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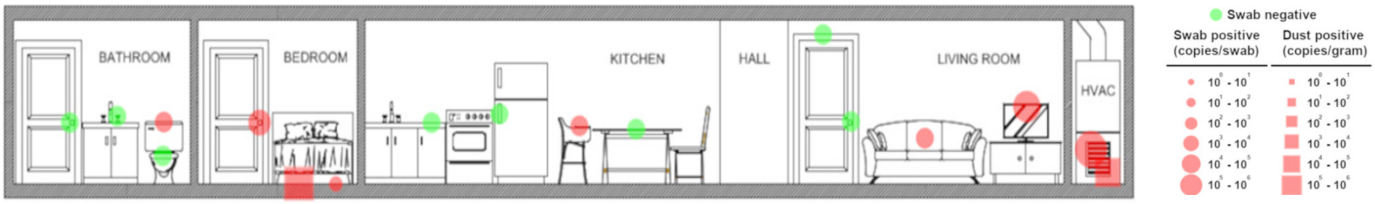
Maestre JP, Jarma D, Yu J-R F, Siegel JA, Horner S, Kinney KA. 2021. Distribution of SARS-CoV-2 RNA signal in a home with COVID-19 positive occupants. *Science of the Total Environment*, **778**, 106201. DOI: 10.1016/j.scitotenv.2021.146201



Abstract

Although many COVID-19 patients isolate and recover at home, the dispersal of SARS-CoV-2 onto surfaces and dust within the home environment remains poorly understood. To investigate the distribution and persistence of SARS-CoV-2 in a home with COVID-19 positive occupants, samples were collected from a household with two confirmed COVID-19 cases (one adult and one child). Home surface swab and dust samples were collected two months after symptom onset (and one month after symptom resolution) in the household. The strength of the SARS-CoV-2 molecular signal in fomites varied as a function of sample location, surface material and cleaning practices. Notably, the SARS-CoV-2 RNA signal was detected at several locations throughout the household although cleaning appears to have attenuated the signal on many surfaces. Of the 24 surfaces sampled, 46% were SARS-CoV-2 positive at the time of sampling. The SARS-CoV-2 concentrations in dust recovered from floor and HVAC filter samples ranged from 10^4 to 10^5 N2 gene copies/g dust. While detection of viral RNA does not imply infectivity, this study confirms that the SARS-CoV-2 RNA signal can be detected at several locations within a COVID-19 isolation home and can persist after symptoms have resolved. In addition, the concentration of SARS-CoV-2 (normalized per unit mass of dust) recovered in home HVAC filters may prove useful for estimating SARS-CoV-2 airborne levels in homes. In this work, using the quantitative filter forensics methodology, we estimated an average integrated airborne SARS-CoV-2 concentration of 69 ± 43 copies/m^3. This approach can be used to help building scientists and engineers develop best practices in homes with COVID-19 positive occupants.

Key findings

1. Efficient ventilation, high-efficiency filtration, and frequent cleaning are important to reduce in-home secondary transmission.
2. SARS-CoV-2 RNA signal can persist in a COVID-19 household for nearly a month following resolution of COVID-19 symptoms.
3. The detection of SARS-CoV-2 RNA signal on infrequently touched surfaces may indicate airborne particles contaminating surfaces not in direct contact with COVID-19 individuals.

Fig. 1. N2 gene copies recovered from samples. Results are illustrated on a generic two-bedroom floor plan that is typical of homes in the study area.

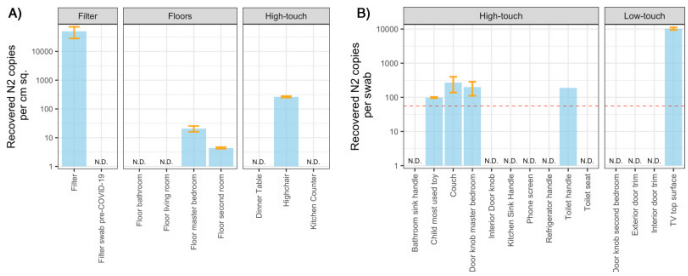


Fig. 2. N2 gene copies recovered per swab across the fomites sampled. A) Fomites sampled by area, allowing the results to be expressed in N2 gene copies/cm^2. B) Fomites sampled with no known areas, results presented in recovered copies per swab, red line represents the effective LOD. N.D. = non-detects.

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