Aerosolized SARS-COV-2: Hospital Level Report

Stanford and icddr,b COVID Air Sampling Team

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Overview

Thank you for your support in collaborating with icddr,b and Stanford University on this project to understand the transmission of SARS-COV-2 in Bangladeshi Hospitals. The data that has been collected will play a key role in understanding the transmission dynamics of SARS-COV-2 within indoor settings and may help guide public health decision making around the world

It is only though your ongoing support that any of this work is possible. We hope that the results shared in this report can help inform your decision making as we all continue to battle the ongoing COVID-19 pandemic.

In this report we aim to both share the overall results of the study as well as provide you the Dhaka Medical College and Hospital specific test results.

In future communication and dissemination of our results, hospital names will be de-identified when we present our overall results to the Bangladeshi Health Community and worldwide scientific community.

Project Rationale

Mounting evidence points to droplet and airborne spread as the dominant routes of SARS-CoV-2 transmission(1–4). The larger size of droplet particles limits their spread in both space and time, requiring close proximity to an infected individual to establish exposure.

Aerosols, in contrast, can travel in suspended air plumes with prolonged viral persistence(5,6). Exposure to SARS-CoV-2 through aerosols can thus occur over larger space and time parameters, posing greater cumulative risk in shared spaces with air recirculation and/or inadequate ventilation.

Aerosolized COVID Testing

Overall Results

We conducted environmental bioaerosol sampling in six public and three private hospitals in Dhaka, Bangladesh between October 2020 and February 2021. From these 9 locations we collected a total of 86 samples.

We selected naturally-ventilated rooms for sampling, which were categorized by whether patients in that area were known or suspected to have COVID-19. We included a range of room types across facilities, including open wards, intensive care units (ICUs), outpatient departments (OPDs), doffing areas, and bathrooms.

Detailed methodology can be found in the manuscript associated with this project or by contacting the authors.

We found aerosolized SARS-COV-2 in 18 (18.6%) of these samples. Aerosolized SARS-COV-2 was found both in locations with COVID patients and locations with no known COVID patients, indicating that airborne transmission in hospital settings may be a risk to both health workers, patients, and visitors to the hospital.

Site Specific Results

In Dhaka Medical College and Hospital we collected a total of 20 samples

Of these samples, 16 were from rooms with a COVID patient or COVID suspected patient in them and 4 samples were taken from locations with no suspected COVID patients.

From 20 we coullected our samples from the following locations

Location Type	Number of Samples
ICU	1
OPD	4
Open ward	10

Location Type	Number of Samples
Other	4
Private room	1

Aerosolized COVID Test Results We found 6 of the 20 samples tested positive for airborne SARS-COV-2 from Dhaka Medical College and Hospital.

The positive samples came from the following locations

Location with Aerosolized COVID	Number of Samples Testing Positive
OPD	2
Open ward	2
Other	1
Private room	1

Of these 6 sample(s) that tested positive, 4 came from rooms with COVID patients or COVID suspected patients in them.

These test results tell if SARS-COV-2 RNA was circulating in the air the day air samples were collected.

The detection of SARS-COV-2 RNA is not proof of infectivity risk, as we did not assess the viability of the viruses we detected.

Additionally, the samples do not tell us the overall risk of COVID being transmitted through the space, as we only sampled at a single time point. If an infected individual came into an area at a later time than when we sampled, additional locations may be risks to people working at and visiting those locations.

Ventilation Testing

To understand the overall risk of COVID transmission in the different spaces at any time it is important to understand each location's ventilation rate.

Poor ventilation is a key risk factor in the transmission of airborne viruses including SARS-COV-2 and Tuberculosis. When a space has a low ventilation rate the air is recirculated, and people breathe in the same air others have exhaled instead of breathing in fresh, outside air. If a virus is in the air, poor ventilation means there is a higher chance of someone in the space breathing it in and getting sick.

The World Health Organization (WHO) recommends a space have a minimum ventilation rate of **60 Liters/person/second (L/p/s)** in naturally ventilated healthcare facilities to reduce the transmission risk of airborne diseases (7).

