

Air, Surface Environmental, and Personal Protective Equipment Contamination by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) From a Symptomatic Patient

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Aim:

To determine the possible mode of transmission and extent of environmental contamination of nosocomial transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)

Definition:

Cleaning: Using 5000ppm of sodium dichloroisocyanurate on high touch area and . using 1000 ppm of sodium dichloroisocyanurate for the floor

Study Population: 3 patients at the dedicated SARS-CoV-2 outbreak center in Singapore in airborne infection isolation rooms

Methods

Date: 1/24/2020 to 2/4/2020

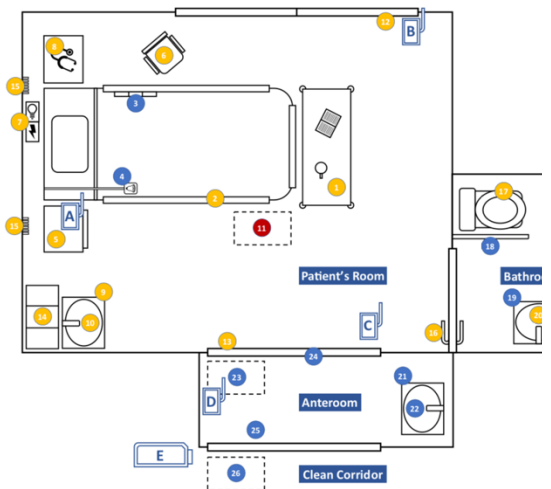
Samples Collected: using RT-PCR

Timing of sample collection: 5 days over a 2-week period.

Samples collected → total 26 sites were collected

- Personal protective equipment (PPE) samples from study physicians exiting the patient rooms
- Air sampling in the room, anteroom and outside the room
- Timing of cleaning were collected and correlated with sampling results

Results



Numbered labels correspond to environmental sampling sites listed in Table 2 in the article. Red circles indicate samples with strong positive results (low Ct value, ≤ 32). Yellow circles indicate samples with weak positive results (high Ct value, > 32). Blue circles indicate samples with no positive results. Blue icons labelled A to E indicate the position of the air samplers within the room (A to C), anteroom (D), and common corridor (E).

Table 1. Sampling Time Points in Relation to Patient Illness and Clinical Cycle Threshold

Patient	Days of illness when samples were collected	Presence of symptoms during sampling	Symptoms
A	4, 10	Yes, both days	Cough, fever, shortness of breath
B	8, 11	Yes on day 8; asymptomatic on day 11	Cough, fever, sputum production
C	5	Yes	Cough

- Patient A (symptomatic D.4 and D.10) **after** routine cleaning: all samples were negative
- Patient B (symptomatic D.8 and asymptomatic D.11) **after** routine cleaning: all samples were negative
- Patient C **before** routine cleaning: 13 (87%) of 15 room sites (including air outlet fans) and 3 (60%) of 5 toilet sites with positive results
- Anteroom and corridor samples were negative
- Only 1 PPE swab, from the surface of a shoe front, was positive
- Air outlet fan tested was positive
- All air samples were negative

Conclusion:

1. Toilet bowl and sink samples were positive, suggesting that viral shedding in stool could be a potential route of transmission
2. The risk of transmission from contaminated footwear is likely low,
3. Current decontamination measures are sufficient

Limitations:

1. Viral culture was not done
2. Small sample size
3. The volume of air SARS-CoV-2 sampled represents only a small fraction of total volume, and air exchanges in the room would have diluted the presence of in the air

Table 2. Environmental and PPE Sites Sampled and Corresponding RT-PCR Results

Sites ^a	Positive samples (patient C; before routine cleaning) ^b	Cycle threshold value ^c
Environmental sites ^d		
Patient's room		
1. Cardiac table, including handle	1/1	35.44
2. Entire length of bed rail	1/1	37.95
3. Control panel on bed	0/1	
4. Call bell attached to bed	0/1	
5. Locker with hand slot	1/1	36.21
6. Chair	1/1	37.07
7. Light switches behind bed	1/1	37.54
8. Stethoscope	1/1	38.24
9. Sink, external rim	1/1	35.54
10. Sink, internal bowl	1/1	36.79
11. Floor	1/1	30.64
12. Glass window in room	1/1	35.79
13. Glass door interior	1/1	35.71
14. PPE storage area over sink	1/1	34.89
15. Air outlet fan	2/3	32.96, 37.94
Toilet area		
16. Door handle	1/1	35.83
17. Toilet bowl, surface	1/1	37.75
18. Hand rail	0/1	
19. Sink, external rim	0/1	
20. Sink, internal bowl	1/1	37.11
Anteroom		
21. Sink, external rim	0/1	
22. Sink, internal bowl	0/1	
23. Floor	0/1	
24. Glass door, room side	0/1	
25. Glass door, corridor side	0/1	
Corridor outside room		
26. Floor	0/1	
Total, No. (%)	17/28 (61)	
Staff PPE sites		
Upper front part of gown	0/2	
Lower front part of gown	0/2	
Front surface of face visor mask	0/2	
Front surface of N95 mask	0/2	
Surface of front of shoes	1/2	38.96