April 14, 2020

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Product Comparison of Cleaning Agents with Implications for Surface Type in Cleaning Hospital Equipment for Eradication of COVID-19 Virus

Executive Summary

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Situation

Clients have requested evidence to support decision making with sourcing effective disinfectants for inactivation of SARS-CoV-2 and the prevention of Covid-19.

Problem Statement:
What are the best practice considerations for disinfecting hospital surfaces during the Covid-19 pandemic?

Technology Under Evaluation:
Cleaning agents and disinfectants utilized in hospitals.

Goal(s) of Assessment:

1. Evidence-based requirements for disinfectants effective against the Coronavirus that cause Covid-19.
2. Compliance with regulations and standard guidelines for disinfectants.
3. Product Comparison of cleaning agents for use against Covid-19 *with implication for surface type in hospitals (Appendix A)*

Background

Over the past decade, there has been a growing appreciation that environmental contamination of hospital surfaces promotes infection transmission for many pathogens. Studies with epidemiologically important pathogens (e.g., MRSA, VRE, *C. difficile*) have shown that surfaces are contaminated and the frequency of hand contamination correlates to the frequency of environmental contamination (ICT, 2020).

In 2017 a MERS-CoV outbreak in South Korea focused on the environmental contamination in the healthcare setting by MERS-CoV diseased patients. The findings were that most of touchable surfaces in MERS units were contaminated by patients and health care workers and the viable virus could shed through respiratory secretion from clinically fully recovered patients. These results emphasize the need for strict environmental surface hygiene practices (Bin SY et al, 2016).

Coronavirus disease 2019 (COVID-19) is a respiratory illness that can spread from person to person, and the first case was reported on January 21, 2020, in the United States. As this is a novel virus, we are all still learning how it spreads. In addition to spreading the virus from person to person, the CDC also states another cause of spreading comes from contact with

contaminated surfaces or objects. Hospitals and the healthcare industry are now focused on cleaning and disinfecting hospital surfaces and equipment to inactivate the Covid-19 virus in the midst of this pandemic.

Technology Description:
Appropriate disinfection practices in the healthcare setting can help prevent Healthcare-Associated Infections (HAI) (APIC, 2019). These disinfectants can be used alone or in combinations:

> These include alcohols, chlorine and chlorine compounds, formaldehyde, glutaraldehyde, *ortho*-phthalaldehyde, hydrogen peroxide, iodophors, peracetic acid, phenolics, and quaternary ammonium compounds. Commercial formulations based on these chemicals are considered unique products and must be registered with EPA or cleared by FDA. In most instances, a given product is designed for a specific purpose and is to be used in a certain manner. Therefore, users should read labels carefully to ensure the correct product is selected for the intended use and applied efficiently (CDC, 2008).

Disinfection of environmental surfaces with an EPA approved disinfectant is key in order to fight pathogens that are responsible for outbreaks while promoting clinician and patient safety (APIC, 2019). **According to Infection Control Today, the efficacy criteria are based on the ease with which the three types of viruses—enveloped, large non-enveloped and small non-enveloped viruses—are inactivated by disinfectants (ICT, 2020). SARS-CoV-2, the virus responsible for the COVID-19 outbreak, is an enveloped virus and therefore the easiest to kill of the three types of viruses (ICT, 2020).**

