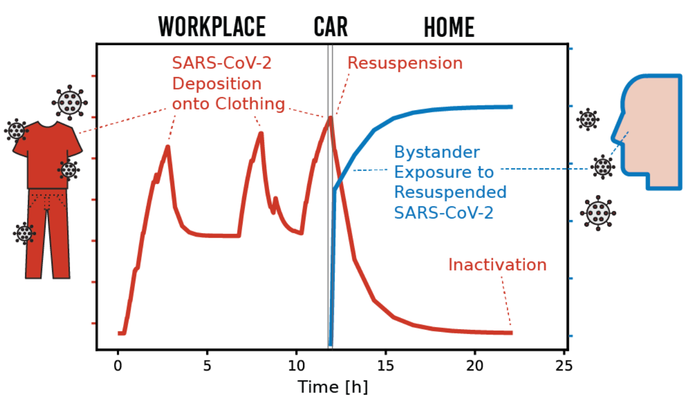
Kvasnicka J, Cohen Hubal EA, Siegel JA, Scott JA, Diamond ML. 2022. Modeling clothing as a vector for transporting airborne particles and pathogens across indoor microenvironments. *Environmental Science and Technology*, **56(9)**, 5641–5652. DOI: 10.1021/acs.est.1c08342

Abstract

Evidence suggests that human exposure to airborne particles and associated contaminants, including respiratory pathogens, can persist beyond a single microenvironment. By accumulating such contaminants from air, clothing may function as a transport vector and source of "secondary exposure." To investigate this function, a novel microenvironmental exposure modeling framework was developed. This framework was applied to a para-occupational exposure scenario involving deposition of viable SARS-CoV-2 in respiratory particles (0.5-10 μm) onto clothing in a non-healthcare setting, and subsequent resuspension in a car and home. Variability was assessed through Monte Carlo simulations. The total volume of infectious particles on the occupant's clothing immediately after work was 30% (5th-95th percentiles: 10-200%) of her primary inhalation exposure in the workplace while unmasked. By her arrival at home, this volume had decreased by 80% (5-95%: 20-100%) because of relatively rapid viral inactivation in cotton clothing. Secondary inhalation exposure (after work) was low in the absence of close proximity and physical contact with contaminated clothing. In comparison, the median primary inhalation exposure in the workplace was higher by at least two orders of magnitude. It remains theoretically possible that resuspension and physical contact with contaminated clothing can occasionally transmit SARS-CoV-2 between humans.



Synopsis

SARS-CoV-2 could, but is unlikely to, be spread by resuspension from contaminated cotton clothing in a non-healthcare setting.

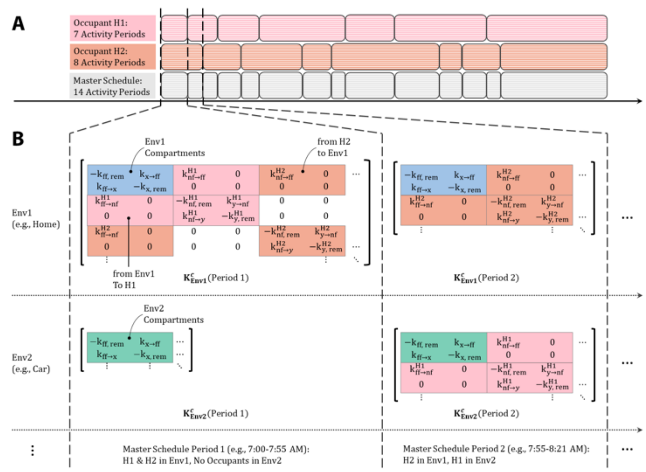


Figure 1. Overview of ABICAM's time-dependent matrices of rate coefficients for indoor microenvironments. (**A**) A "master schedule" maps the activities of two arbitrary human occupants ($H1$ and $H2$) to specific time periods. To illustrate, each activity period is represented by a superellipse with length directly proportional to duration. (**B**) For a given contaminant (c), each indoor microenvironment is associated with a matrix [$\boldsymbol{K}_{\boldsymbol{e}}^{\boldsymbol{c}}(\boldsymbol{t})$ in **eqn 1**]. The size of each matrix reflects the total number of compartments in the microenvironment and therefore changes as human occupants enter and leave. In this example, $H1$ moves from $Env1$ to $Env2$ as time progresses from Period 1 to Period 2, while $H2$ remains in $Env1$. Rate coefficients [T^{-1}] for contaminant mass transfer ($\rightarrow$) and removal (rem) are denoted by k with subscripts, nf, ff, x, and y referring to near field, far field, and arbitrary environmental and human compartments, respectively.

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