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Letter to the Editor

Infection control challenges in handling recurrent blockage of sewage pipes in isolation facility designated for patients with COVID-19

Sir,

Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), the causative agent of coronavirus disease 2019 (COVID-19), has been identified in stool samples by reverse transcription polymerase chain reaction (RT-PCR) in 48% of patients with COVID-19 with a median faecal viral load of 5.1 $\log_{10}$ and 3.9 $\log_{10}$ copies/mL in patients with and without diarrhoea, respectively [1]. Wastewater-based epidemiology has been suggested as an adjunct to improve surveillance of COVID-19 [2]. Leakage from a broken sewage pipe was shown to be a possible transmission vehicle by genome sequencing during a COVID-19 outbreak in a densely populated community [3]. The risk of SARS-CoV-2 contamination is likely to be higher in sewage from a designated COVID-19 ward. Here, we describe our infection prevention and control (IPC) experience in handling recurrent blockage of the defective sewage pipes in a COVID-19 ward, leading to leakage and contamination to the ward immediately below (Ward A) in a university-affiliated hospital in Hong Kong.

The initial leakage occurred on 12th December 2020. An infection control nurse (ICN) attended Ward A immediately to assess the situation. A potentially contaminated zone of 10 m^2 from the centre of seepage was defined, from which patients and staff were evacuated. The ICN provided on-site support to the facility management staff (FMS) during the urgent repair work, performing directly observed donning and doffing (DODD) of personal protective equipment (surgical respirator, cap, face shield, isolation gown and gloves) to ensure staff safety [4–6]. The ward was terminally disinfected using sodium hypochlorite solution (1000 ppm) and ultraviolet C irradiation (UVDI-360 Room Sanitizer; Badger Technologies, Denmark) after the procedures.

Further episodes of sewage pipe blockage, leading to seepage of sewage into Ward A, occurred 12 and 48 days after the original incident, and replacement of the sewage pipes was deemed necessary. A task force, comprising ICN, FMS, hospital management, and staff from the COVID-19 ward and Ward A, was established to oversee safe execution of the work. Patient services were relocated during the work, and the ICN and FMS collaborated to manage the risks to staff during the work. Clean and dirty zones were defined clearly, along with areas for DODD. Environmental swabs were collected from the internal lumen of sewage pipes before and after disinfection using sodium hypochlorite solution (10,000 ppm) as pre-reconstruction risk assessment (Figure 1). The ICN supervised the reconstruction work and performed air sampling as described previously [7] during the cutting of sewage pipes, which was considered likely to generate aerosols. SARS-CoV-2 RNA was detectable in 100% (5/5) and 40% (2/5) of environmental swabs before and after disinfection, and 100% (2/2) of air samples (see online Supplementary material) collected 6 and 8 days after closure of the COVID-19 ward, respectively. All six FMS who participated in the drainage and reconstruction works were negative for SARS-CoV-2 by RT-PCR 14 days after the work.

This experience has implications for hospital maintenance in the future. First, it was challenging to train the FMS for IPC and to map the location of sewage pipes within a short time before the work. We have now decided to identify a designated team of FMS to handle problems in hospital facilities which may pose a risk of infection. IPC training specifically related to the repair work and fit test for surgical respirators can be arranged for the designated FMS in advance. Second, we identified that it is essential to have accurate mapping of sewage pipework, especially in an old-fashioned hospital like ours, to permit a rapid response, especially during periods of high bed occupancy. Ideally, horizontal sewage pipes should be repositioned so that they do not run directly over areas occupied by patients. Third, we recommend a standardized ward design for new hospital buildings with no sewage pipes running horizontally between floors. Fourth, SARS-CoV-2 RNA was detected persistently in the sewage pipes despite disinfection. Although this does not necessarily point to the presence of infectious virus, we determined that the dismantled sewage pipes from the COVID-19 ward should be treated as clinical waste with proper packaging and disposal by a licensed clinical waste collector [8], rather than treated as construction waste. Finally, the IPC team should be actively involved in the risk assessment for facilities man-

