

## Abstract

# Measurements of SARS-CoV-2 RNA Concentrations in Indoor and Outdoor Air in Italy: Implications for the Role of Airborne Transmission <sup>†</sup>

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- <sup>†</sup> Presented at the 4th International Electronic Conference on Atmospheric Sciences, 16–31 July 2021; Available online: <https://ecas2021.sciforum.net/>



**Citation:** Chirizzi, D.; Conte, M.; Feltracco, M.; Trabucco, S.; Dinoi, A.; Gregoris, E.; Barbaro, E.; La Bella, G.; Ciccarese, G.; Belosi, F.; et al. Measurements of SARS-CoV-2 RNA Concentrations in Indoor and Outdoor Air in Italy: Implications for the Role of Airborne Transmission. *Environ. Sci. Proc.* **2021**, *8*, 29. <https://doi.org/10.3390/ecas2021-10330>

Academic Editor: Anthony R. Lupo

Published: 22 June 2021

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**Abstract:** The work deals with identification/quantification of genetic material (RNA) of SARS-CoV-2 in air in different locations in Italy. This is an extremely important aspect to investigate the risks of airborne transmission and the role of this mechanism of transmission on the development of pandemic.

**Keywords:** SARS-CoV-2; COVID-19; airborne transmission; coronavirus; indoors

Since the beginning of the COVID-19 pandemic, there have been scientific questions regarding the role of the airborne transmission of SARS-CoV-2 and its influence on the spread of COVID-19 [1–4]. One of the key parameters to ascertain the risks of airborne transmission is the concentrations of SARS-CoV-2 genetic material (RNA) in the air in different environments. This work investigates this aspect in both outdoor and indoor environments in different towns of Italy during the first and the second wave of the pandemic.

Outdoor samples were collected using both PM<sub>10</sub> low-volume (2.3 m<sup>3</sup>/h) samplers for 48 h in parallel in Venice (Veneto region, north-east of Italy) and Lecce (Puglia region, south-east of Italy) during the first wave of the pandemic. In addition, two samples for each site were collected using MOUDI multistage impactors (1.8 m<sup>3</sup>/h for six days of sampling) that were able to separate 12 size ranges of particles.

During the second wave of the pandemic in Italy (November–December 2020), air samples were collected in the following different community indoor environments: one train station and two food markets in the metropolitan city of Venice (Veneto Region); one canteen in Bologna (Emilia-Romagna region, central Italy); one shopping centre, one hair salon, and one pharmacy in Lecce (Puglia region).

All the collected samples were analysed to individuate the presence of SARS-CoV-2 RNA traces using the following two independent approaches: real-time RT-PCR and

ddPCR [5]. The recovery tests conducted using the Mengo virus strain MC<sub>0</sub> indicate a recovery of about 50%.

Modelling of the expected average concentrations in the different environments was also conducted using an influx of customers' data and local epidemiological information to compare with the measurements. The results show a negligible risk for airborne transmission in residential outdoor zones, excluding crowded areas. In the community indoor environments investigated, indoor ventilation seems to play an important role in reducing the concentrations of virus-laden particles as well as the use of facemasks.

**Supplementary Materials:** The following are available online at <https://www.mdpi.com/article/10.3390/ecas2021-10330/s1>.

**Data Availability Statement:** The data presented in this study are available on request from the corresponding author.

**Conflicts of Interest:** The authors declare no conflict of interest.

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