

Hygiene concerns regarding SARS-CoV-2 (COVID-19, Novel Coronavirus) and considerations when using public restrooms and restaurants



Executive Summary

Due to the present pandemic situation with COVID-19, two scientists have conducted a short literature review to add their microbiological and hygiene perspectives on the spreading of SARS-CoV-2 with a focus on areas of public restrooms and restaurant environments.

Topics discussed are: How the virus spreads; the risk of touching surfaces in public restrooms; surface contamination risks of different materials including plastic towel and napkin dispensers and paper refills; and the importance of handwashing.

This summary represents the current knowledge as of July 2020.

What is SARS-CoV-2?

SARS-CoV-2 is the name of the virus which causes the disease COVID-19 also called the Novel Coronavirus.

In early 2020, after a December 2019 outbreak in China, the World Health Organization identified SARS-CoV-2 as a new type of coronavirus which causes a disease called COVID-19 with symptoms ranging from mild to deadly.

COVID-19 spreads very easily and sustainably between people - mainly through close contact from person-to-person³. Also, people without symptoms may be able to spread the virus. Information from the ongoing COVID-19 pandemic suggests that this virus is spreading more efficiently than influenza, but not as efficiently as measles, which is highly contagious. In general, the more closely a person interacts with others, and the longer that interaction, the higher the risk of COVID-19 spread²⁵.

SARS-CoV-2 is one of seven types of human coronavirus. Generally, coronaviruses are a large family of viruses which may cause illness in animals or humans. In humans, several coronaviruses are known to cause respiratory infections ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS)^{28, 31}.

Coronaviruses are enveloped viruses - which in electron micrographs of spherical particles create an image reminiscent of the solar corona. Enveloped viruses have an outermost lipid bilayer coating and structures within the envelope, different proteins, are used to attach to and enter human cells⁶. The envelope does not make the virus more resistant as might be thought at first glance. Due to its lipid bilayer, the envelope is quite easily destroyed by heat, soaps, alcohol, UV light, etc. When the envelope is destroyed, the virus becomes unable to infect.

Different coronavirus species are not identical, but they have some qualities in common. As SARS-CoV-2 is a new coronavirus, there is not much known about its properties. For this reason, studies of other coronaviruses could be considered when making assumptions regarding SARS-CoV-2. Experience is taken from SARS(-CoV-1) and MERS. Additionally, it is also easier to experiment with less pathogenic species, and therefore more data is available if studies on related viruses are considered.

What is the route of infection for SARS-CoV-2?

This virus is primarily spread from person to person, via small air-droplets, and coming from infected people sneezing and coughing, but also when speaking ^{7,21}. It is most important to keep distance from infected people. Outdoor air is preferable to being indoors in small, inadequately ventilated environments ²⁴. It may be possible that a person can get COVID-19 by touching a surface or object that has the virus on it, and then touching their own mouth, nose or possibly their eyes ²⁵. This way of transmission cannot be excluded but this is not thought to be the main way the virus spreads because the environmental stability of SARS-CoV-2 is regarded as low ^{4,22}. To avoid surface transmission, washing and/or disinfecting hands is very important ¹. At this point there is no evidence that people can be infected via water or food ^{7,15}.

What is the survivability of SARS-CoV-2 on surfaces and in air?

In contrast to bacteria, which are living organisms, viruses are infectious particles without their own metabolism. In order to multiply, viruses need a living cell as a host. Therefore, they can never grow on their own, e.g. in humid areas, as bacteria do. It is more precise to talk about inactivating a virus, rather than killing it. An inactivated virus can no longer cause infection.

Generally, the environmental survivability of coronaviruses depends on many different factors including humidity, temperature, how many viruses were initially added, material, presence of substances, etc. Furthermore, some parameters seem to benefit human coronaviruses such as the stabilizing effect of low temperature and high relative humidity ^{2,8,19}. The analysis of several studies reveals that human coronaviruses such as SARS, MERS or endemic human coronaviruses (HCoV) can persist on inanimate surfaces like metal, glass or plastic for up to several days.

The aerosol and surface stability of SARS-CoV-2 and SARS-CoV-1 was investigated by van Doremalen *et al.* ²². The results indicate that aerosol and fomite transmission of SARS-CoV-2 is plausible, since the virus can remain viable and infectious in aerosols for hours and on surfaces for days (depending on the inoculum shed). The amount of virus on a surface is important. If many viruses are applied, it will take longer before decreasing to a sufficiently low number of viruses so they cannot infect anymore, compared to very few viruses being applied from the beginning. All these parameters, the difference in amount of virus applied, and the method of virus detection make it difficult to compare results between different studies.