Clinical Evidence Assessment

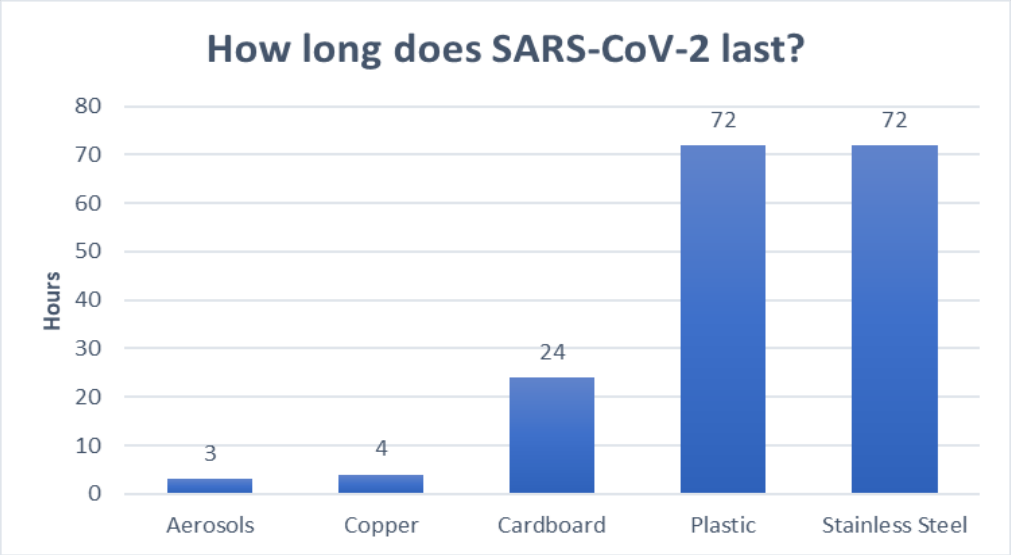
Guidelines:
The CDC lists Guidelines for Environmental Infection Control in Health-Care Facilities (CDC, 2019). Referencing Section E.I. “Cleaning and Disinfecting Strategies for Environmental Surfaces in Patient-Care Areas,” there are recommendations for patient rooms, medical equipment, and other high-touch surface areas for EPA-registered hospital disinfectants (CDC, 2019).

The United States Environmental Protection Agency (EPA) is an independent agency of the United States federal government for environmental protection. **In late January, the EPA initiated plans and guidance to register surface disinfectants effective against Covid-19 via “Emerging Viral Pathogens Guidance for Antimicrobial Pesticides” (EPA, 2020).** This allows for expedition of claims of already EPA-registered surface disinfectants that do not require review of new efficacy data (EPA, 2020). The disinfectants with Emerging Viral Pathogen Claims are recorded within the EPA’s “List N: Disinfectants for Use Against SARS-CoV-2” and are assigned an EPA registration number to verify (EPA, 2020). It is important to

check the disinfectant's EPA registration number and follow all directions and Instructions For Use (IFU) prior to disinfecting hospital surfaces.

Note: Product Comparison Table of Disinfectants to Use Against SARS-CoV-2 (Appendix A).

Evidence:
Current evidence suggests that SARS-CoV-2 may remain viable for hours to days on surfaces made from a variety of materials (CDC, 2020). Several studies were evaluated in regard to the spread of Covid-19 and surfaces. The New England Journal of Medicine conducted studies that indicate that aerosol and fomite transmission of SARS-CoV-2 is plausible, since the virus can remain viable and infectious in aerosols for hours and on surfaces up to days (depending on the inoculum shed). These findings echo those with SARS-CoV-1, in which these forms of transmission were associated with nosocomial spread and super-spreading events,[5] and they provide information for pandemic mitigation efforts (NEJM, 2020).



Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1, NEJM

Second, the study of evidence stated that as no specific therapies are available for SARS-CoV-2, early containment and prevention of further spread will be crucial to stop the ongoing outbreak and to control this novel infectious thread (Kampf et al. 2020).

Thirdly, a high proportion of asymptomatic infections could partially explain the high attack rate among cruise ship passengers and crew. SARS-CoV-2 RNA was identified on a variety of surfaces in cabins of both symptomatic and asymptomatic infected passengers up to 17 days

after cabins were vacated on the Diamond Princess but before disinfection procedures had been conducted (Kakimoto et al. 2020).

Financial Data:
Noted in Appendix A (Note: data is limited due to various labeling of product)

Refer to local or GPO agreements for pricing; insure current contracted EPA-registered disinfectants for use against SARS-CoV-2. If none are applicable, or shortages exist, use benchmark pricing to determine target pricing.

