DHS S&T Research & Development Response to SARS-CoV-2 / COVID-19

Homeland Security
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UNDERSTANDING TRANSMISSION TO CONTROL THE SPREAD

Efforts to control the spread of the SARS-CoV-2 rely on the virus' ability to survive in the air and on surfaces. S&T is collaborating with partners and performers to help answer critical questions about the SARS-CoV-2 virus, including:

- How stable is the virus in different conditions?
- How effective are different decontamination products on surfaces?
- How can we best clean personal protective equipment (PPE) and verify functionality?

S&T EFFORTS TO ANSWER CRITICAL QUESTIONS

Master Question List

A team of dedicated experts reviews all available resources on the SARS-CoV-2 virus and resulting pandemic and synthesizes the information into a concise format to aid decision makers and the public. We call this the Master Question List (MQL). The MQL is updated weekly and available to the public online: (https://www.dhs.gov/publication/st-master-question-list-covid-19). The MQL features information about virus spread, disease progression, effectiveness of treatments, vaccine development efforts, decontamination methods, and more.

Laboratory Research

S&T provides DHS Components and stakeholders high-confidence guidance on SARS-CoV-2 through rapidly-executed applied-science studies and risk assessments to inform the operational response. Building on experience gained through response to the 2015 Ebola outbreak, S&T is executing laboratory studies at the National Biodefense Analysis and Countermeasures Center (NBACC) and with other qualified performers to produce unique data on SARS-CoV-2 environmental stability and decontamination.

International Research Collaborations

S&T is collaborating with our international partners (Australia, Canada, UK, and New Zealand) to share expertise as we all address critical aspects of virus stability & decontamination, leveraging each country's strengths.

Technology Scouting

To support DHS Component requests, S&T's Technology Scouting and Transition group is investigating different technologies for use in disinfecting surfaces and testing for the virus in humans.

S&T LABORATORY RESEARCH IS AT THE FOREFRONT OF THE COVID-19 FIGHT

S&T is currently executing SARS-CoV-2 studies at the NBACC laboratory facility. These studies are focused on answering the following questions:

- How long can SARS-CoV-2 survive on commonly used surfaces (e.g., stainless steel, nitrile, plastic) at different temperature and humidity levels?
- How long can SARS-CoV-2 survive in simulated human saliva droplets and respiratory fluids?
- How long can SARS-CoV-2 survive in the air?
- How effective are various disinfectants at eliminating the SARS-CoV-2 virus?

NBACC EMERGING RESULTS (AS OF 4/21/20)

Although studies are ongoing, preliminary NBACC results have provided critical insight to SARS-CoV-2 surface stability. Key findings include:

1. **Higher humidity may reduce virus survival.** When in saliva droplets, the virus is most stable at low humidity levels, such as room temperature.
   - Operational Relevance: This indicates that the virus is more likely to be stable and persist in climates with lower humidity, like most U.S. winter climates and airplane cabins. Increasing indoor humidity levels may speed virus decay, as with change in seasonal humidity.

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2. **The virus dies faster at higher temperatures.** The virus is less stable in saliva droplets on surfaces than in culture media and dies faster in saliva droplets at higher temperatures.
   - Operational Relevance: Increased temperatures may help kill the virus and reduce transmission. Also, testing in human-relevant conditions is crucial.
3. **Bleach & Isopropyl Alcohol (IPA) are effective decontamination solutions.** Diluted bleach (1 cup in 1 gallon) was effective in reducing virus infectivity at least >99.9% in saliva droplets after 5 minutes on a stainless-steel surface. 70% IPA killed > 99.9% virus in a wet droplet of saliva and >98.1% virus died on stainless steel after just 30 seconds.
   - Operational Relevance: Reinforces the effectiveness of these EPA recommended disinfectants for use by DHS and other entities to clean and disinfect facilities.
4. **Virus stability in saliva is not dependent on droplet size.** There is no statistical difference in half-life as a function of droplet size in saliva.
   - Operational Relevance: Surface stability data is applicable to a broad range of droplets generated by infected individuals (e.g., talking, coughing, medical procedures).

NBACC NEXT STEPS

In the next 3 weeks, NBACC will continue to execute laboratory research to refine and expand results. Anticipated gains in SARS-CoV-2 information include:

- Additional survival data on commonly used surfaces (e.g., stainless steel, nitrile, plastic) at different temperatures and humidity levels
- Aerosol survival data for indoor and outdoor conditions, including the effect of temperature, humidity, and sunlight to inactivate the virus
- Effectiveness of disinfectants to kill the virus in simulated saliva droplets and respiratory fluids on surfaces

OTHER LABORATORY RESEARCH

S&T is initiating studies with partners to address:

- Effectiveness of different decontamination methods for Personal Protective Equipment (PPE) reuse, such as N95 masks
- SARS-CoV-2 survival in human waste streams
- SARS-CoV-2 exposure levels during stages of infection and contamination levels on PPE

IMPACTS FOR DHS AND THE HOMELAND

S&T foundational programs, such as **the Probabilistic Analysis of National Threats Hazards and Risks (PANTHR) program**, are essential to producing critical information that will help federal leaders, public health officials, and front-line operators make informed decisions about the guidance, types of equipment, and protocols needed to combat the spread of SARS-CoV-2.

For example, understanding the virus survival and stability can help control the spread in the community and at home by informing:

- Which types of surfaces and fluids can remain contaminated and for how long?
- Which type of decontamination products and methods should be used at home, in medical settings, and by DHS operators?

S&T efforts can also help decision makers extend the amount of PPE available to healthcare workers by providing scientifically-backed methods to decontaminate and re-use PPE equipment such as masks.

Additionally, lab results generated by S&T can improve accuracy of public health modeling predictions for potential spread (illnesses/deaths) and improve understanding of the impact that specific interventions (social distancing, individual PPE, etc.) may have on combatting the pandemic.

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