

Possible additional interventions to address hospital transmission risks of SARS-CoV-2

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Executive Summary

- This paper focuses on acute NHS hospitals and additional actions to be taken to reduce environmental risks concerning the transmission of SARS-CoV-2.
- We have identified areas where there is evidence to support improvements in infection prevention and control (IPC) with respect to transmission of SARS-CoV-2 in the hospital environment. We have identified six areas where improvements in IPC practice could be made and suggested actions for each of these.
- We focus on risks and practicable actions relating to transmission from contaminated surfaces, infectivity according to timing of symptoms, contamination in bathrooms/toilets, aerosolisation / environmental contamination of when removing PPE, healthcare workers who are COVID-19 test positive, and hand drying.
- We recommend that a gap analysis should be carried out immediately (comparing these recommended actions with existent guidance) and then current IPC guidance is updated/strengthened and implemented.

Introduction

After review of existing evidence, we have identified pertinent hospital environment associated transmission risks for SARS-CoV-2 that can be addressed. For each identified transmission risk, a brief context is provided and actions suggested.

Source references and discussion of the context surrounding advice in this document can be found in Environmental Influence on Transmission (SAGE - EMG paper 02/05/20); and SARS-CoV-2 in the hospital environment and risk of COVID-19 nosocomial transmission (SAGE-EMG paper 5/5/2020 – available in the repository)

EMG suggests using a hierarchy of risk approach (Appendix 1) to enable mitigation measures to be considered, both in terms of how the impact on the transmission routes and the level at which they are implemented within an organisation. Throughout, we indicate the controls as:

(E) Eliminate, (S) Substitute, (En) Engineering/environment, (A) Administrative, (P) PPE.

Risk of transmission from contaminated surfaces should be recognised as a significant potential infection route

Context:

Evidence from previous coronavirus outbreaks, supported by preliminary modelling for the SARS-CoV-2 outbreak within EMG suggests that the infection can be transmitted by touching objects and there is a realistic possibility that this may be a significant route. Evidence to date suggests virus can persist on surfaces at a level that may pose a risk for up to 48 hours, and contamination has been found on surfaces in several hospital environmental sampling studies.

The evidence suggests that cleaning with appropriate materials does significantly reduce virus survival, and so cleaning is likely to be a major factor in reducing risk of virus transmission.

Coronaviruses can be efficiently inactivated by surface disinfection procedures with 62–71% ethanol, 0.5% hydrogen peroxide or 0.1% sodium hypochlorite within 1 minute. Other biocidal agents such as 0.05–0.2% benzalkonium chloride or 0.02% chlorhexidine digluconate proved to be less effective. NHS guidance recommends use of combined detergent/chlorine products as these are single step/practicable options.

Wang *et al* (2020) used quantitative real-time reverse transcription PCR (qRT-PCR) methods to confirm the existence of SARS-Cov-2 on 36 surfaces wiped with 1000 mg/L chlorine containing disinfectant. The authors did not find any SARS-Cov-2 RNA on the 36 surface samples after cleaning. The monitoring data in this study suggested that the strict disinfection and hand hygiene could decrease the hospital-associated COVID-19 infection risk of the staff in isolation wards.

Actions:

- i. Increase frequency of surface decontamination, and especially of frequent touched sites – current NHS guidance says at least twice daily; we suggest that higher frequencies are required. (A)
- ii. Alcohol or disinfectant wipes should be made widely available in hospitals, so that there is local capability for (frequent) decontamination of frequent touched surfaces (i.e. additional to Facilities directed cleaning). (A)
- iii. Other mitigation approaches such as novel surface materials could be considered in high risk areas. For example alcohol release door plates have been shown to reduce contamination for bacterial pathogens and may be a viable option for reducing viral transmission. Innovations to reduce contact through devices such as automatic door opening and contactless operation of systems may also be useful for reducing transmission. It is important that any such measures focus on the priority areas of high touch sites rather than all surfaces and systems. (En)

Infectivity appears to be highest just before symptoms start/very early in symptomatic infection

Context:

Available evidence suggests that viral load in patients (and so healthcare workers) is highest early during illness and possibly just prior to symptom onset. Higher viral load in patients is associated with greater environmental contamination. It is plausible, therefore, that viral shedding and environmental contamination will similarly be higher at these times.

