Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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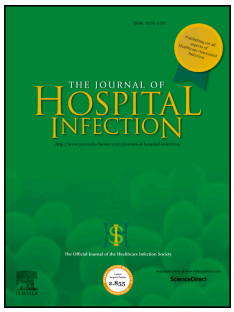

COVID-19 Pandemic – Let's not forget surfaces

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COVID-19 Pandemic – Let's not forget surfaces

SARS-CoV-2, responsible for the current pandemic, is spread by droplet transmission and is not thought to be airborne. In indoor environments, there is growing concern over how the virus can circulate within a space. Due to droplet transmission, a 2-metre distance has been implemented in the UK. While droplet transmission in air must be considered, and is a critical component to the safety of healthcare workers interacting with patients, it is also important to consider the role of surfaces.

The current guidance states that surface cleaning should be undertaken a minimum of 20 minutes following an Aerosol Generating Procedure (AGP) on a SARS-CoV-2 positive patient (PHE 2020), however there is little guidance on general surface cleaning in other contexts. SARS-CoV-2 remains viable on plastic and steel surfaces up to 72 hours, and copper and cardboard no more than 8 (van Doremalen, Bushmaker et al. 2020). Without effective surface cleaning, this can represent an important risk for surface-mediated transmission. Now more than ever, moment 5 of the 5 moments for hand hygiene, hand hygiene after contact with surrounding surfaces, must be followed (WHO 2009). This is vital in clinical areas, but for non-clinical environments also, due to asymptomatic carriage in adults.

A DNA oligonucleotide surrogate for contaminated bodily fluid based on the Cauliflower Mosaic Virus (AB863139.1) was used to determine how SARS-CoV-2 would spread within a clinical surface environment. 100µl containing 1.15E+09 copies of oligonucleotide was inoculated onto a bed rail within an isolation room on a paediatric ward on a Monday morning. Samples were taken from ward surfaces that evening and the following four evenings using cotton swabs to assess dispersal. Swabs were transferred into molecular grade water and processed by qPCR (Efficiency= 103%, R^2= 0.99). A total of 44 samples were taken, twenty from the immediate bedspace environment, eight from the wider bedspace environment (e.g. cubicle door handles), seven from clinical areas (e.g. height and weight room), and nine from general ward areas (e.g. reception). This surrogate was readily removed with hand washing adhering to the 5 moments. A single wipe (Clinell Universal or PDI alcohol wipe) was demonstrated to remove 98.88-99.84% of surrogate dried on a surface. Samples were not taken from the original inoculation site to prevent the removal of the inoculation material.

The results showed that, within 24 hours, the surrogate had moved from the isolation room and transferred to 41% of all surfaces sampled within the ward, with a peak at 52 % on Day 3. The surrogate DNA persisted throughout the sampling period.