Operational Considerations:
Hospitals and health systems will have unique circumstances when considering operational impact; factors relevant to this discussion include the impact of COVID-19 on service areas, the acuity of illness, and the volume of patients treated. Alternative care sites and surge units may be utilized to appropriately address both. These factors will impact operations, including deployment of additional EVS and/or utilization of janitorial staff to appropriately disinfect and clean facilities. Hospitals and health systems should anticipate appropriate training, guidance, and monitoring of both current and potentially new or re-assigned staff when completing disinfection and cleaning to insure the appropriate agent(s) are used on applicable surfaces, not only to appropriately inactivate the virus, but disinfect for other potential microbes and protect the surface from damage. Compliance with known standards will be imperative.

The process of cleaning secondary to the coronavirus epidemic will also change, with an impact on staffing needs (most likely increasing demand), and changing the agents used for cleaning and disinfecting both patient and non-patient areas of the facilities as described by the CDC.

Operational modes have been described by the CDC as conventional, contingent, and crisis. Supply chain should understand the present operational mode of the facility, and the anticipated mode of the facility in the short and intermediate term to insure an adequate supply of product.

Recommendations

- Develop a standard procedure with Infection Prevention and Environmental Services in regard to high potential exposure of patients with known or suspected aerosol transmittable diseases using established guidelines for Covid-19.
    - Establish knowledge of cleaning agents and disinfectants utilized on specific surfaces, per manufacturer's instructions for use (IFU).
    - Manage utilization of all cleaning agents and disinfectants within the hospital.
    - Develop a plan for utilizing EPA-registered disinfectants that inactivate SARS-CoV-2 in infected areas (i.e. triage, reception, inpatient areas) and utilizing alternate disinfectants in other low traffic and non-exposure areas in lieu of potential product shortages.

    - Recommend support and implementation of disinfection practices during Covid-19 pandemic to housekeeping and janitorial staff employed with alternative care sites (i.e. converted hotels, school gymnasiums).
        - OSHA has established occupational risk exposure levels for the American workers and highlights the increased risk as workers change or increase tasks within their respective role: https://www.osha.gov/SLTC/covid-19/hazardrecognition.html.
        - Interim guidance is provided for EVS and janitorial staff with potential exposure to COVID-19. Employers must provide this communication and training found in OSHA's Interim Guidance section for Environmental Services Workers and Employers: https://www.osha.gov/SLTC/covid19/controlprevention.html#environmental
- Engage with facility leadership/Command Central leadership to understand volume requirements; consider short and intermediate term impacts to supply chain sourcing requirements.
- Utilize benchmark pricing when applicable. Monitor and record offenders of price gouging in vendor profiles.
- Refer to the CDC's Guidance for Infection Control in Healthcare, Home, and Community Settings: https://www.cdc.gov/sars/guidance/I-infection/healthcare.html
- https://www.cdc.gov/coronavirus/2019-ncov/community/organizations/cleaning-disinfection.html
- https://www.cdc.gov/coronavirus/2019-ncov/healthcare-facilities/alternative-care-sites.html
    - Develop a communication plan with Environmental Services and Janitorial Services to include recent CDC guidance that discusses proper cleaning in response to Covid-19 (i.e. inpatient, outpatient settings, alternate care sites).
    - Include guidance in regard to appropriate disinfectant agent for surface types. This will protect the longevity and functionality of the surface. Refer to Appendix B for manufacturer contact information for further questions or to obtain an IFU.

Abstracts

Initial Investigation of Transmission of COVID-19 Among Crew Members During Quarantine of a Cruise Ship — Yokohama, Japan, February 2020.