Actions:

- i. Patients with suspected/possible COVID-19 need to be segregated, especially in admission/waiting and non-COVID areas. Mask usage should be emphasised for all suspected individuals. Ideally, segregation should be separate spaces, but there is also potential to use screens, for example to protect reception staff. (En/A)
- ii. For patients with new onset symptoms, it is important to achieve isolation and instigation of contact tracing as soon as possible. (A)
- iii. A high index of suspicion should be used to identify/test patients or healthcare workers with early COVID-19 (or repeat healthcare worker screening). (A)
- iv. Ensuring good ventilation in admission/waiting areas is an appropriate precaution to minimise opportunistic airborne transmission risk. (En)

Excess contamination by SARS-CoV-2 in bathrooms/toilets

Context:

While the infectivity of faeces remains unclear, SARS-CoV-2 can be detected in faeces and in/around toilets/bathrooms used by COVID-19 patients. Faecal shedding may therefore be a potential source of contamination, particularly in shared toilet facilities.

In addition, a possible transmission route exists from aerosolised faecal matter when water trap seals (U-Bends) become empty as a result of pressure surges in the wastewater plumbing system due to heavy usage or evaporation due to underuse.

While SARS-CoV-2 particles can be found in faeces, the infectivity/time course/transmissibility of virus in faeces is unclear and further work is required.

Lidless toilets may pose a higher risk for aerosolisation of SARS-CoV-2 compared to putting lids down when flushing, evidence is required.

Actions:

- i. Increased frequency/cleaning/surface decontamination of bathroom/toilets with chlorine-based disinfectants should take place, especially but not solely in COVID-19 areas. (A)
- ii. There needs to be care over the disposal of faeces and subsequent equipment decontamination following use of commodes by (possibly) COVID-19 positive patients. (A)
- iii. Empty water traps in sinks, showers, baths and toilets are possible and may pose a potential transmission route. Floor drains should be checked and refilled regularly. (En)

Potential for aerosolisation / environmental contamination of virus when removing PPE

Context:

Recent data from a Wuhan hospital show that some clinical staff areas, including rooms where personal protective equipment was removed, had high environmental levels of SARS-CoV-2 levels; these levels became undetectable after better sanitization procedures were implemented. This issue is not mentioned in the current Infection Prevention and Control COVID-19 Management Checklist.

Actions:

- i. Increased frequency/cleaning/surface decontamination of areas used to remove PPE with chlorine-based disinfectants should take place, where practicable timed to coincide with periods immediately after PPE removal by groups of staff. This is particularly pertinent for COVID-19 areas. (A)
- ii. The importance of removing masks last of all when removing PPE, followed by thorough hand washing should be re-emphasised. (P)
- iii. Ensure good ventilation of areas where PPE is removed, and consider adding air cleaning/disinfection devices to mitigate risk if the air is poorly ventilated. (En)

Undetected NHS healthcare workers who are COVID-19 test positive while still at work

Context:

Data show a wide range of asymptomatic infection rates (2% to 25%) in screened healthcare workers. Recent NHS data suggest a rate of ~5% of HCWs are COVID-19 positive while at work. CDC has reported that 8% of the HCW COVID-19 cases for whom they had clinical data had not reported fever, cough, or shortness of breath. Also, recent environmental sampling in a Wuhan hospital showed that two areas with high footfall - the entrance to a shop and a site next to one of the hospitals - had high levels of SARS-CoV-2.

Actions:

Action:

- i. Need to remphasise the need for healthcare workers to be alert for subtle symptoms of COVID-19. (A)
- ii. Use increased testing capacity to check for hidden/unsuspected COVID-19 in healthcare workers. (A)
- iii. Healthcare workers should be assigned to work in rather than across hospital zones; this is especially pertinent with redesign NHS working practices, for example to divide hospitals into areas with patients and healthcare workers that are COVID-19 positive, COVID-19 positive or COVID-19 indeterminate. (S/A)
- iv. Greater attention is needed by healthcare workers to social distancing, notably when not wearing PPE and in non-clinical areas. (A)
- v. Consideration should be given to recommending the routine use of surgical masks by healthcare workers including in non-clinical areas. (P)
- vi. Frequent cleaning of staff areas, including frequent touch points. (A)
- vii. Limiting the density of healthcare workers e.g. better staggering of meal breaks. (A)
- viii. Ensuring that staff areas are well ventilated as far as possible. (En)

