



**NFL Infectious Disease News – April 2020  
Duke Infection Control Outreach Network (DICON)  
Volume 11, Number 4**

**Update #4 - Environmental Transmission of COVID-19: Basic Principles, Controversies and Practical Advice on Reducing the Risk of Transmission of Coronaviruses in Athletic Facilities**

**Background.** Coronaviruses are transmitted by two main routes: respiratory droplets and contaminated environments. The most common method of spread is through respiratory droplets generated when infected individuals cough, sneeze, talk or exhale; these droplets can directly infect others in close proximity (i.e., within 6 feet). As a result, the majority of infection prevention recommendations are designed to decrease exposure to respiratory droplets from infected individuals (e.g., social distancing). Infectious droplets can also cause environmental contamination that, in turn, serve as a source of indirect (secondary) transmission when susceptible individuals touch these surfaces and then transfer virus to their mouths or other mucous membranes via contaminated hands. The frequency and relative importance of secondary transmission from contaminated surfaces remain controversial. This newsletter will discuss the available data on the frequency and duration of environmental contamination of COVID-19, explain unresolved issues about its importance, and provide current best practices for reducing the risk of secondary transmission in athletic facilities.

**Data on the transmissibility of coronaviruses in the environment.** Various investigators have demonstrated that SARS-CoV-2 can be recovered from environmental surfaces (e.g., stainless steel, plastic, cardboard, paper, mask surface) in experimental studies for periods ranging from a few hours to multiple days [1]. Widespread environmental viral contamination of door handles, bed sheets, bed rails, medical equipment, and other surfaces in bathrooms and elsewhere has been demonstrated in the rooms of hospitalized patients with COVID-19 [2]. Studies of the coronavirus that caused Severe Acute Respiratory Syndrome (SARS) and the Middle East Respiratory Syndrome (MERS) showed similar findings [3]. The duration and extent of viral contamination is affected by the ambient temperature, relative humidity, and the size of the inoculum of virus in droplets, which vary from patient to patient depending on the stage and severity of illness [4].

**Unresolved issues related to the infectiveness of coronaviruses on environmental surfaces.** To our knowledge, there are no conclusive studies that have quantitated the frequency or relative importance of environmental spread of coronaviruses compared to spread via respiratory droplets. While secondary transfer of COVID-19 from the environment can and has led to infections, information is currently lacking on several key issues:

- Some of the previously mentioned studies have demonstrated that the RNA in SARS-CoV-2 virus was transmissible in the environment, as it could be cultured after recovery from an environmental surface. Other studies simply showed that viral RNA was present but did not determine if this RNA was sufficient for transmission.
- To our knowledge, no one has determined the minimum infective dose or inoculum of SARS-CoV-2 virus that is capable of causing disease in exposed individuals. In fact, the minimum infective inoculum probably varies between individuals based on differences in age, co-morbidities, and behaviors. In all likelihood, we will never know the minimum infective dose, as this is usually determined through virus challenges that would be unethical given the high morbidity and mortality related to SARS-CoV-2 infection.
- The “transferability” of virus on and from different environmental surfaces remains unknown, but the propensity that exposure will result in transfer of an infectious viral dose to an exposed mucous membrane likely varies by frequency, intensity, and duration of contact.

Despite these unresolved issues, we and most other infectious disease specialists and epidemiologists believe that environmental transmission can and does occur. Thus, the mitigation measures discussed below are logical, appropriate, and likely to reduce the risk of transmission of COVID-19.

