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Transmission of COVID-19 from Surfaces

Is SARS-CoV-2 viable on inanimate surfaces, and if so for how long?

Key Findings

- Surface Type (Experimental studies)
 - From four surfaces SARS-CoV-2 was tested on (plastic, stainless steel, copper, and cardboard), SARS-CoV-2 was most stable on plastic and stainless steel.¹
 - On plastic and stainless steel, SARS-CoV-2 was viable for 72 hours.¹
 - On copper, SARS-CoV-2 was viable for 4 hours.¹
 - On cardboard, SARS-CoV-2 was viable for 24 hours.¹
 - SARS-CoV-2 was found to persist on smooth surfaces longer than other surfaces.⁴
 - There was a decrease in the titer of the viral load the longer the virus was on the surface.¹
 - The viability in aerosols was also tested and was determined to be viable for 3 hours.¹
 - SARS-CoV-2 was diluted in simulated saliva and tested on 2 surfaces (stainless steel and ABS plastic). Different environmental conditions were created based on relative humidity (20%, 40%, and 60%) and temperature (24°C and 35°C). At 24°C and 20% relative humidity, the mean half-life in hours across both was $t_{1/2} = 15.33 \pm 2.75$. At 35°C and 60% relative humidity, $t_{1/2} = 2.26 \pm 1.42$.⁸
 - SARS-CoV-2 was dried or placed in a solution.¹⁰
 - Dried SARS-CoV-2 was viable for >14 days at 4°C, 3-5 days at 20-25°C, and 1 day at 37°C. When suspended in solution, it was viable for 14 days at 4°C, 7 days at 20-25°C, and 1-2 days at 33-37°C.¹⁰
 - After 6 days at pH ≥ 10 and ≤ 4 , SARS-CoV-2 was no longer detected with the more extreme pHs inactivating the virus faster.¹⁰
 - After 1 minute in different disinfectants (e.g. 75% ethanol, 10% bleach, advanced hand sanitizer), SARS-CoV-2 infectivity was reduced by \log_{10} reductions of $\geq 1.83 \pm 0.29$, $\geq 3.25 \pm 0.00$, and $\geq 2.50 \pm 0.0$ respectively.¹⁰
 - SARS-CoV-2 was found to persist on paper bank notes for up to 28 days at room temperature with 50% humidity, with a faster rate of inactivation on polymer vs paper notes.¹³
 - The amount of virus recovered from porous cotton was 99% less than that from non-porous materials in the same temperature and humidity conditions.¹³
- Temperature
 - While controlling for light, humidity, and surface material, increasing the temperature from 20 C to 40 C while maintaining humidity drastically reduced the survivability of the virus from 28 days to as little as 24 hours.¹³
- Surfaces in different locations (Studies from clinical locations)

In 6 studies conducted in hospitals, rates of contamination on environmental objects ranged from 0%-75%.

- When potentially contaminated objects were swabbed in an ICU and GW, SARS-CoV-2 was detected on many of them.²
 - Objects tested positive for SARS-CoV-2 included computer mice (6/8 in ICU and 1/5 in GW), trash cans (3/5 in ICU and 0/8 in GW), sickbed handrails (6/14 in ICU and 0/12 in GW), and doorknobs (1/12 in GW).²
- 80 samples from high touch areas (telephones, bedrails, chairs, and door handles) were collected from 8 facilities. 68 samples were taken after disinfection using a 0.1% hypochlorite solution and all were negative. 2/12 samples taken prior to disinfection were positive.⁵
- There were 10/57 positive samples from a hospital with 5 severely symptomatic patients while there were 3/22 positive samples from a hospital with 8 asymptomatic patients. The positive samples were taken from places around the patients' room such as their infusion bag, pillow, monitor, and the room floor.⁷
- 37 swab samples were taken from high touch surfaces (medical equipment, touch screens, shelves, door handles, hand sanitizer, and bed rails) from the negative pressure COVID-19 floor in a hospital in Milan, Italy. The positivity rates were 7/20 (in contaminated areas which are corridor for patients and ICU), 2/4 (in semi-contaminated areas which are undressing rooms and locker/passage for medical staff), and 0/13 (in clean areas which are dressing rooms).⁹
- Air (using an air sampler) and surface (computer keyboards/mice, alcohol gel dispensers, and chairs) samples were taken from a hospital in London. In areas that were occupied by COVID-19 patients, 67/105 samples were positive versus public areas of the hospital had 29/64 samples positive. Overall, 14/31 of the air samples were positive and 114/218 of the surface samples were positive.¹¹
- Emergency department (most patients were there less than 4 hours and all patients stayed in their bed or stretcher)¹²
 - 192 surface samples were collected from objects that were in direct contact with COVID-19 patients and objects that were nearby patients (within 6.6 feet) before and after decontamination; 10/192 were positive
 - Objects in direct contact
 - Before decontamination: 3/5 positive (BP cuff, pulse OX, stretcher)
 - After decontamination: 2/41 positive (BP cuff and stretcher)
 - Objects nearby
 - Before decontamination: 2/20 positive (plastic screen between 2 patients and stretcher)
 - After decontamination: 2/36 positive (trolley)

Recommendations

- Caution should be taken when interacting with objects that may have been exposed to SARS-CoV-2 as the virus is viable for some time.¹ There has been no evidence to date of fomite transmission.
- Caution should especially be taken with objects made from plastic and stainless steel for at least 72 hours post potential exposure.¹
- Common area objects (computer mice, trash cans, and door handles) and high touch areas (bed rails and hand sanitizer) may be positive for SARS-CoV-2 so take caution when handling anything, especially in an ICU setting.^{2,3,7,9,11}
 - Patient's personal items such as cell phones may also be contaminated.⁶

- Disinfecting
 - Disinfecting surfaces (with a 0.1% hypochlorite solution) that may be contaminated with SARS-CoV-2 may help reduce the risk of transmission.⁵
 - Disinfectants (5% ethanol, 10% bleach, advanced hand sanitizer) can decrease the infectivity of SARS-CoV-2 therefore can help to reduce transmission especially in the hospital environment.¹⁰
- Increasing temperature and humidity can decrease the half-life of SARS-CoV-2 on hard / non-porous surfaces both when SARS-CoV-2 is dried and in solution. Therefore, exposure risk from surfaces can vary depending on environmental conditions.^{8,10}
- In the ED, the probability of objects being contaminated may potentially be lower since patient turnover is quicker; when appropriate decontamination techniques are used, the risk of infectivity from objects there may be relatively low. More caution should be taken regarding objects that touch patients directly such as BP cuffs.¹²
- Under ideal conditions (large inoculum size, low temperature, low humidity, low light), SARS-CoV-2 can be found on smooth surfaces for up to 28 days following contamination.

Sources

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