Chin *et al.* ⁴ investigated the stability of SARS-CoV-2 in different environmental conditions including the survivability on tissue papers. In an experimental setting, droplets of virus culture were pipetted on different materials and the virus titer was measured at different elapsed time points. It was shown that at the first measurement time after 30 min of incubation, the virus load on paper was greatly reduced. After 3 hours, no virus was detectable.

In another study, data are reported on the presence of SARS-CoV-2 on inanimate surfaces under real life conditions. An Infectious Disease Emergency Unit and in a Sub-Intensive Care ward that were deemed likely to be contaminated by the presence of the virus were investigated by swabbing surfaces and objects. The results suggest a lower level of virus was found under real-life conditions (which is different to the above-mentioned experimental studies conducted under controlled lab conditions) ⁵.

Coronaviruses seem to have a low stability in the environment and are very sensitive to oxidants, like chlorine ¹⁵. Sunlight (UV-light) and ozone also help destroy this virus ²⁴. And the virus can be efficiently inactivated by surface disinfection procedures ¹².

In a study by van Doremalen *et al.* it was shown that SARS-CoV-2 was more stable on plastic and stainless steel than on copper and cardboard. On plastics and stainless steel, it can survive for several days. The survival on absorbent surfaces like paper boards and tissue paper is in the range of minutes to hours. The risk of transmission via touching of contaminated paper is low ²⁰. The same results of experiments have been published for SARS-CoV-1¹⁶ where large respiratory droplets of SARS-CoV containing the virus fell onto paper. Even with a higher concentration of virus than would normally occur in nasopharyngeal aspirate samples, no virus infectivity remained after the paper was dried. These findings led to the conclusion that the risk of infection via contact with droplet-contaminated paper is small.

Is there a risk of getting COVID-19 visiting a public restroom?

Since spreading of this virus is attributed mainly to air droplets/aerosols from people with COVID-19, social distancing has been considered as a major action to prevent spreading of this disease ^{26,29}. Additionally, frequent and thorough handwashing is another highly recommended measure ³⁰.

Within the COVID-19 pandemic the use of public restrooms might bear the risk of being infected because these are visited frequently by different people and they are easily crowded. Additionally, the space often has poor ventilation. Evidence suggests that COVID-19 could be transmitted via air in inadequately ventilated environments ²⁴. Jet air driers for drying hands have been found to increase the spreading of many different microbes, including viruses, via air to different surfaces in the bathroom ¹³.

Surfaces in the restroom could also be contaminated with SARS-CoV-2 by sneezing, coughing or via aerosols from speaking.

Flushing the toilet without a lid has also been discussed as a potential risk. Flushing a toilet without a lid (or without closing the lid) may create aerosols, and the stools of people infected can contain many viruses. However, it is unclear whether the virus in feces is infectious but might be an additional source for transmission ^{11, 17, 23}.

Considering the spatial characteristics of public restrooms, together with fact of being highly frequented areas, restroom visits can present a risk. This creates a dilemma. On the one hand, restrooms are not ideal places to stay, but on the other hand, they should be visited for hygienic reasons. The conclusion from this could be that the visit should be efficient and short, in order to limit exposure time and to help prevent overcrowding.

Why is handwashing important?

All surfaces outside and inside the restroom could potentially harbor unwanted bacteria and viruses. For this reason, handwashing is the important last step before leaving this space ²⁷.

Washing hands with soap and water followed by drying with towels are efficient ways to reduce both bacteria and viruses from hands ^{9, 10}. SARS-CoV-2 virus is sensitive to detergents in the soap as this destroys the envelope surrounding the virus which is needed for the virus to be virulent. Alcohol-based disinfectants also work in the same way ¹⁴.

Hand drying is a very important part of handwashing. It is the last stage of the handwashing process and must leave the hands thoroughly dried and hygienic ^{9, 10}. A recommended way is the use of hand towels which not only absorb water but additionally use mechanical effects to remove bacteria and viruses. The use of disposable paper hand towels is generally considered hygienic and efficient for this purpose ¹⁸.

What should be considered to hygienically dispense paper hand towels?

