Answers to the comments on “air born possibility of covid19 virus”

Mehdi Vosoughi^{1,2} • Chiman Karami³ • Abdollah Dargahi¹ • Farhad Jeddi⁴ • Kamyar Mazloum Jalali⁵ • Aidin Hadisi³ • Somayeh Biparva Haghighi⁶ • Hadi Peeri Doganeh⁷ • Zahra Noorimotlagh⁸ • Seyyed Abbas Mirzaee^{8,9}

Received: 4 August 2021 / Accepted: 19 August 2021 / Published online: 29 August 2021

© The Author(s), under exclusive licence to Springer-Verlag GmbH Germany, part of Springer Nature 2021

Coronavirus disease (COVID-19) is a contagious disease spread by a new coronavirus type. Most people with COVID-19 show a mild respiratory disease and recover without any need for special treatment. However, sometimes, some people show sever symptoms that can even lead to their death (Dargahi et al. 2021a, b; Karami et al. 2021b; Vosoughi et al. 2021). At the beginning of the SARS-COV-2 pandemic, there were conflicting reports as whether the new coronavirus can be transmitted via air or not. Some studies suggested that the new coronavirus can be airborne and these studies were preliminary and contradicted other studies. Sampling by Vosoughi et al. were performed for evaluating airborne potential of COVID-19 virus in the corona wards of the hospital (Karami et al. 2021a).

Readers' questions

The original paper (Vosoughi et al. 2021) claims that all the air samples were negative in term of SARSCoV-2

by an impinger containing 15 mL of culture medium with a flow rate of 28 L/min and sampling time of 50–60 min. In view of this, we thank the authors for their contribution to the scientific literature on the matter. However, despite this gratitude, we believe that the air sampling method from Vosoughi et al. (2021) are fundamentally flawed and is not transparent for other researchers.

One of the main reasons that all samples were negative in Vosoughi et al. (2021) study can be resulted from high flow rate. Moreover, they did not mention that air sampling was performed before or after disinfection in the hospital wards. Additionally, in this study, the type and volume of the impinger are not specified. Based on our knowledge and experience, by applying 28.3 L min⁻¹ flow rate, the culture medium will be instantly sucked from inside the impinger into the sampling pump. In the Vosoughi et al. (2021) study, air sampling was done with this flow rate for 50–60 min, which is practically impossible (the reported condition was examined in our air laboratory). We believe that the air sampling method in Vosoughi et al. (2021) study is not flawless, and therefore, the conclusions they have drawn are not supported

The authors of paper (Vosoughi et al. 2021) are very grateful for the writers of Letter to the Editor, who have carefully read the article and given some suggestion.

✉ Chiman Karami
chkarami.chiman@gmail.com

✉ Abdollah Dargahi
a.dargahi29@yahoo.com

¹ Social Determinants of Health Research Center, Ardabil University of Medical Sciences, Ardabil, Iran

² Department of Environmental Health Engineering, School of Public Health, Ardabil University of Medical Sciences, Ardabil, Iran

³ Department of Microbiology, Parasitology and Immunology, School of Medicine, Ardabil University of Medical Sciences, Ardabil, Iran

⁴ Department of Genetics and Pathology, School of Medicine, Ardabil University of Medical Sciences, Ardabil, Iran

⁵ Department of Microbiology and Medical Virology, Kerman University of Medical Sciences, Kerman, Iran

⁶ Faculty of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran

⁷ Zoonotic Research Center (ZRC) School of Medicine, Ardabil University of Medical Sciences, Ardabil, Iran

⁸ Health & Environment Research Center, Ilam University of Medical Sciences, Ilam, Iran

⁹ Department of Environmental Health Engineering, Faculty of Health, Ilam University of Medical Sciences, Ilam, Iran

The response to the questions

Thanks to the dear readers who asked the good questions.

For this study, we did the air sampling in the corona wards of the hospital. To do this, previous studies for viruses sampling in air, especially the coronavirus, have been used as a guide. In the studies of Kenarkoohi et al. (2020) and Masoumbeigi et al. (2020), as the readers mentioned, the flow rates of 12 and 40 L/min have been carried out for air sampling for COVID-19 virus. In both studies, special suction pumps were used. It should be noted that some viruses may exit from the impinger environment at high flow rates; however, the amount of air sucked per unit time increases, which helps to collect more viruses in short time. The problem of liquid suction into the pump can be solved by selecting a larger volume and higher height of the impinger. Various studies have shown that despite the low flow rate of the pumps, the air samples are still negative for coronavirus. Therefore, the reason for the negative air samples in our study is most likely related to the lack of transmission of this type of virus through the air. Other studies have found a similar results (Faridi et al. 2020; Kenarkoohi et al. 2020; Masoumbeigi et al. 2020; Karami et al. 2021a).

In this study, we selected 400 mL impinger that the bubbles produced burst at a certain height in the middle of the path, and the effluent air from the impinger could easily enter the pump without liquid suction into the pump. Therefore, the 400 mL glass impinger and suction pump (vacuum pump model: JAVAC EP) were selected.