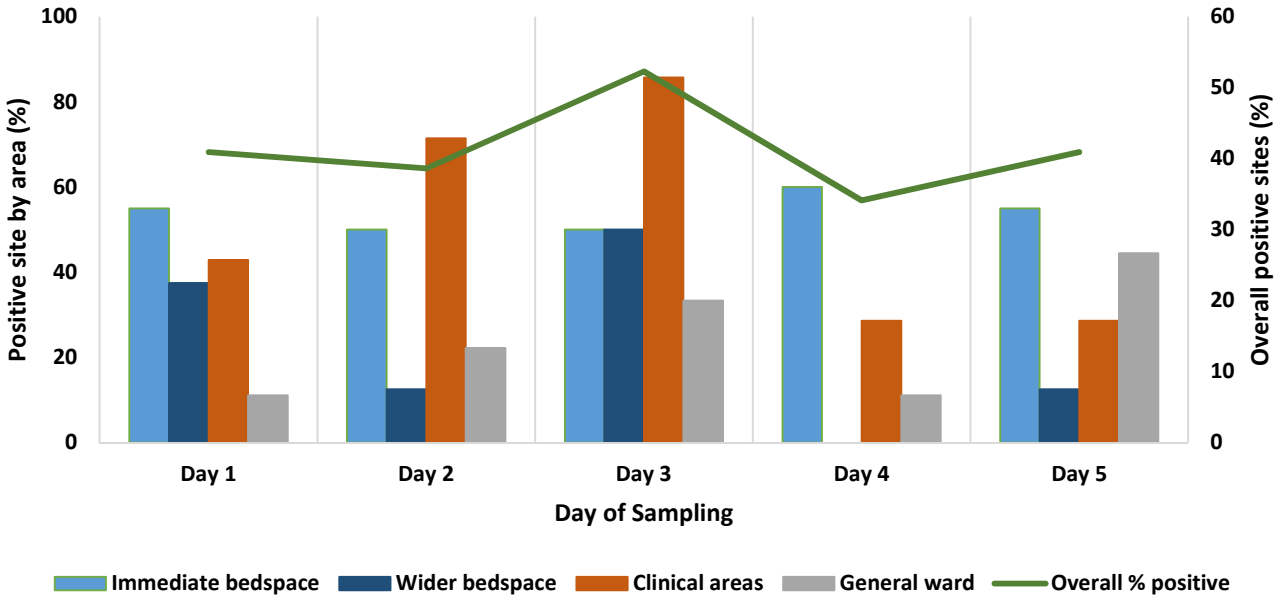

Figure 1. Percentage positive sites overall and in different areas, following daily ward sampling of 44 sites.

When considering postive sites in relation to distance from the initial inoculation site and area sampled, it is clear that both of these factors play a role. Most positive sites were recovered from surfaces near the isolation room. The immediate bedspace environment and clinical areas had, overall, the most postivie sites, both reaching heights of 60% and 86% positive sites respectivley. Most positive sites came from bed rails, classified as an immediate bedspace site, within a nearby four-bed-bay, highlighting risk to other patients.

The results from this study show how important surface-mediated transmission is, particularly in light of the current outbreak. The surrogate DNA persisted on surfaces with 41% positive sites on day 5, implying a combination of poor cleaning, movement of patients and carers not adhering to the 5 moments, and potential re-inoculation of the surrogate DNA following patient movement between the isolation room and clinical areas. Locating the surrogate DNA outside the isolation room highlights how easily surfaces play a role in tranmitting infectious agents, even from rooms designed to help containment.

The surrogate DNA was inoculated once to a single site, while patients infected with SARS-CoV-2 will introduce continual shedding of the virus through touching surfaces and coughing. Healthcare workers cannot prevent the spread of the virus during AGPs and contact with infected patients, unless strict hand hygene, careful donning and doffing of personal protective equipment (PPE) and consistent cleaning is undertaken (Soma 2020).

Sputum viral load has been widely investigated, and can be as high as 10^8 viral copies in 1 ml of sputum (Rothe, Schunk et al. 2020), however there is no data avaiable for the potential viral load on hands after patient contact or touching surfaces (Kampf, Todt et al. 2020). While this study makes no comparisons between positive site and copy numbers required for infectious dose, the speedy and consistent spread of the surrogate DNA has important implications for infection control. As a high risk area, the isolation room where the bedrail was inoculated had a different cleaning regimen to the rest of the ward, however its wide dissemination indicates cleaning failure. As the surrogate is removed readily with good hand hygiene, this also indicated hand hygiene failure.

It is important to consider all methods of tranmission, including the risk from surfaces. To reduce the risk, the first line of defence for preventing the spread of SARS-CoV-2, and other potential pathogens, is effective cleaning. SARS-CoV-2 in an eveloped virus, very susceptible to most cleaning agents, which destroy the evelope and deactivate the virus (Harapan, Itoh et al. 2020). Our study highlights the role surfaces can play as a reservoir of pathogens and that the requirement for surface cleaning needs to be addressed.

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