Public Health Ontario | Santé publique Ontario

SYNOPSIS

10/21/2020

Review of "The effect of temperature on persistence of SARS-CoV-2 on common surfaces"

Article citation: Riddell S, Goldie S, Hill A, Eagles D, Drew TW. The effect of temperature on persistence of SARS-CoV-2 on common surfaces. Virol J. 2020 Oct 7 [Epub ahead of print]. Available from: https://doi.org/10.1186/s12985-020-01418-7

One-minute summary

- The authors tested the stability of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) under controlled conditions on six surface types.
- Viral recovery from the surfaces declined exponentially on all surfaces over time.
- Infectious virus on **stainless steel, glass and polymer banknote** was:
  - detectable at 28 days (d) at 20°C and 7 d at 30°C
  - undetectable at 48 hours (h) at 40°C
- Infectious virus on **paper banknote** was:
  - detectable at 28 d at 20°C and 21 d at 30°C (<1 log recovered at 14 d and 21 d)
  - undetectable at 48 h at 40°C
- Infectious virus on **vinyl** was:
  - detectable at 28 d at 20°C and 3 d at 30°C
  - undetectable at 48 h at 40°C
- Infectious virus on **cotton** was:
  - undetectable after 14 d at 20°C (most reduction after inoculation) and after 48 h at 40°C
  - detectable for 3 d at 30°C
- At 40°C, a >4 log reduction of infectious virus was seen on all surfaces at 24 h post-inoculation.
- The authors conclude that **infectious SARS-CoV-2 survives on non-porous surfaces for at least 28 days at 20°C and 50% relative humidity in the dark.**
- **There was a 90% reduction in virus titre by 10 d post-inoculation at 20°C on all surfaces.**

Additional information

- The authors used a virus stock concentration of 4.97 x 10^7/mL diluted in an organic matrix (to mimic body secretions) to inoculate surfaces. The authors believe this amount of virus may be present in some patients with high viral loads. However, this concentration is at least 2 logs higher than that used in another study[1] which reported shorter survival times.

- The researchers inoculated surfaces at 50% relative humidity at 20°C, 30°C and 40°C in the dark. Virus recovery for each surface type was done in triplicate at each temperature at a fixed schedule.
- **Calculated time to achieve a 90% reduction in titre (D-values) and calculated time to achieve a 50% reduction in titre (half-life)** at different temperatures for the 6 surface types were:
    - **20°C:** paper notes: 9.13 d (2.74 d); polymer notes: 6.85 d (2.06 d); vinyl: 6.34 d (1.91 d); glass: 6.32 d (1.90 d); stainless steel: 5.96 d (1.80 d); cotton: 5.57 d (1.68 d)
    - **30°C:** paper notes: 4.32 d (32.7 h); polymer note: 2.04 d (14.7 h); stainless steel: 1.74 d (12.6 h); cotton: 1.65 d (11.0 h); glass: 1.45 d (10.5 h); vinyl: 1.40 d (10.1 h)
    - **40°C:** vinyl: 9.90 h (3.0 h); glass: 6.55 h (2.0 h); paper note: 5.39 h (1.6 h); stainless steel: 4.86 h (1.5 h); polymer note: 4.78 h (1.4 h). D-value could not be calculated for cotton as no infectious virus was detected at 24 h post-inoculation.
- **Z-values (temperature change to achieve a ten-fold change in the D-value)** for surfaces types: **cotton: 18.91°C; vinyl: 16.86°C; glass: 14.65°C; stainless steel: 13.62°C; polymer note: 13.02°C; paper note: 12.43°C**.
- The high viral inoculum in the suspension matrix, controlled temperature and relative humidity, lack of light and different types of cotton used in this study may account for the long survival times observed.

PHO reviewer's comments

- As the authors acknowledge, the controlled environmental conditions of this study do not reflect real world conditions of varying ambient conditions (e.g., humidity, temperature, light and ultraviolet radiation). In addition, use and wear of surfaces that would likely affect viral survival and potential for transmission. However, as the virus can survive for a period on various surfaces, this study highlights the importance of diligent hand hygiene, and frequent cleaning and disinfecting of surfaces that are touched regularly.

Additional references

1. van Doremalen N, Bushmaker T, Morris DH, Holbrook MG, Gamble A, Williamson BN, et al. Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. N Engl J Med. 2020;382(16):1564-7. Available from: https://doi.org/10.1056/nejmc2004973

Citation

Ontario Agency for Health Protection and Promotion (Public Health Ontario). Review of "The effect of temperature on persistence of SARS-CoV-2 on common surfaces". Toronto, ON: Queen's Printer for Ontario; 2020.

Disclaimer

This document was developed by Public Health Ontario (PHO). PHO provides scientific and technical advice to Ontario's government, public health organizations and health care providers. PHO's work is guided by the current best available evidence at the time of publication.

The application and use of this document is the responsibility of the user. PHO assumes no liability resulting from any such application or use.

Public Health Ontario

Public Health Ontario is a Crown corporation dedicated to protecting and promoting the health of all Ontarians and reducing inequities in health. Public Health Ontario links public health practitioners, front-line health workers and researchers to the best scientific intelligence and knowledge from around the world.

For more information about PHO, visit publichealthontario.ca.

Ontario