Glutaraldehyde was used to disinfect medical equipment in bronchoscopic wards and sodium hypochlorite with a concentration of 2% was used to disinfect other surfaces. In this study, we attempted to perform air sampling after routine surface disinfection. This was done for minimizing secondary contaminants. Previous studies have shown that this virus can be found at the surfaces of hospital environment. Therefore, in order to prevent secondary contamination in the sampling process, sampling was usually done after disinfection of surfaces. Despite the negative results in terms of the presence of corona in the air of the corona ward, which has been shown by the studies of Masoumbeigi et al. (2020), Faridi et al. (2020), Vosoughi et al. (2021), and other researchers (Rahmani Samani et al. 2021), however, it is better to follow health protocols as prevention tools. The World Health Organization emphasizes the importance of wearing a mask and also use of all personal protective equipment. In addition to advising staff on these issues, the World Health Organization recommends providing personal protective equipment and other facilities and supplies needed by staff. Finally, the organization emphasizes the importance of hand hygiene, sneezing and coughing rituals, environmental cleaning and disinfection, and maintaining physical distance

and avoiding close and unprotected contact with people with fever or respiratory symptoms (Zandian et al. 2021; Organization 2020a, b; Sarailoo et al. 2021).

References

- Dargahi A, Jeddi F, Ghobadi H, Vosoughi M, Karami C, Sarailoo M, Hadisi A, Mokhtari SA, Haghighi SB, Sadeghi H (2021a) Evaluation of masks' internal and external surfaces used by health care workers and patients in coronavirus-2 (SARS-CoV-2) wards. *Environ Res* 196:110948
- Dargahi A, Jeddi F, Vosoughi M, Karami C, Hadisi A, Mokhtari SA, Ghobadi H, Alighadri M, Haghighi SB, Sadeghi H (2021b) Investigation of SARS CoV-2 virus in environmental surface. *Environ Res* 195:110765
- Faridi S, Niazi S, Sadeghi K, Naddafi K, Yavarian J, Shamsipour M, Jandaghi NZS, Sadeghniai K, Nabizadeh R, Yunesian M (2020) A field indoor air measurement of SARS-CoV-2 in the patient rooms of the largest hospital in Iran. *Sci Total Environ* 725:138401
- Karami C, Dargahi A, Vosoughi M, Normohammadi A, Jalali F, Asghariazar V, Mokhtari A, Sedigh A, Zandian H, Alighadri M (2021a) SARS-CoV-2 in municipal wastewater treatment plant, collection network and hospital wastewater. *Environ Sci Pollut Res* :1–9. <https://doi.org/10.1007/s11356-021-15374-4>
- Karami C, Normohammadi A, Dargahi A, Vosoughi M, Zandian H, Jeddi F, Mokhtari SA, Moradi-Asl E (2021b) Investigation of SARS-CoV-2 virus on nozzle surfaces of fuel supply stations in North West of Iran. *Sci Total Environ* 780:146641
- Kenarkoohi A, Noorimotlagh Z, Falahi S, Amarloei A, Mirzaee SA, Pakzad I, Bastani E (2020) Hospital indoor air quality monitoring for the detection of SARS-CoV-2 (COVID-19) virus. *Sci Total Environ* 748:141324
- Masoumbeigi H, Ghanizadeh G, Arfaei RY, Heydari S, Goodarzi H, Sari RD, Tat M (2020) Investigation of hospital indoor air quality for the presence of SARS-Cov-2. *J Environ Health Sci Eng* 18:1259–1263
- Organization, W. H (2020a) Coronavirus disease 2019 (COVID-19): situation report, 73
- Organization, W. H (2020b) Coronavirus disease (COVID-19)
- Rahmani Samani F, Khodabakhshi A, Mobini GR, Bagherzadeh F, Farhadkhani M, Hemati S, Mohammadi-Moghadam F (2021) Air and surface contamination with SARS-CoV-2 in COVID-19 admitting wards in Shahrekord Hajar Hospital, Iran. *J Mazandaran Univ Med Sci* 31:170–176
- Sarailoo M, Matin S, Vosoughi M, Dargahi A, Gholizadeh H, Rajabi Damavandi M, Abbasi-Ghahramanloo A, Kamran A (2021) Investigating the relationship between occupation and SARS-CoV2. *Work*:1–6
- Vosoughi M, Karami C, Dargahi A, Jeddi F, Jalali KM, Hadisi A, Haghighi SB, Dogahe HP, Noorimotlagh Z, Mirzaee SA (2021) Investigation of SARS-CoV-2 in hospital indoor air of COVID-19 patients' ward with impinger method. *Environ Sci Pollut Res*:1–9
- Zandian H, Sarailoo M, Dargahi S, Gholizadeh H, Vosoughi M, Dargahi A (2021) Evaluation of knowledge and health behavior of university of medical sciences students about the prevention of COVID-19. *Work*:1–7

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.