Hand hygiene/drying**Context:**

The promoted healthcare hand washing technique includes an important paper towel step, in which hands and wrists are thoroughly dried. NHS guidance (and infection control teams) advise against the use of hand dryers in hospital clinical areas; clinical areas are not defined, however. It is clear that some hospital toilets, especially in communal areas, are used by patients, healthcare workers and visitors. Furthermore, hand dryers are prevalent in such hospital toilets.

Hand hygiene methods may have a significant effect on hand contamination and subsequent surface contamination. Experiments conducted using a bacteriophage surrogate showed that substantially more contamination was found on touch surfaces and on volunteers' clothing following drying hands using jet air dryers compared with paper towels. Work has also shown jet dryers to cause significant surface and air contamination in bathroom environments.

The risk of faecal excretion of SARS-CoV-2 is noted above.

There are issues concerning the use of paper towels instead of hand dryers, including fire load risk of waste paper in public spaces, the risk of toilet blockage from paper towels, and supply continuity, which need to be considered.

Actions:

- i. Paper towels should be used instead of hand dryers in toilets in all areas of hospitals. (A/En)
- ii. Guidance on hand hygiene and drying should be clearly displayed in all public toilet areas as well as staff areas. (A)
- iii. Management of paper towel waste needs to be considered carefully as this is potentially contaminated. (A)
- iv. Make doors to exit toilets “no touch” as far as possible so that people do not recontaminate hands on door handles touch plates. (En)

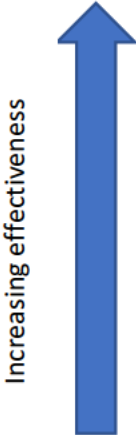
Other considerations

We note that application of these approaches will vary in hospitals according to area/building/site, not least given the wide range in risk according to the prevalence of (risk of contact with) SARS-CoV-2. Redesign of NHS working practices, for example to divide hospitals into areas with patients and healthcare workers that are COVID-19 positive, COVID-19 negative or COVID-19 indeterminate, will mean that differing infection prevention and control risk assessments are required according to location. These risk assessments need to take account of each specific environment, including considering the original design/intended function of each location. A simple example here is using a corridor as a patient waiting area. Ventilation/airflows in a corridor may disperse virus aerosols posing an infection risk, including to others who have to use the corridor. Thus, the corridor may not have been originally designed to manage such risks.

We also note that such redesign of NHS working practices/hospitals may only achieve partial segregation of (COVID-19 positive, COVID-19 negative or COVID-19 indeterminate) patients and healthcare workers. Some healthcare workers may pass between the different areas and patients from these separate areas may be required to attend a common department/service e.g. radiology.

In general, physical distancing and avoidance of high density groups (including healthcare workers) will be required to minimise risks of virus transmission. For example, no or limited visitors, and consultations by phone or video should be practised where possible.

Appendix 1: Hierarchy of control model that might be used for SARS-CoV-2 risk assessment

Elimination	Redesign the activity such that the risk is removed or eliminated	<p>Most effective – removes exposure</p>  <p>Increasing effectiveness</p> <p>Least effective – relies on personal compliance</p>
Substitution	Replace the activity with an activity that reduces the risk. Care is required to avoid introducing new hazards from the substitution.	
Engineering Controls	Design measures that help control or mitigate risks, such as barriers, guards, etc. Priority should be given to measures that provide collective protection rather than those that just protect individuals or a small group of people.	
Administrative Controls	Identifying and implementing the procedures to improve safety, such as undertaking risk assessments, preparing and communicating mitigating procedures, and increasing signage.	
PPE	Personal Protective Equipment: local kit to mitigate the risks to those exposed to the hazard. People must be familiar with the function and limitation of each item of PPE for this to be an effective measure. Ideally, PPE is only considered after all previous measures higher in the hierarchy are identified as not being fully effective in controlling the risks.	

PHIA probability yardstick – to be used when expressing likelihood or confidence

