

Studies & Research on Detection & Infectivity Potential of COVID-19 (SARS-CoV-2) on Inanimate Surfaces

In response to the San Francisco Public Library's (SFPL) questions regarding interpretation of the most recent REALM study findings of the COVID-19 respiratory droplets on Library materials, the San Francisco Department of Public Health, Occupational Safety & Health unit (SF DPH-OSH) requested the Information and Guidance Section (I&G) of the City's COVID Command Center perform a literature review on the risks and risk mitigation for returned library material contamination in light of SARS-CoV2. The literature review was performed by a Library employee working as a content researcher with I&G in their Disaster Service Worker (DSW) role.

The following is a list of the studies provided by I&G as well as some additional recently released studies.

1. *The Lancet Infectious Diseases* 20.8 (2020) by Goldman, Emanuel. "Exaggerated Risk of Transmission of COVID-19 by Fomites" states:

"In my opinion, the chance of transmission through inanimate surfaces is very small, and only in instances where an infected person coughs or sneezes on the surface, and someone else touches that surface soon after the cough or sneeze (within 1–2 h). I do not disagree with erring on the side of caution, but this can go to extremes not justified by the data. Although periodically disinfecting surfaces and use of gloves are reasonable precautions especially in hospitals, I believe that fomites that have not been in contact with an infected carrier for many hours do not pose a measurable risk of transmission in non-hospital settings. A more balanced perspective is needed to curb excesses that become counterproductive."

Is the amount of the virus the REALM study applied to the test materials reasonable?

Per Dr. Emanuel Goldman's article, and as he has communicated to the REALM Project:

- *"I am a virologist and microbiologist who published a Comment in Lancet last month concerning the risk (or lack thereof) of transmitting COVID-19 by inanimate objects such as library materials. See [https://www.thelancet.com/journals/laninf/article/PIIS1473-3099\(20\)30561-2/fulltext](https://www.thelancet.com/journals/laninf/article/PIIS1473-3099(20)30561-2/fulltext).*

Numerous librarians worldwide have contacted me because the advice you are providing is in disagreement with the assessment that I published in the Lancet comment. I was asked to look at the research study on which your recommendations are based, and I find that research to be subject to the same criticism of the research I reviewed in my Lancet Comment, namely the work used extraordinarily huge and unrealistic amounts of virus (2.6×10^5 , i.e., 260,000) on the materials tested. This has essentially no relation to a real-life scenario, as discussed in my Lancet Comment."

- ***"The work used extraordinarily huge and unrealistic amounts of virus (2.6×10^5 , i.e., 260,000) on the materials tested. This has essentially no relation to a real-life scenario. Even with these large amounts, half of the virus is dead after 1 hour on the surface. With a half-life of 1 hour, 7 hours would be enough to expect no remaining virus on library materials if the amount at the start were 100 virus particles, already a high end start point in itself."***
- ***"Many studies of virus presence on surfaces (and even in liquids) are based on detection of viral RNA and not on the presence of infectious viral particles. In cases where infectious virus particles have been measured, results show much less infectious virus compared to the amount of virus predicted from the RNA content. In one study with the original SARS virus, there was no detectable infectious virus found in samples containing considerable viral RNA (reference 7 in my published Lancet Comment).***
- ***"There are NO confirmed cases of transmission of this virus by surfaces in the scientific literature, and there is at least one report of lack of transmission by surfaces where it would have been expected had it occurred."***