Kensaku Kakimoto[1]; Hajime Kamiya[2]; Takuya Yamagishi[2]; Tamano Matsui[2]; Motoi Suzuki[2]; Takaji Wakita

Abstract:

An outbreak of coronavirus disease 2019 (COVID-19) among passengers and crew on a cruise ship led to quarantine of approximately 3,700 passengers and crew that began on February 3,

2020 and lasted for nearly 4 weeks at the Port of Yokohama, Japan (*1*). By February 9, 20 cases had occurred among the ship's crew members. By the end of quarantine, approximately 700 cases of COVID-19 had been laboratory-confirmed among passengers and crew. This report describes findings from the initial phase of the cruise ship investigation into COVID-19 cases among crew members during February 4–12, 2020.

Interviews were conducted with nine crew members with confirmed COVID-19 on February 12, just before their disembarkation; three of these patients reported close contact with other crew members with confirmed COVID-19 before their symptoms began. These interviews indicated that infection had apparently spread among persons whose cabins were on the same deck (deck 3) and who worked in the same occupational group (food service), **probably through contact or droplet spread, which is consistent with current understanding of COVID-19 transmission (*2*).** Eight of 20 crew members with confirmed COVID-19 had cabin mates; investigators later learned that following disembarkation, as of March 4, five of the eight cabin mates had also developed COVID-19.

This investigation underscores the need for swift epidemiologic investigation as soon as a COVID-19 case is detected in an area or group where a large number of persons gather in a closed or crowded setting (e.g., a cruise ship, music club, health care setting, sports arena, or gymnasium). These settings have been previously associated with infections spread by contact or droplet, such as influenza (*3*). Close contacts of persons with confirmed COVID-19 should self-quarantine and monitor their symptoms; persons who develop COVID-19 symptoms while on board a ship should be isolated to limit transmission to other passengers and crew. †

Abstract:

Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1.

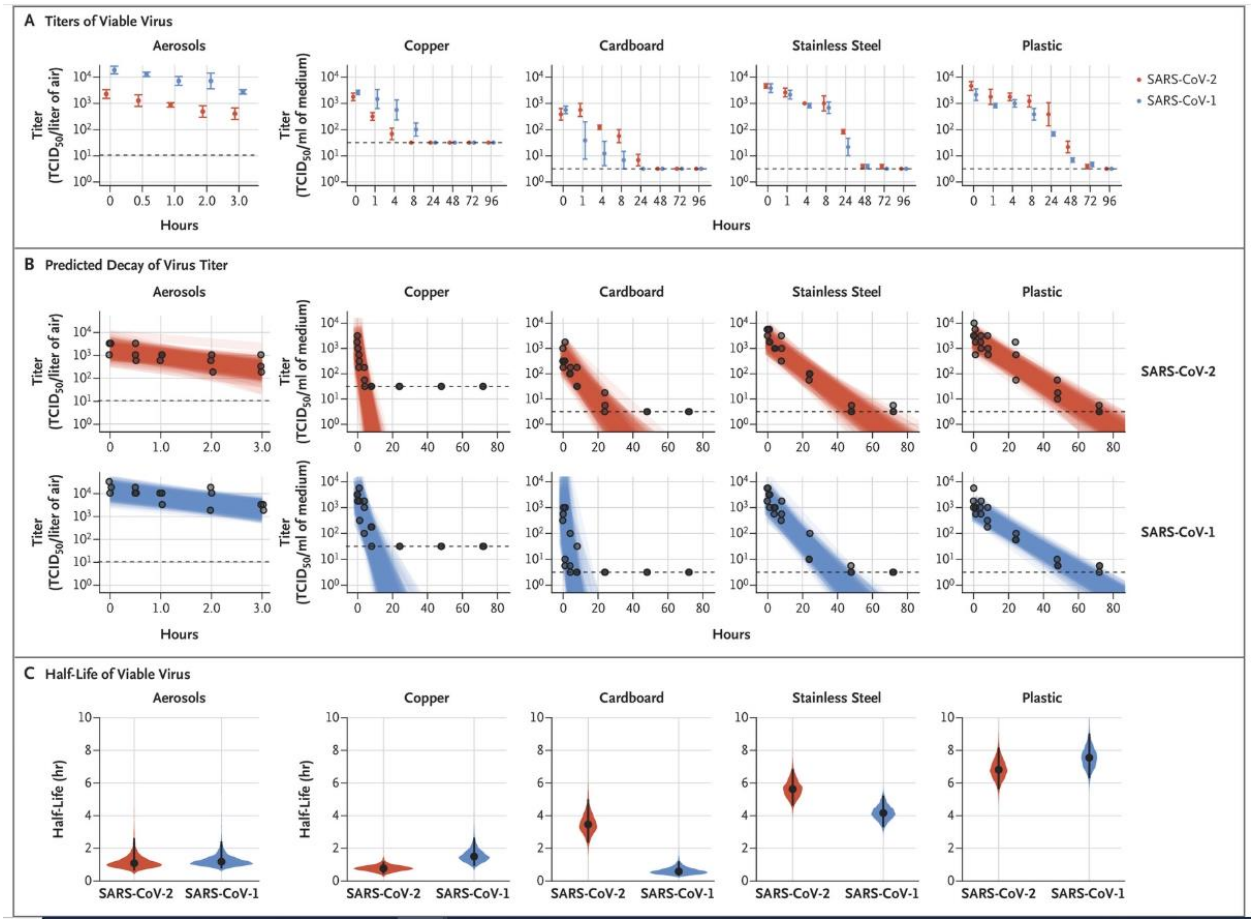
March 17, 2020
DOI: 10.1056/NEJMc2004973