**Practical advice for reducing the risk of environmental transmission of SARS-CoV-2 virus in athletic facilities.** Well-designed studies have shown that all coronaviruses are rapidly and effectively eliminated by common cleaning agents and disinfectants, including the disinfectants DICON currently recommends for cleaning your athletic facility (see **Section 3 of the DICON Manual**). In addition, the EPA recently summarized disinfectants with presumed activity against SARS-CoV-2 (<https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2>). More specifically, disinfectants that contain quaternary ammonium (quats), hydrogen peroxide, or bleach are highly effective in eradicating coronaviruses on surfaces. When disinfecting surfaces in the training facility, be sure to follow these steps:

- Use microfiber cloths to apply quats (see **Best Practice 3.A.iii. in the DICON Manual**).
- Ensure that surface disinfectants are not wiped away until the appropriate “contact time” has been achieved. Refer to the label on the disinfectant used in your facility (and EPA list N, linked above) for the specific contact time required. As a rule of thumb, disinfectants must stay wet on surfaces for *at least* one minute, though some may require a longer contact time to ensure appropriate eradication of SARS-CoV-2 (see **Best Practice 3.A.iv. in the DICON Manual**).
- Use electrostatic sprayers to ensure complete application of disinfectants to all surfaces (see **Best Practice 3.A.v. in the DICON Manual**). In most cases, this strategy should be considered as “adjunctive” and used to apply additional disinfectant after manual disinfection has been performed.
- Other measures are often used in healthcare facilities to “enhance” standard disinfection methods. The two most important and evidence-based of these measures are UV germicidal irradiation and vaporized hydrogen peroxide. Both are likely effective in eliminating coronaviruses. However, we are currently unaware of sufficient peer-reviewed data to recommend these enhanced disinfection strategies in outpatient or training room settings (see **Best Practice 3.C.ii in the DICON Manual**). That said, we acknowledge that use of these

enhanced strategies may provide benefit, particularly for public relations and facility morale. Each of these strategies has significant logistical limitations that must be addressed, though these limitations are beyond the scope of this discussion.

- In inpatient settings, environmental services personnel are instructed to wear gowns and gloves when disinfecting a COVID-19 hospital room. However, routine disinfection of the environment can be performed without special precautions in outpatient facilities and athletic facilities.
- Surfaces should be disinfected after each use, whenever possible (*see Best Practice 3.B.i. in the DICON Manual*). At baseline, we recommend cleaning and disinfecting the entire facility at least once each day. We believe that increased frequency of disinfection is warranted in athletic facilities during the current pandemic (i.e., two times each day or more).

### Summary Points and Conclusions

1. Although many questions remain unresolved about the frequency and importance of environmental transmission of coronaviruses, most experts believe such transmission can occur. Thus, environmental disinfection has become an important prevention measure in healthcare facilities.
2. Disinfectants that contain quaternary ammonium compounds (quats), hydrogen peroxide, or bleach are highly effective in eradicating coronaviruses from the environment. Routine cleaning does not require the use of special protective equipment such as goggles or gowns.
3. Electrostatic sprayers that ensure complete application of disinfectants to all surfaces are recommended as an “adjunctive” measure after manual disinfection has been performed.
4. Enhanced cleaning methods such as UV germicidal irradiation and vaporized hydrogen peroxide are not currently recommended as a routine or absolutely necessary but can have benefit as discussed above.

### References

1. van Doremalen N, Bushmaker T, Morris DH, et al. Aerosol and surface stability of HCoV-19 (SARS-CoV-2) compared to SARS-CoV-1. *N Engl J Med* 2020. doi: 10.1056/NEJMc2004973.
2. Ong SW, Tan YK, Chia PY, et al. Air, surface environmental, and personal protective equipment contamination by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) from a symptomatic patient. *JAMA* published online March 4, 2020 doi:10.1001/jama.2020.3227.
3. Bin SY, Heo JY, Song MS, et al. Environmental contamination and viral shedding in MERS patients during MERS-CoV outbreak in South Korea. *Clin Infect Dis* 2016;62(6):755-760.
4. Otter JA, Donskey C, Yesli S et al. Transmission of SARS and MERS coronaviruses and influenza viruses in healthcare settings: the possible role of dry surface contamination. *J Hosp Infect* 2016;92:235-50