



Office of the Prime Minister's Chief Science Advisor
Kaitohutohu Mātanga Pūtaiao Matua ki te Pirimia

Can SARS-CoV-2 survive in refrigerated environments – and for how long?

Prepared under urgency – 17 August 2020; updated 20 October 2020

Summary

The available evidence regarding possible survival and transmission of the coronavirus SARS-CoV-2 via cold temperature environments is highly uncertain, but we cannot completely rule out cold supply chain as a possible route of transmission.

Background

COVID-19 is a respiratory illness caused by the novel coronavirus SARS-CoV-2. The primary route of transmission is through person-to-person contact and through direct contact with droplets generated when an infected person coughs or sneezes. However, the recent COVID-19 outbreak in Auckland has connections to Americold, a cold storage and supply chain management company, which has raised the possibility of viral entry into Aotearoa New Zealand via cold supply chains.

Evidence

- There is a limited evidence base on which to determine the likelihood of such a route of transmission acting as the start of this cluster. Very few studies looking at virus survival in cold temperatures have been done on SARS-CoV-2 because of its novelty, so the majority of relevant studies are on related viruses SARS-CoV and MERS-CoV.
- Research published in *The Lancet* suggests that SARS-CoV-2 is highly stable for an extended period at 4°C, for over two weeks (Chin et al., 2020).
- In a pre-print shared on 18 August 2020 (not yet peer-reviewed), researchers contaminated pieces of chicken, salmon and pork with SARS-CoV-2 and found that the virus remained infective after three weeks in refrigerated (4°) and frozen (–20°C and –80°C) settings (note that was the maximum length of time studied) (Fisher et al., 2020).
- Other related coronaviruses have been found to survive for periods of over two weeks, some over 28 days, at 4°C (Ren et al., 2020)(Casanova et al., 2010)(Guionie et al., 2013).
- Media reports¹ have detailed the detection of SARS-CoV-2 RNA on frozen food and packaging imported into China, including chicken wings from Brazil and fish products from Ecuador. There is no evidence to suggest infection has occurred from these imports.

¹ <https://www.odt.co.nz/news/world/chinese-cities-find-covid-frozen-food-imports>;
https://www.nzherald.co.nz/lifestyle/news/article.cfm?c_id=6&objectid=12356713; <https://www.the-scientist.com/news-opinion/coronavirus-found-on-food-packaging-but-likely-of-little-concern-67825>;
<https://www.nytimes.com/2020/08/13/health/coronavirus-frozen-food.html>;
<https://www.scmp.com/news/china/society/article/3096934/coronavirus-found-frozen-seafood-packaging-chinese-port-city>

- On 17 October, the Chinese Center for Disease Control and Prevention reported isolating live virus from the outer packaging of imported frozen cod.² These reports are unconfirmed, and no data is available for independent corroboration of the finding. The discovery was made as part of trace sourcing efforts after an outbreak in the coastal city of Qingdao. Out of 670,000 samples collected from the cold storage food chain in China, only 22 have returned a positive test result.
- There is no evidence that SARS-CoV-2 can be contracted by consuming food. SARS-CoV-2 primarily infects the respiratory tract and its enveloped structure makes it much less robust compared to common foodborne enteric viruses such as hepatitis A and norovirus. Furthermore, food safety and manufacturing regulations are designed to minimise the risk of foodborne transmission of disease.

Advice from international organisations

- The UK Food Standards Agency has undertaken a qualitative risk assessment on the risk of food or food contact materials and surfaces being a source or transmission route of SARS-CoV-2 for UK consumers, updating the review as new evidence becomes known. The most recent update concluded there was negligible risk of potentially infectious exposure via consuming or handling food or its packaging, with risk elevated to very low if food was contaminated, noting high uncertainty for these estimates given the limited available evidence and data gaps (Oakenfull & Wilson, 2020).
- The WHO,³ FDA,⁴ and CDC⁵ have stated that there is currently no evidence to support transmission of SARS-CoV-2 associated with food or packaging. The CDC webpage says “it may be possible that people can get COVID-19 by touching a surface or object, such as a food package or dining ware that has the virus on it and then touching their own mouth, nose, or possibly their eyes”.⁶

References

- Casanova, L. M., Jeon, S., Rutala, W. A., Weber, D. J., & Sobsey, M. D. (2010). Effects of air temperature and relative humidity on coronavirus survival on surfaces. *Applied and Environmental Microbiology*, 76(9), 2712–2717. <https://doi.org/10.1128/AEM.02291-09>
- Chin, A. W. H., Chu, J. T. S., Perera, M. R. A., Hui, K. P. Y., Yen, H.-L., Chan, M. C. W., Peiris, M., & Poon, L. L. M. (2020). Stability of SARS-CoV-2 in different environmental conditions. In *The Lancet Microbe* (Vol. 1, Issue 1). Elsevier Ltd. [https://doi.org/10.1016/s2666-5247\(20\)30003-3](https://doi.org/10.1016/s2666-5247(20)30003-3)
- Fisher, D., Reilly, A., Zheng, A. K. E., Cook, A. R., & Anderson, D. E. (2020). Seeding of outbreaks of COVID-19 by contaminated fresh and frozen food. *BioRxiv Preprint*.
- Guionie, O., Courtillon, C., Allee, C., Maurel, S., Queguiner, M., & Etteradossi, N. (2013). An experimental study of the survival of turkey coronavirus at room temperature and +4°C. *Avian*

² <https://www.theguardian.com/world/2020/oct/19/live-coronavirus-found-on-frozen-food-packaging-in-china>; http://www.xinhuanet.com/english/2020-10/18/c_139448045.htm; http://www.chinacdc.cn/yw_9324/202010/t20201017_222144.html

³ WHO Interim Guidance, p1 [COVID-19 and food safety: guidance for food businesses Interim guidance 7 April 2020](#)

⁴ FDA webpage, Q: Can I get the coronavirus from food, food packaging, or food containers and preparation area? <https://www.fda.gov/emergency-preparedness-and-response/coronavirus-disease-2019-covid-19/covid-19-frequently-asked-questions#food> (accessed 17/8/20)

⁵ CDC webpage <https://www.cdc.gov/coronavirus/2019-ncov/faq.html#Spread> (last updated 4 Aug, accessed 17/8/20)

⁶ CDC webpage <https://www.cdc.gov/coronavirus/2019-ncov/faq.html#Spread> (last updated 4 Aug, accessed 17/8/20)

Pathology, 42(3), 248–252. <https://doi.org/10.1080/03079457.2013.779364>

Oakenfull, R., & Wilson, A. (2020). *Qualitative Risk Assessment : What is the risk of food or food contact materials being a source or transmission route of SARS-CoV-2 for UK consumers ? section 4*, 1–21. <https://www.food.gov.uk/research/research-projects/qualitative-risk-assessment-on-the-risk-of-food-or-food-contact-materials-as-a-transmission-route-for-sars-cov-2>

Ren, S. Y., Wang, W. B., Hao, Y. G., Zhang, H. R., Wang, Z. C., Chen, Y. L., & Gao, R. D. (2020). Stability and infectivity of coronaviruses in inanimate environments. *World Journal of Clinical Cases*, 8(8), 1391–1399. <https://doi.org/10.12998/WJCC.V8.I8.1391>