There have been discussions regarding the safe use of dispensers and paper in restrooms and the risk of self-infection by touching contaminated surfaces or materials - followed by virus transmission to eyes, mouth or nose (mucus contact). Hygienically designed dispensers for paper hand towels, toilet paper and paper napkins should be easy to clean and fill. Dispenser design should allow the user to take the paper product without touching the dispenser itself. There is touch-free sensor-activated and touch-free manual hand towel dispensers available. Bearing in mind that the length of time spent in public restrooms should be limited, intuitive systems with a high-speed delivery of paper towels like touch-free manual hand towel systems are recommended.

The paper itself is considered a low risk material for keeping and transferring viruses ^{4, 16, 20, 22}. Reliable and fast access to paper towels allows the user to take an additional towel that can be used to cover the door handle of the restroom in order to prevent direct touching of the door handle with clean hands when exiting.

Is using paper dispenser napkins a concern in a restaurant?

Like paper towels napkins are made of tissue paper. The range of virus inactivation on absorbent materials like paper tissues ranges from minutes to hours, and the risk of transmission via touching contaminated paper is low ²⁰. When napkins are hygienically protected within the dispenser casing, it provides a dry environment which is unsuitable for viral survival. Therefore, paper napkins provided in dispensers should not give rise to concern regarding transmission of SARS-CoV-2.

Summary and Conclusions



Since SARS-CoV-2 is primarily spread via small air droplets from infected people, the most important preventive measures are social distancing and frequent handwashing



The virus could be transmitted via air in inadequately ventilated environments like small restrooms. Therefore, the restroom visit should be efficient and short in order to limit the exposure time and to help prevent overcrowding in the restroom



Hygienic handwashing includes efficient hand drying. Paper towels are recommended as they not only dry hands thoroughly but also provide a mechanical removal of virus and bacteria. They also serve as a method to protect hands when touching surfaces and door handles.



Touch-Free manual hand towel dispenser systems deliver paper towels hygienically in a quick, intuitive and reliable way.



Generally, the risk of transfer of SARS-CoV-2 viruses from paper used as an absorbent material in paper towels and napkins is regarded as low