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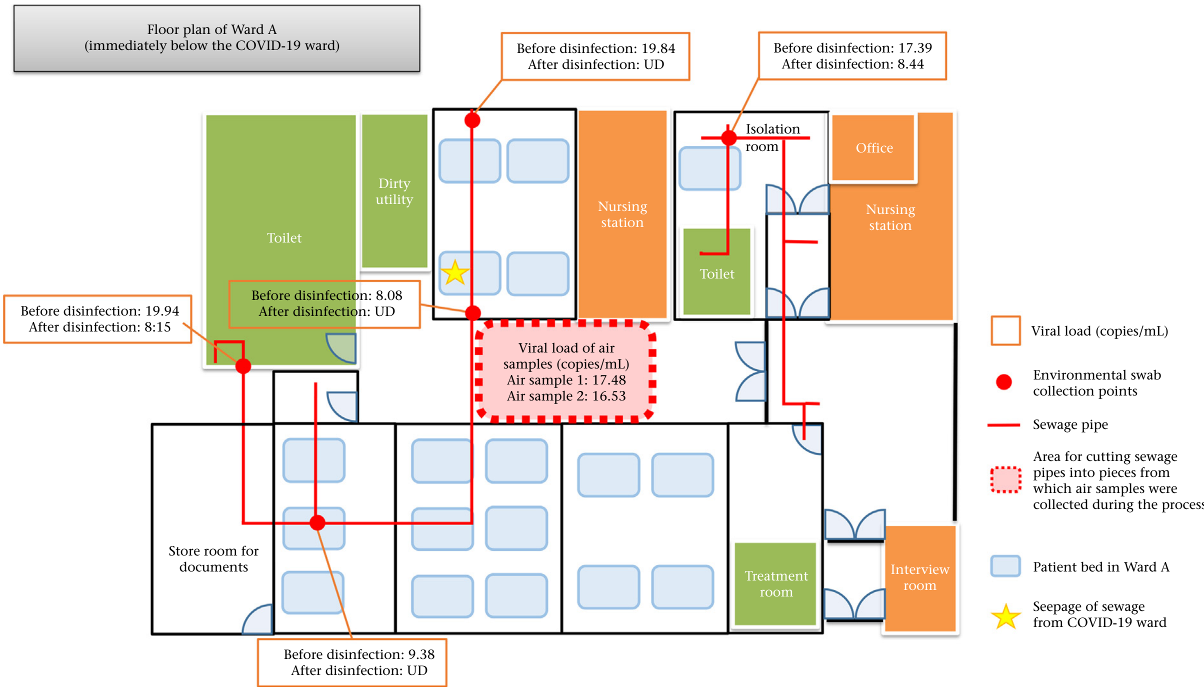

Figure 1. Floor plan of Ward A illustrating the sewage pipes of the coronavirus disease 2019 (COVID-19) ward and the sites of environmental and air sample collection for the detection of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). Ward A is located immediately below the COVID-19 ward. Red lines represent the horizontal sewage pipes of the COVID-19 ward, which were mounted on the ceiling of Ward A. The vertical sewage pipes are not shown. Red dots represent the cleaning eyes at pipe bends, where environmental swabs were taken from the internal lumen of the sewage pipes before and after disinfection with a high concentration of sodium hypochlorite solution (10,000 ppm). Viral loads of SARS-CoV-2 (copies/mL) before and after disinfection are shown in the figure. The sewage pipes were removed from the ceiling and cut into pieces (40–50 cm in length). During the process of cutting the sewage pipes, air samples were collected using an MD8 airscan sampling device (Sartorius AG, Göttingen, Germany) with sterile gelatin filters 80 mm in diameter with a 3-µm pore size (type 17528-80-ACD) (Sartorius AG) as described previously with minor modification [7]. Briefly, the air sampler was placed 50 cm away from the pipe cutter. One thousand litres of air (rate 40 L/min) was collected by a gelatin filter for the first 25 min of work (Air Sample 1), and another 1000 L of air was collected by another gelatin filter for the next 25 min of work (Air Sample 2). UD, undetectable.

agement in hospitals to ensure staff and patient safety during the COVID-19 pandemic.

Conflict of interest statement

None declared.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jhin.2021.03.002.

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