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- ***“In my opinion, the risk of transmission on library materials is negligible, but if you want to play it safe, leave the materials undisturbed for a day. No cleaning would be required in that case.”***
2. *The Lancet Infectious Diseases Correspondence* (September 29, 2020) by Goldman, Emanuel, et al "Low risk of SARS-CoV-2 transmission by fomites in real-life conditions" - [https://www.thelancet.com/journals/laninf/article/PIIS1473-3099\(20\)30678-2/fulltext](https://www.thelancet.com/journals/laninf/article/PIIS1473-3099(20)30678-2/fulltext)
- Performed two sequential studies seeking to determine on one hand the extent, if any, of contamination of inanimate surfaces in a standard infectious disease ward of a major referral hospital in northern Italy, and on the other hand whether the risk of contamination was higher in emergency rooms and sub-intensive care wards than on ordinary wards.
 - **Our findings suggest that environmental contamination leading to SARS-CoV-2 transmission is unlikely to occur in real-life conditions, provided that standard cleaning procedures and precautions are enforced.**
 - **These data would support Goldman’s point that the chance of transmission through inanimate surfaces is less frequent than hitherto recognised.**
3. Studies cited in the “Wired” article *“It’s Time to Talk About COVID-19 and Surfaces Again”* (<https://www.wired.com/story/its-time-to-talk-about-covid-19-and-surfaces-again/>) further support these findings. Specifically they state:
- ***“Depending on the material, the researchers could still detect the virus after a few hours on cardboard, and after several days on plastic and steel. They were careful to say that their findings only went as far as that. They were reporting how quickly the virus decayed in a laboratory setting, not whether it could still infect a person or was even a likely mode of transmission.” “Plus, the amount of remaining virus doesn’t tell us much about whether it could reasonably get into someone’s airways and cause an infection.”***
“Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1, April 16, 2020” - UCLA, the National Institutes of Health & Princeton researchers
 - ***In a study published in September in Clinical Microbiology and Infection, researchers in Israel tried to piece it all together. They conducted lab studies, leaving samples out for days on various surfaces, and found they could culture the remaining virus in tissue. In other words, it remained infectious. Then they gathered samples from highly contaminated environments: Covid-19 isolation wards at a hospital, and at a hotel used for people in quarantine. The virus was abundant. But when they tried to culture those real-world samples, none were infectious. Later that month, researchers at an Italian hospital reported similar conclusions in The Lancet.***

Conclusions: Despite prolonged viability of SARS-CoV-2 under laboratory-controlled conditions, uncultivable viral contamination of inanimate surfaces might suggest low feasibility for indirect fomite transmission.

Clinical Microbiology and Infection 2020;1 by Amir Ben-Shmuel, et al “Detection and Infectivity Potential of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Environmental Contamination in Isolation Units and Quarantine Facilities”, Clinical Microbiology and Infection, September 10, 2020

- ***“Consider, Wyllie says, the extraordinary chain of events that would need to happen to successfully spread SARS-CoV-2 on a surface. A sufficiently large amount of the virus would need to be sprayed by an infected person onto a surface. The surface would need to be the right kind of material, exposed to the right levels of light, temperature, and humidity so that the virus does not quickly degrade. Then the virus would need to be picked up—which you***

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*would most likely do with your hands. But the virus is vulnerable there. (“Enveloped” viruses like SARS-CoV-2 **do not fare well** on porous surfaces like skin and clothing.) And then it needs to find a way inside you—usually through your nose or your eye—in a concentration big enough to get past your mucosal defenses and establish itself in your cells. The risk, Wyllie concludes, is low.* (Anne Wyllie – Microbiologist, Yale University)

