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SARS-CoV-2 virus transfers to skin through contact with contaminated solids

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Transfer of SARS-CoV-2 from solids to fingers is one step in infection via contaminated solids, and the possibility of infection from this route has driven calls for increased frequency of handwashing during the COVID-19 pandemic. To analyze this route of infection, we measured the percentage of SARS-CoV-2 that was transferred from a solid to an artificial finger. A droplet of SARS-CoV-2 suspension (1 μ L) was placed on a solid, and then artificial skin was briefly pressed against the solid with a light force (3 N). Transfer from a variety of solids was detected, and transfer from the non-porous solids, glass, stainless steel, and Teflon, was substantial when the droplet was still wet. The viral titer for the finger was 13–16% or 0.8–0.9 log less than for the input droplet. Transfer still occurred after the droplet evaporated, but was smaller, 3–9%. We found a lower level of transfer from porous solids but did not find a significant effect of solid wettability for non-porous solids.

In the period January 2020 to May 2021, about 170 million people contracted COVID-19, and about 3.6 million have died as a result of the illness¹. The disease is caused by a virus, SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2). In 2020, the US CDC stated that the primary mechanism for transmission is close contacts or inhalation of respiratory droplets². Some diseases can also be transferred via contaminated solids (fomites), and the World Health Organization states that “fomite transmission is considered a likely mode of transmission for SARS-CoV-2”³. A study on hamsters showed that direct inhalation is the main mechanism, but infection via fomite transmission also occurred⁴. Modelling of the pandemic and disease transmission found that up to 25% of the disease transmissions during lockdown was via fomites⁵. Studies have shown that SARS-CoV-2 remains infective up to 7 days after a droplet is placed on some solids^{6,7}, indicating the window of possible infection from solids may be large. This has led to widespread fear of touching communal objects and to health authorities suggesting that people increase the frequency and quality of their hand-washing⁸. A parallel approach is to design coatings for solids that inactivate the virus and to apply these coatings to communal objects^{9–14}.

An important question remains unanswered: does the virus actually transfer from contaminated objects to a person’s hand? The transfer of virus from the contaminated solid surface to the body is necessary for infection via fomites. In this article, we describe measurements of the percentage transfer of SARS-CoV-2 to skin from a variety of solids.

Following biosafety protocols, we were not able to examine transfer to the skin of living humans. We instead