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Absence of contamination of personal protective equipment (PPE) by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2)

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Introduction

Local transmission of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) infection in Singapore has been reported[1]. As the pandemic spreads globally, increased utilization and shortages of personal protective equipment (PPE) are expected. While extended PPE use would mitigate utilization rate, its safety is unknown. At the National Centre for Infectious Diseases, recommendations for healthcare workers (HCWs) in contact with known or suspected patients are in concordance with the US Centers for Disease Control and Prevention, which recommends gloves, gown, respiratory protection (e.g. disposable N95 respirator), and eye protection (e.g. goggles or disposable face shield), without use of shoe covers[2].

An initial pilot study showed no contamination of N95 and disposable face visors after patient care, although there was one instance of detection of SARS-CoV-2 nucleic acid on the front surface of a HCW's shoe[3]. To evaluate the safety of extended PPE use, we conducted a one-day PPE sampling study on HCWs caring for confirmed SARS-CoV-2 infected patients to ascertain the per contact episode risk of PPE contamination with SARS-CoV-2.

Methods

PPE samples were collected by five trained personnel using a standardized technique with Puritan® EnviroMax Plus pre-moistened sterile swabs from the entire front of goggles, front surface of N95 respirator, and front surface of shoes from 30 HCWs (Table 1) exiting patient rooms. Gloves and gowns were not swabbed as these are disposed after each use. Data on HCW category and details of activity in the room were recorded. Patients with positive SARS-CoV-2 PCR within the prior 48 hours were selected, and clinical data (day of illness, presence of symptoms, and cycle threshold (Ct) value of clinical PCR) obtained from the

medical record. Environmental samples were tested with specific real-time RT-PCR methods targeting the SARS-CoV-2 RNA-dependent RNA polymerase (RdRP) and E genes[4].

Results

15 patients (7 female, 8 male) were selected. Patient characteristics varied by day of illness (median 14, IQR 8.25-17.25), presence of symptoms (63% symptomatic), and clinical PCR Ct value (median 30.08, IQR 28.85-30.86). None was requiring ventilatory support and no aerosol generating procedures were carried out prior to or during sampling. All 90 samples from 30 HCWs (doctors, nurses, and cleaners) were negative (Table 1). Median time spent in the patient's room was 6 minutes (IQR 5-10; median by subgroup: doctors=8, nurses=7, cleaners=3). Activities ranged from casual contact (e.g. administering medications, cleaning) to closer contact (e.g. physical examination, collection of respiratory samples).

Discussion

One limitation of our study is the use of surface swabs for sampling the surface of N95 masks, rather than processing masks in extraction buffers with detergents, which is a method that has been used for isolation of influenza from N95 respirators[5]. Surface swabbing may be insufficient for detection of entrapped viral particles. Second, all patients were in airborne infection isolation rooms with 12 air exchanges per hour, and these results may not be generalizable to other room configurations. Third, we did not assess the concomitant level of viral contamination of the environment in this study to correlate with the level of PPE contamination.

Previous laboratory studies demonstrated that viruses such as SARS-CoV and human coronavirus 229E can remain viable on PPE items including latex gloves and disposable gowns[6-8], though these were not performed in clinical settings. Despite the potential for extensive environmental contamination by SARS-CoV-2, we did not find similar

contamination of PPE after patient contact. This provides assurance that extended use of N95 and goggles with strict adherence to environmental and hand hygiene while managing SARS-CoV-2 patients could be a safe option.

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Disclosures:

No conflicts of interest declared.

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Table 1: Characteristics of PPE samples collected and relevant patient clinical data

	Staff type	Duration of time (mins)	Activity (examination, parameters, cleaning, etc.)	Clinical Data of patient		
				Day of illness	Symptomatic	Ct Value
1	Doctor	5	Examination	14	No	31.59
2	Doctor	5	Examination	9	Yes	20.80
3	Doctor	10	Communication without examination	9	Yes	20.80
4	Doctor	25	Examination	4	Yes	27.69
5	Doctor	6	Examination	8	Yes	30.7
6	Doctor	6	Examination	15	Yes	29.51
7	Doctor	8	Examination	19	Yes	30.24
8	Doctor	3	Examination	19	No	29.86
9	Doctor	11	Examination	15	No	31.4
10	Doctor	7	Examination	18	No	28.32
11	Doctor	5	Examination	14	Yes	29.02
12	Doctor	15	Examination	8	Yes	27.86
13	Doctor	20	Examination	8	Yes	27.86
14	Doctor	6	Examination	12	Yes	36.95
15	Doctor	10	Examination	10	No	31.33
16	Nurse	7	Collecting respiratory specimen	14	No	31.59
17	Nurse	5	Administering medications and communicating with patient	4	Yes	27.69
18	Nurse	18	Blood taking and communicating with patient	8	Yes	30.7
19	Nurse	19	Blood taking and collecting respiratory specimen	8	Yes	30.7
20	Nurse	4	Changing of wrist tag and collection of stool sample	15	Yes	29.51
21	Nurse	5	Collecting respiratory sample	18	No	28.32
22	Nurse	7	Collecting respiratory sample	19	Yes	30.24
23	Nurse	10	Administering medications	8	Yes	27.86
24	Nurse	5	Administering medications	20	Yes	29.91
25	Nurse	5	Monitoring vitals	15	Yes	32.23
26	Cleaner	5	Cleaning of high-touch areas	14	No	31.59
27	Cleaner	7	Cleaning of high-touch areas	9	Yes	20.80
28	Cleaner	2	Clearing trash	18	No	28.32
29	Cleaner	3	Clearing trash	15	No	31.4
30	Cleaner	3	Clearing trash	19	No	29.86

Ct = cycle threshold (Cycle threshold refers to the number of cycles required for the fluorescent signal to cross the threshold in RT-PCR; a lower cycle threshold value indicates a higher viral load)