognized the "*Airborne Route*" as another way of COVID-19 spreading in addition to direct interpersonal contagion.

[2] For instance, a recent nationwide study from Harvard T.H. Chan School of Public Health found that 1 unit increase in long-term average exposure to PM2.5 is associated with an 8% increase in the COVID-19 mortality rate in the USA. Moreover, an international research effort which included the Max Planck Institute for Chemistry in Mainz found that 15% of worldwide COVID-19 deaths can be traced back to long-term exposure to PM2.5

- In particular, **super-spread (or "high-way") effects** are observable when, under stable weather conditions, the PM10 exceedances are repeated over time with frequencies beyond three consecutive days.[3] This is a typical condition in many European cities where the temperature is around 5-10 degrees, the relative humidity is over 80% and the presence of emissions is high due to fossil or biomass combustion caused by vehicular traffic or domestic heating. In such conditions, **the virus may cover distances up to 10 meters from the emission source**. Notably, while one person can normally infect two individuals, in this "super-spread scenario," one person may infect up to five individuals.

- **Sars-Cov-2 can also rapidly diffuse in any indoor environment** in the presence of one or more infected people, but there are different technologies that can be useful in reducing the risk of virus diffusion in indoor environments (e.g. schools, offices, and restaurants) to near zero. For instance, air conditioning systems play a decisive role in controlling the dispersion of droplets and aerosols produced by breathing in closed environments. Notably, **doubling the air conditioning flow rate inside a closed room reduces the concentration of contaminated particles by 99.6%.**

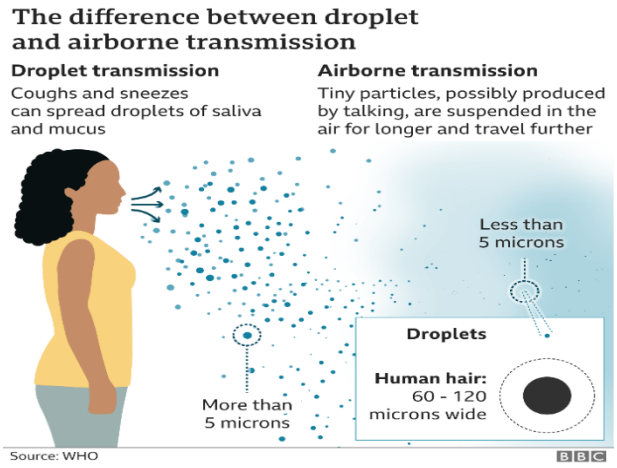

Figure 2. The difference between droplet and airborne transmission. BBC News, 8 July 2020, https://www.bbc.com/news/world-53329946.

- **Air exchange is fundamental in the dilution of the virus** and its transfer to the outside. The reduction of airborne biological pollutants present in the droplets significantly decreases the concentration of the pathogen in the air. This, together with the today's use of barrier means (wearing face masks, social distancing and hand washing), represents the main tool in reducing the risk of contagion in closed environments.

KEY RECOMMENDATIONS

- In order to **prevent the "super-spreading" effect induced by heavy air pollution** during the next European winter (when climatic conditions, humidity and temperature will be ideal for viral spreading), it is critical to reduce the levels of particulate matter by:
  - In the short-term: Temporarily halting all vehicular traffic and reducing heating combustion in cities experiencing more than two consecutive days of PM exceedances during a COVID-19 emergency context.
  - In the mid-term: Reducing the use of fossil fuels and biomass combustion while favouring the transition to renewable energy sources.
- To **avoid the detrimental impact of "super-spread" events** in the presence of prolonged PM exceedances, it is critical to:
  - Increase the interpersonal safety distance beyond two meters.
  - Close all windows and doors to avoid high concentrations of PM indoors.
  - Make the use of FFP2 face masks compulsory, both indoors and outdoors.
- **Monitoring the presence of Sars-COV-2 RNA on particulate matter**, both indoors and outdoors, should be used **as an early indicator of COVID-19** local epidemic recurrences[4].

[3] Super-spread events are generally observed also for the seasonal flu, resulting in high healthcare-related costs each year.
[4] In this context, SIMA has a specific project proposal which can be presented to interested OSCE PA delegations.

- **The use of air purification, or mechanical ventilation, should be actively implemented** to enhance safety in any indoor environment.
- **The interpersonal safety distance should be increased to at least two metres** to better protect citizens' health amid the coronavirus pandemic. In parallel, it is critical to **require all citizens to use face masks in every public place.**

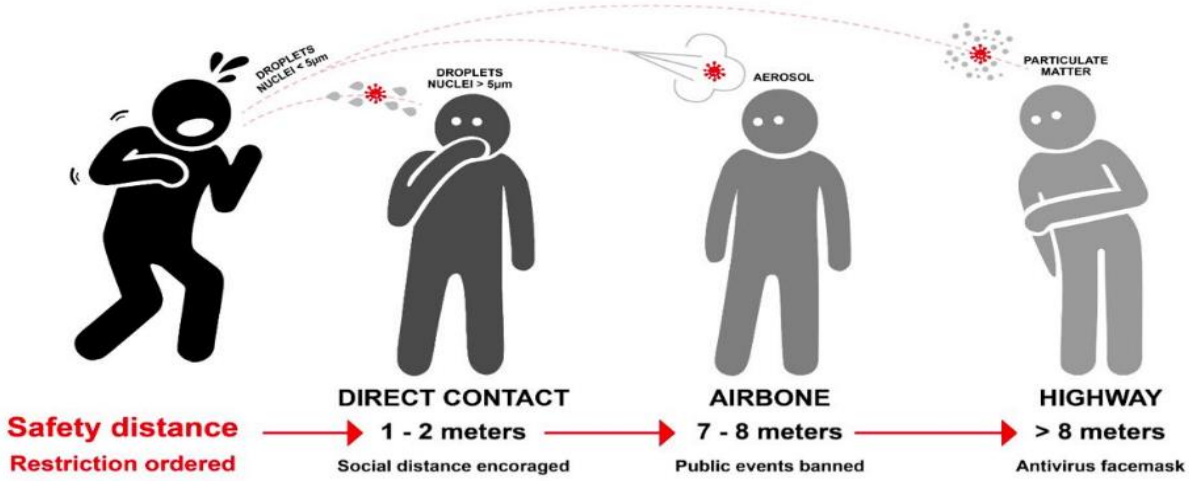

Figure 3 . SIMA's scheme of possible enhancement of viral transmission through stabilized human exhalation on PM.

- **The capacity of healthcare systems should be immediately boosted** by re-opening closed hospitals and making use of military infrastructures to efficiently manage the expected surge in COVID-19-related admissions. Simultaneously, **outpatient medical services** (those that can isolate and closely follow patients and direct contacts at home) **must be urgently reinforced**.

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