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Brief Report

Environmental detection of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) from medical equipment in long-term care facilities undergoing COVID-19 outbreaks



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Key Words:

Infection control
Environmental sampling

Environmental sampling was conducted at long-term care facilities to determine the extent of surface contamination with severe acute respiratory syndrome coronavirus 2 virus. Medical equipment used throughout the facility was determined to be contaminated.

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Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) outbreaks in community long-term care facilities have primarily been linked to person-to-person transmission; however, despite implementation of enhanced infection control measures limiting person-to-person transmission potential, many long-term care facilities continue to report new cases and sustained outbreaks.¹ Environmental contamination with SARS-CoV-2 virus has been hypothesized to propagate spread; however, the extent to which environmental contamination occurs in long-term care settings has yet to be fully understood.^{2,3}

We conducted environmental sampling to assess the extent of surface contamination with SARS-CoV-2 virus within long-term care facilities with declared COVID-19 outbreaks

METHODS

We assessed surface SARS-CoV-2 contamination at 3 licensed long-term care facilities with declared COVID-19 outbreaks within a Canadian metropolitan city. Each long-term care facility services over 150 residents and provides room and board, management of medical conditions, and assistance with activities of daily living.⁴

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Conflicts of interest: None to report.

Environmental samples were collected from high-touch surfaces, communal sites, and mobile medical equipment at various sites in each of the 3 facilities. Sampling sites were selected based on the distribution of COVID-19 cases within the facility, areas common to case clusters, and the advice of an infection prevention and control specialist. Patient rooms and patient bathrooms were excluded from sampling, as the presence of SARS-CoV-2 in the personal areas of patients diagnosed with COVID-19 was expected.

Sample collection was conducted using elements of the protocol developed by the World Health Organization; however, sampling of ventilation inlets, collection of control samples, and repeat sampling were not completed.⁵ Sterile premoistened swabs (Aptima Multitest Swab Specimen Collection Kit; Hologic Inc., San Diego, CA) were used to sample sites. A sample collection area of 25 cm² was used for all surfaces. Sampling of larger surfaces was completed by sampling the theorized most frequently touched 25 cm². Sample collection was completed by 2 senior environmental health officers experienced in environmental sample collection.

Samples were analyzed at the British Columbia Centre for Disease Control Public Health Laboratory via real-time reverse transcriptase-polymerase chain reaction, targeting the RNA-dependent RNA polymerase and E gene regions of the SARS-CoV-2 virus.² Cycle time values (CT values) were reported for all samples in which SARS-CoV-2 was detected. CT values ≤38 were reported as positives, CT values ≥38.1–40 were reported as indeterminate, while CT values ≥40.1 were reported as negatives.

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Table 1
Sites sampled and results