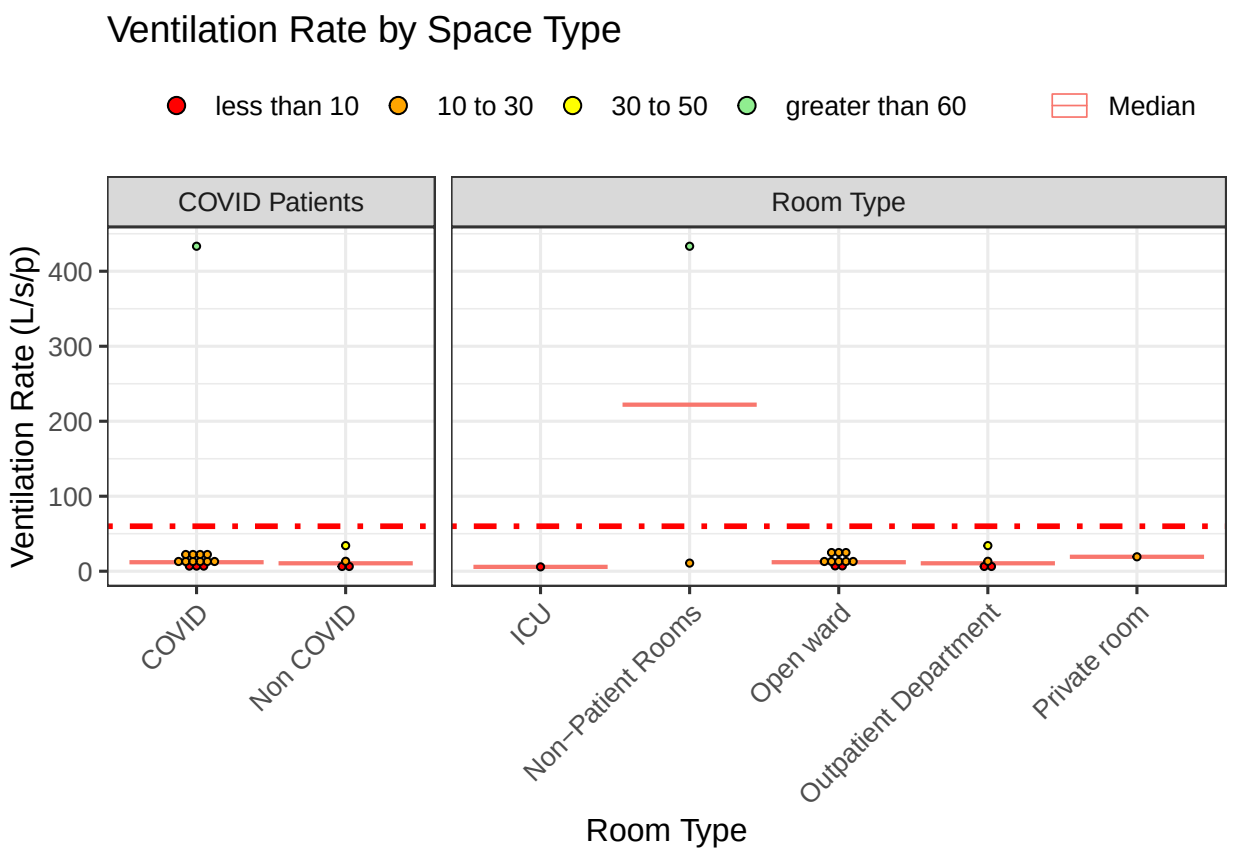
We collected information on the ventilation rate of each space we sampled using a portable Carbon Dioxide monitor.

Overall, we found that ventilation rates varied widely between the room types that we sampled. The median ventilation rate of our 86 samples was 13.0356712 L/p/s, which is much lower than the WHO recommended value.

Site Specific Ventilation Results

In Dhaka Medical College and Hospital we found that:

1 of the 20 or 5% of the samples collected from Dhaka Medical College and Hospital meet the WHO recommendation for naturally ventilated spaces.



This indicates that patients and healthcare workers might be at increased risk of contracting COVID-19 if a COVID-infected individual enters one of these inadequately ventilated spaces.

Reccomendations

- We know that PPE, including masks, is not 100% protective against COVID-19. Protection of healthcare workers, patients, and visitors can be enhanced by improving ventilation. Practical measures to enhance ventilation include fully opening windows and ensuring cross-ventilation by opening doors and windows on opposite sides of the room whenever possible. If a carbon dioxide monitor is available, CO2 levels should be maintained below 500ppm.
- Other strategies to improve ventilation include limiting the number of people in a room and ensuring adequate physical distancing.
- When identifying spaces for housing patients with COVID-19, we found that rooms with the highest ceilings have the best ventilation.
- All spaces inside a healthcare facility should be considered high-risk in the setting of community-transmission of COVID-19. This includes OPDs as well as offices and break rooms for staff. From studies outside of Bangladesh, we know that healthcare providers are more likely to be exposed to COVID-19 from colleagues and family than from patients.
- Overall, OPDs were found to have the highest positivity rates for SARS-CoV-2 as well as the lowest measures of ventilation. Strategies to reduce risk in these spaces could include mandatory mask wearing by patients and outdoor waiting areas and triage tents to minimize crowding in indoor spaces.

References

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