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References

1. Beale S, Johnson AM, Zambon M et al. Hand Hygiene Practices and the Risk of Human Coronavirus Infections in a UK Community Cohort [version 1; peer review: awaiting peer review] *Wellcome Open Research* 2020, 5:98 <https://doi.org/10.12688/wellcomeopenres.15796.1>
2. Casanova LM, Jeon S, Rutala WA, Weber DJ, Sobsey MD. Effects of air temperature and relative humidity on coronavirus survival on surfaces. *Appl Environ Microbiol.* 2010;76(9):2712-2717. doi:10.1128/AEM.02291-09
3. Chan JF, Yuan S, Kok KH, et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. *Lancet.* 2020;395(10223):514-523. doi:10.1016/S0140-6736(20)30154-9
4. Chin AWH, Chu JTS, Perera MRA, Hui KPY, Yen HL, Chan MCW, Peiris M, Poon LLM. Stability of SARS-CoV-2 in different environmental conditions. *The Lancet Microbe.* 2020 May;1(1):e10. doi:10.1016/S2666-5247(20)30003-3.
5. Colaneri M, Seminari E, Novati S, et al. SARS-CoV-2 RNA contamination of inanimate surfaces and virus viability in a health care emergency unit [published online ahead of print, 2020 May 22]. *Clin Microbiol Infect.* 2020;S1198-743X(20)30286-X. doi:10.1016/j.cmi.2020.05.009
6. Cyranoski D. Profile of a killer: the complex biology powering the coronavirus pandemic. *Nature.* 2020;581(7806):22-26. doi:10.1038/d41586-020-01315-7
7. Eslami H, Jalili M. The role of environmental factors to transmission of SARS-CoV-2 (COVID-19). *AMB Express.* 2020;10(1):92. Published 2020 May 15. doi:10.1186/s13568-020-01028-0
8. Geller C, Varbanov M, Duval RE. Human coronaviruses: insights into environmental resistance and its influence on the development of new antiseptic strategies. *Viruses.* 2012;4(11):3044-3068. Published 2012 Nov 12. doi:10.3390/v4113044
9. Huang C, Ma W, Stack S. The hygienic efficacy of different hand-drying methods: a review of the evidence. *Mayo Clin Proc.* 2012;87(8):791-798. doi:10.1016/j.mayocp.2012.02.019
10. Jensen D, Schaffner D, Danyluk M, Harris L. Efficacy of handwashing duration and drying methods. *external icon Int Assn Food Prot.* 2012 July.
11. Johnson DL, Mead KR, Lynch RA, Hirst DV. Lifting the lid on toilet plume aerosol: a literature review with suggestions for future research. *Am J Infect Control.* 2013;41(3):254-258. doi:10.1016/j.ajic.2012.04.330
12. Kampf G, Todt D, Pfaender S, Steinmann E. Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents. *J Hosp Infect.* 2020;104(3):246-251. doi:10.1016/j.jhin.2020.01.022
13. Kimmitt PT, Redway KF. Evaluation of the potential for virus dispersal during hand drying: a comparison of three methods. *J Appl Microbiol.* 2015 120, 478-486. doi/epdf/10.1111/jam.13014
14. Kratzel A, Todt D, V'kovski P, et al. Inactivation of Severe Acute Respiratory Syndrome Coronavirus 2 by WHO-Recommended Hand Rub Formulations and Alcohols. *Emerging Infectious Diseases.* 2020;26(7):1592-1595. doi:10.3201/eid2607.200915.
15. La Rosa G, Bonadonna L, Lucentini L, Kenmoe S, Suffredini E. Coronavirus in water environments: Occurrence, persistence and concentration methods - A scoping review. *Water Res.* 2020;179:115899. doi:10.1016/j.watres.2020.115899
16. Lai MY, Cheng PK, Lim WW. Survival of severe acute respiratory syndrome coronavirus. *Clin Infect Dis.* 2005 Oct 1;41(7):e67-71. doi: 10.1086/433186. Epub 2005 Aug 22. PMID: 16142653; PMCID: PMC7107832.
17. Li YY, Wang JX, Chen X. Can a toilet promote virus transmission? From a fluid dynamics perspective. *Phys Fluids* (1994). 2020;32(6):065107. doi:10.1063/5.0013318
18. Moura I, Ewin D, Wilcox M. Small study shows paper towels much more effective at removing viruses than hand dryers. News release 16-APR-2020, European society of clinical microbiology and infectious disease. https://www.eurekalert.org/pub_releases/2020-04/esoc-sss041520.php
19. Otter JA, Donskey C, Yezli S, Douthwaite S, Goldenberg SD, Weber DJ. Transmission of SARS and MERS coronaviruses and influenza virus in healthcare settings: the possible role of dry surface contamination. *J Hosp Infect.* 2016;92(3):235-250. doi:10.1016/j.jhin.2015.08.027
20. Ren SY, Wang WB, Hao YG, et al. Stability and infectivity of coronaviruses in inanimate environments. *World J Clin Cases.* 2020;8(8):1391-1399. doi:10.12998/wjcc.v8.i8.1391
21. Stadnytskyi V, Bax CE, Bax A, Anfinrud P. The airborne lifetime of small speech droplets and their potential importance in SARS-CoV-2 transmission. *Proc Natl Acad Sci U S A.* 2020;117(22):1187511877. doi:10.1073/pnas.2006874117
22. van Doremalen N, Bushmaker T, Morris DH, et al. Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1. *N Engl J Med.* 2020;382(16):1564-1567. doi:10.1056/NEJMc2004973
23. Xiao F, Sun J, Xu Y, Li F, Huang X, Li H, et al. Infectious SARS-CoV-2 in feces of patient with severe COVID-19. *Emerg Infect Dis.* 2020 Aug [June 2020]. <https://doi.org/10.3201/eid2608.200681> https://wwwnc.cdc.gov/eid/article/26/8/20-0681_article?deliveryName=USCDC_333-DM28664
24. Yao M, Zhang L, Ma J, Zhou L. On airborne transmission and control of SARS-Cov-2. *Sci Total Environ.* 2020;731:139178. doi: 10.1016/j.scitotenv.2020.139178
25. CDC 1 <https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/how-covidspreads.html>.
26. CDC 2 <https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html>
27. CDC 3 [<https://www.cdc.gov/coronavirus/2019-ncov/hcp/hand-hygiene.html>].
28. WHO 1 <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/q-a-coronaviruses>].
29. WHO 2 https://www.who.int/health-topics/coronavirus#tab=tab_2.
30. WHO 3 https://www.who.int/gpsc/clean_hands_protection/en/.
31. Medical news today <https://www.medicalnewstoday.com/articles/256521>] 22.06.2020