Facility number	Location	Cycle threshold value
<i>Staff area</i>		
1	Female staff washroom stall inner stall door handle	Negative
1	Female staff washroom soap dispenser push handle	Negative
1	Female staff washroom main door inner door handle	Negative
1	Male staff washroom stall inner stall door handle	Negative
1	Male staff washroom soap dispenser push handle	Negative
1	Male staff washroom main door inner door handle	Negative
1	Numeric keypad of door entry from kitchen to staff washroom corridor	Negative
1	Numeric keypad of door entry from staff washroom corridor to kitchen	Negative
1	Cold water tap handle on water cooler	Negative
1	Refrigerator door handle in staff lounge	Negative
1	Microwave keypad of microwave in staff lounge	Negative
1	Microwave keypad of silver microwave in staff lounge	Negative
1	Cold water tap handle of staff water cooler in staff lounge	Negative
1	Phone receiver of phone in staff lounge	Negative
2	1st floor water cooler – cold water tap handle	Negative
2	1st floor staff microwave keypad on top of fridge	Negative
2	1st floor staff microwave keypad on top of table	Negative
2	1st floor men's staff washroom/changing room door handle	Negative
2	1st floor beauty salon outer door handle	Negative
3	Staff room microwave keypad	Negative
<i>Care provision areas</i>		
1	1st floor mobile nutrition cart	Negative
1	1st floor medication cart handle (right side)	Negative
1	2nd drawer handle of 1st floor medication cart	Negative
1	1st floor nursing station photocopier touch screen	Negative
1	1st floor medication administration record (MAR) binder cover at 1st nursing station	Negative
1	Numeric keypad on 1st floor nursing station portable phone	Negative
1	Pen shaft on 1st floor nursing station staff sign-in table	Negative
1	1st floor blue (normal adult size – color: blue) blood pressure cuff bladder on mobile patient vitals cart	39.18
1	1st floor red (large adult size – color: red) blood pressure cuff bladder on mobile patient vitals cart	38.6
1	1st floor thermometer probe handle on mobile patient vitals cart	Negative
1	2nd floor thermometer probe handle on mobile patient vitals cart (cart serves facility COVID-19 case cluster)	Negative
1	2nd floor glucometer on nursing station medication cart (cart serves facility COVID-19 case cluster)	Negative
1	2nd floor refrigerator door handle on nursing station insulin bar refrigerator	Negative
1	2nd floor nursing station black chair arm rest (right side)	Negative
1	2nd floor nursing station mouse on 2nd floor nursing station computer	Negative
1	Numeric keypad on 2nd floor nursing station portable phone	Negative
2	3rd floor medication cart side handle	Negative
2	3rd floor medication cart pill crusher button	Negative
2	3rd floor medication cart blood pressure machine artery marker/second section of bladder	Negative
2	3rd floor medication cart blood pressure machine touch fastening strap	38.65
2	3rd floor nursing station blood pressure machine artery bladder	Negative
2	3rd floor COVID-19 resident section linen cart handle	38.54
2	3rd floor COVID-19 resident section interior door handle	Negative
2	3rd floor nursing station portable telephone keypad	Negative
2	3rd floor nursing station thermometer trigger and handle	Negative
2	3rd floor nursing station communication binder	Negative
2	3rd floor nursing station medication administration record binder (blue binder)	Negative
2	4th floor medication cart O2 saturation finger probe	Negative
2	4th floor blood pressure artery /second section of bladder	Negative
2	4th floor medication cart blood pressure machine "start" button	Negative
2	4th floor nursing station thermometer handle and blue button	Negative
2	4th floor nursing station cordless portable phone numeric keypad	Negative
2	4th floor nursing station communication binder (black)	Negative
2	4th floor housekeeping cart handle	Negative
2	4th floor nursing station medication administration record binder	Negative
2	4th floor thermometer next to staff washroom (buttons only)	Negative
2	4th floor laundry cart handle	Negative
2	4th floor laundry chute handle (beside staff only washroom)	Negative
3	3rd floor nursing station mobile blood pressure machine cart handle	Negative
3	3rd floor nursing station thermometer button	Negative
3	3rd floor nursing station blood pressure cuff (artery marker section)	37.38
3	3rd floor nursing station blood pressure cuff touch fastening strap	Negative
3	3rd floor nursing station MAR e-tablet (Crystal 1)	Negative
3	3rd floor nursing station MAR e-tablet (Crystal 2)	38.48
3	3rd floor laundry cart handles (west side) in COVID-19 resident section	Negative
3	3rd floor sling lift	Negative
3	3rd floor lift operation buttons in hallway	Negative
3	3rd floor north side garbage chute handle	Negative
3	2nd floor nursing station black phone receiver handle	Negative
3	2nd floor enhanced cleaning cart handle	Negative

(continued)

Table 1 (Continued)

Facility number	Location	Cycle threshold value
3	1st floor nursing station cold water cooler lever	Negative
3	1st floor nursing station reusable goggle legs	Negative
3	1st floor nursing station digital blood pressure cuff touch screen	Negative
3	1st floor nursing station wrap sleeve	Negative
3	8th floor ventilation outflow fan	Negative
3	8th floor elevator call buttons	Negative
3	8th floor hand sanitizer button/handle	Negative
3	8th floor balcony door interior handle	Negative
3	8th floor room exterior door handle	Negative
3	Main floor cleaning cart	Negative
<i>Main areas</i>		
2	1st floor main entrance phone numeric keypad	Negative
2	1st floor main entrance phone receiver	Negative
<i>Institutional kitchen area</i>		
3	Grey hot food cart rear handle	Negative
3	Grey hot food cart silver door handle	Negative
3	Grey rolling food cart front handle	Negative
3	Grey rolling food cart for secure COVID-19 area front handle	Negative
3	Silver coffee urn operation button	Negative
3	Kitchen elevator call buttons	Negative
3	Kitchen phone numeric pad	Negative

Consent for environmental sampling was obtained through the Director of Care or Facility Operator at each COVID-19 outbreak facility.