4. *The Lancet Microbe* 1.1 (2020) by Chin,Chu, et al “Stability of SARS-CoV-2 in different environmental conditions” which states:
“No infectious virus could be recovered from printing and tissue papers after a 3-hour incubation, whereas no infectious virus could be detected from treated wood and cloth on day 2. By contrast, SARS-CoV-2 was more stable on smooth surfaces.”
5. The webinar, “Mitigating COVID-19 When Managing Paper-Based, Circulating, and Other Types of Collections, March 30, 2020”: Dr. Berendes, epidemiologist, and Dr. Rasberry, Health Scientist at the CDC, in addressing the handling of library and museum collections stated:
They are not concerned about transmission via paper products. “So again for paper based products, we're really not concerned and you don't have to really worry about finding ways to disinfect those materials. The virus, if it's present, would be present in very low quantities and would die off pretty quickly.
6. *Longitudinal monitoring of SARS-CoV-2 RNA on high-touch surfaces in a community setting* by Abigail P. Harvey^{1#}, Erica R. Fuhrmeister^{1#}, Molly Cantrell¹, Ana K. Pitol², Jenna M. Swarthout¹, Julie E. Powers¹, Maya L. Nadimpalli¹, Timothy R. Julian^{3,4,5}, Amy J. Pickering^{1,6*} medRxiv preprint doi: <https://doi.org/10.1101/2020.10.27.20220905>
“Environmental surveillance of surface contamination is an unexplored tool for understanding transmission of SARS-CoV-2 in community settings. We conducted longitudinal swab sampling of high touch non-porous surfaces in a Massachusetts town during a COVID-19 outbreak from April to June 2020. Twenty-nine of 348 (8.3 %) surface samples were positive for SARS-CoV-2, including crosswalk buttons, trash can handles, and door handles of essential business entrances (grocery store, liquor store, bank, and gas station). The estimated risk of infection from touching a contaminated surface was low (less than 5 in 10,000), suggesting fomites play a minimal role in SARS-CoV-2 community transmission. The weekly percentage of positive samples (out of n=33 unique surfaces per week) best predicted variation in city-level COVID-19 cases using a 7-day lead time. Environmental surveillance of SARS-CoV-2 RNA on high-touch surfaces could be a useful tool to provide early warning of COVID-19 case trends.”
7. Center for Disease Control (CDC) “Polling Locations and Voters Interim guidance to prevent spread of coronavirus disease 2019 (COVID-19), November 23, 2020”
<https://www.cdc.gov/coronavirus/2019-ncov/community/election-polling-locations.html>
States:
“Mail-in ballots submitted directly to polling locations can be held for three hours prior to processing to further reduce risk.” This is of interest because it can be reasonably anticipated that per unit of surface area ballots would have greater exposure than library books and similar materials. The CDC guidance naturally emphasizes the importance of hand hygiene when handling ballots.
8. AIHA “Reopening: Guidance for Libraries” states:
“Books and other paper-based materials are not considered a high risk for transmission. - Books and other library materials that have been handled by patrons within the facility should be isolated for a minimum of 24 hours before re-shelving. Isolate for 72 hours, if possible, for

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additional precautions. Disinfect, if possible, after isolation period. - Books and other library materials that have been checked out, then returned, should be isolated for a minimum of 48 hours before re-shelving. Isolate for 72 hours, if possible, for additional precautions. Disinfect, if possible, after isolation period."

NOTE: This document does not cite any studies to justify their isolation recommendations.

9. *New Variants of Coronavirus: What You Should Know*, Hopkins Medicine, Updated February 22, 2021 <https://www.hopkinsmedicine.org/health/conditions-and-diseases/coronavirus/a-new-strain-of-coronavirus-what-you-should-know>

Bollinger says that as of now, none of the new coronavirus variants call for any new prevention strategies. "We need to continue doing what we're doing," he says.

Ray concurs: "There is no demonstration yet that these variants are biologically different in ways that would require any change in current recommendations meant to limit spread of COVID-19," he says. "Nonetheless, we must continue to be vigilant for such phenomena."

Ray stresses that human behavior is important. The more people who are infected, the more chances there are for a mutation to occur. Limiting the spread of the virus through maintaining COVID-19 safeguards (mask wearing, physical distancing and practicing hand hygiene) gives the virus fewer chances to change. It also reduces the spread of more infectious variants, if they do occur.

"We need to re-emphasize basic public health measures, including masking, physical distancing, good ventilation indoors and limiting gatherings of people in close proximity with poor ventilation. We give the virus an advantage to evolve when we congregate in more confined spaces," he says.

Based on the information cited above, DPH-OSH recommends that:

- **As a highly conservative protective measure, returned materials should be quarantined for one day.** The one day (24 hour) quarantine period exceeds that used for other activities (example, handling of voting materials) so can be reconsidered should operational issues arise.
- Continue to emphasize with staff the importance of frequent hand washing, avoiding touching their faces and frequent cleaning of high touch surfaces.