# Coronavirus disease - 2019: A lesson from history

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**Abstract**

Viral infections have become an increasingly worsening, SARS-Cov-2 is the third coronavirus that emerged during the past twenty years. The contagion can also occur by inhalation of aerosolized viruses, capable of floating in the air for long times (in closed spaces) and traveling unknown distances. A lesson from history shows that exclusive infectious disease hospitals with multiple building are still a modern architectural choice. Individual spaces are needed and this is an important way to reduce the viral load. Nowadays, the restrictions should involve not only the interpersonal relationships but also environmental measures.

**Key-words:** SARS-Cov-2, coronavirus, environmental, COVID-19, transmission.

In the last century, viral infections have become an increasingly worsening threat: from 1918 to 1920 the so-called “Spanish influenza” caused by H1N1 infected 500 million people, tens of millions died (3 to 5% of the entire world population); in 1957-1960, the “Asian” flu (H2N2) provoked 2 million deaths; in 1968, the Hong Kong influenza (H3N2) caused 20,000 deaths in Italy.

Severe Acute Respiratory Syndrome - Coronavirus – 2 (SARS-CoV-2), a.k.a. COronaVIrus Disease-2019 (COVID-19), is the third coronavirus that emerged during the past twenty years, after SARS-CoV in 2002 and Middle East Respiratory Syndrome (MERS-CoV) in 2012; perhaps a neglected viral emergency that will occur again.

In 1893, after a serious smallpox outbreak in Milan (Italy), a new hospital was built in the open countryside to host and cure patients affected by serious contagious diseases, beyond the outskirts of the city. Six large buildings were constructed, isolated from each other and self-sufficient. Each pavillon was dedicated to a single disease: smallpox, measles, diphtheria, scarlet fever and typhoid fever; the last one was reserved for patients with unknown diseases. Every edifice was separated from the others by surrounding walls and fences and included various services: the disinfection plant with chimneys connected to the incineration ovens, the dryers, the tanks for chemical disinfection and for steam sterilization. (Figure 1) This efficient infectious diseases’ infirmary worked for almost a century, recording only 4% of death (6/150 thousand hospitalized patients), then it was closed at the end of the 20th century. Despite the increasing threat from super-resistant bacteria and new virus infections, these specialized hospitals are currently lacking, leaving us unprepared with COVID-19.

We suppose that this multiple building structure for an infectious disease hospital and the selection of an off-side location is still the best choice nowadays. It should be equipped with intensive and sub-intensive care units based on single rooms instead of large common spaces. Current technology for assisted ventilation with efficient sterilization and filtering consents the design of individual spaces in respect of the human dignity with the non-secondary benefit of possible close proximity of a family member in these most dramatic moments.

Viruses are gene drifts that maintain their ability to infect for long periods if not disturbed by physical and chemical agents. The contribution of airborne spread of the COVID-19 infection is likely greater than what is currently recognized.[1]

Looking at the "Surveillance Pyramid and its relationship with the recently proposed epidemic containment"[2] (see box in Figure 1), we can assume that individual restrictions are only partially effective, and that the coexistence with COVID-19 will be long-lasting.

Coronaviruses have round morphology, 0.1 – 0.5μm in size; among the airborne particles, they represent a subset of the PM2.5, with an aerodynamic diameter ≤ 2.5 μm, dispersible in the environment.

Granulometric studies showed that the size of particles in the respirable range reaching the pulmonary alveoli have a median mass aerodynamic diameter between 1 and 5 μm.[3] Therefore, in addition to direct transmission (face to face, by droplets) and the indirect spread through contaminated objects, the COVID-19 contagion can also occur by inhalation of aerosolized viruses~~,~~ capable of floating in the air for long times (in closed spaces) and traveling unknown distances. Furthermore, we do not know if the negatively charged carbon particles from environmental pollution in our highly industrialized region play a role by carrying the positively charged viruses. The same applies to pollens, whose presence in Lombardy (Italy) during spring season is extremely significant, in particular the Betulaceae/Corilaceae.

The restrictions on crowding remain absolutely valid, although they should involve not only the interpersonal relationships but also environmental measures.[4] With a warning, however, well highlighted in a recent article: "*Quarantines and travel bans are often the first response against new infectious diseases. However, these old tools are usually of limited utility for highly transmissible diseases, and if imposed with too heavy a hand, or in too hap-hazard a manner, they can be counterproductive. With a virus such as SARS-CoV-2, they cannot provide a sufficient response*".[5]

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## FIGURE LEGEND

**Figure 1.** Infectious disease specialized hospital (Derganino Hospital, Milan) with six large buildings at the early ‘900 and the “Surveillance Pyramid” of the viral spread.

## Authors' contribution

FDB wrote the article; OVB reviewed it and gave some hint for discussion; DZ wrote and reviewed the final version. All authors read and approved the final version of the manuscript.