RESULTS

Overall 89 sites were sampled. Table 1 details the sites sampled at each facility. Sampled sites included 20 (22.5%) sites in staff communal areas, and 60 (67.4%) sites in care provision areas; for example, nursing stations, and related medical equipment. Seven sites (7.9%) in an institutional kitchen were also sampled, as well as 2 sites (2.2%) at a main entrance of a facility.

Eighty-four (94.3%) of the 89 sites were negative for both SARS-CoV-2 virus targets. Six (6.7%) sites tested positive or indeterminate for the SARS-CoV-2 virus: 2 sites from each of the 3 facilities. The 6 sites with detected SARS-CoV-2 viral RNA included the bladder of a normal adult size reusable blood pressure cuff (E gene cycle threshold: 39.18) (Image 1) and the bladder of a large adult size reusable blood pressure cuff (38.6) (Image 2) in facility 1 (Table 1); the touch fastening strap of a reusable blood pressure cuff (38.65) (Image 3) and the handle of a mobile linen cart (38.54) (Image 4) in facility 2 (Table 1); the bladder of a reusable blood pressure cuff (37.38) (Image 5) and the touch display of an electronic medication administration record (MAR) tablet (38.48) (Image 6) in facility 3 (Table 1).

The lowest CT value for a sample with SARS-CoV-2 viral RNA detected was the bladder of a blood pressure cuff in facility 3 (37.38).

Four (44%) of 9 environmental samples taken from blood pressure cuffs contained detectable levels of SARS-CoV-2 viral RNA.

DISCUSSION

Environmental contamination with SARS-CoV-2 virus was detected at each of the 3 COVID-19 outbreak facilities sampled in this study, including surfaces of 5 frequently used medical devices transferred between patient rooms, and 1 high-touch surface used by care staff in the course of providing patient care. The detection of SARS-CoV-2 virus on medical devices, such as blood pressure cuffs, used between residents supports the possibility that environmental contamination may be a route for the spread of COVID-19 disease within health care facilities.

The consistent detection of viral RNA on blood pressure cuffs was an unexpected finding. However, as respiratory etiquette recommends individuals cough or sneeze into their antecubital fossa, it is

possible that symptomatic COVID-19 patients may expel SARS-CoV-2 virus on their upper arm with subsequent transmission to a blood pressure cuff. This finding may also relate to the frequency of use of these devices in the facilities, as well as insufficient infection control practices related to their cleaning, disinfection, use, and storage.

Standard environmental infection control practices recommend cleaning and disinfection of noncritical medical equipment with a low-to-intermediate level disinfectant⁶; however, standard practice may not suffice, especially if equipment is frequently used within a facility allowing for virus accumulation on equipment. Frequently used devices should be cleaned and disinfected on a per-use basis. Single-use, disposable options for equipment, such as blood pressure cuffs, may also be considered.

This study contains limitations. The swabs used were not validated for environmental sampling, and the sensitivity of their use for the novel virus SARS-CoV-2 is not known. Additionally, all samples with viral RNA detected recorded a CT value greater than 24, a level at which the detected virus may not be infectious in the context of a human nasopharyngeal sample infecting Vero cell lines.⁷ However, although the cycle threshold values for these 6 samples were above an observed threshold for SARS-CoV-2 Vero cell infectivity, infectious levels of the virus may have been present before an environmental sample was taken.

Future studies focusing on environmental contamination with SARS-CoV-2 are required to confirm these results and explore other mechanisms of environmental transmission in the long-term care environment. Given the ubiquity of blood pressure cuffs throughout acute and community health care settings, further research should also explore their role as fomites for SARS-CoV-2 transmission.

CONCLUSIONS

The findings suggest medical equipment is a potential environmental route for transmission of SARS-CoV-2 virus in long-term care facilities. As such, enhanced environmental cleaning for all medical equipment or prohibiting communal use is recommended.

SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found in the online version at <https://doi.org/10.1016/j.ajic.2020.07.001>.

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