We evaluated the stability of SARS-CoV-2 and SARS-CoV-1 in aerosols and on various surfaces and estimated their decay rates using a Bayesian regression model (see the Methods section in the Supplementary Appendix, available with the full text of this letter at NEJM.org). SARS-CoV-2 nCoV-WA1-2020 (MN985325.1) and SARS-CoV-1 Tor2 (AY274119.3) were the strains used. Aerosols (<5 μm) containing SARS-CoV-2 ($10^{5.25}$ 50% tissue-culture infectious dose [$TCID_{50}$] per milliliter) or SARS-CoV-1 ($10^{6.75-7.00}$ $TCID_{50}$ per milliliter) were generated with the use of a three-jet Collison nebulizer and fed into a Goldberg drum to create an aerosolized environment. The inoculum resulted in cycle-threshold values between 20 and 22, similar to those observed in samples obtained from the upper and lower respiratory tract in humans.

Our data consisted of 10 experimental conditions involving two viruses (SARS-CoV-2 and SARS-CoV-1) in five environmental conditions (aerosols, plastic, stainless steel, copper, and cardboard). All experimental measurements are reported as means across three

replicatesSARS-CoV-2 was more stable on plastic and stainless steel than on copper and cardboard, and viable virus was detected up to 72 hours after application to these surfaces (Figure 1A), although the virus titer was greatly reduced (from $10^{3.7}$ to $10^{0.6}$ $TCID_{50}$ per milliliter of medium after 72 hours on plastic and from $10^{3.7}$ to $10^{0.6}$ $TCID_{50}$ per milliliter after 48 hours on stainless steel).

Figure 1A



Our results indicate that aerosol and fomite transmission of SARS-CoV-2 is plausible, since the virus can remain viable and infectious in aerosols for hours and on surfaces up to days (depending on the inoculum shed). These findings echo those with SARS-CoV-1, in which these forms of transmission were associated with nosocomial spread and super-spreading events,[5] and they provide information for pandemic mitigation efforts.

Abstract:

Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents.

J Hosp Infect. 2020 Mar;104(3):246-251. doi: 10.1016/j.jhin.2020.01.022. Epub 2020 Feb 6.

Currently, the emergence of a novel human coronavirus, SARS-CoV-2, has become a global health concern causing severe respiratory tract infections in humans. Human-to-human

transmissions have been described with incubation times between 2-10 days, facilitating its spread via droplets, contaminated hands or surfaces. We therefore reviewed the literature on all available information about the persistence of human and veterinary coronaviruses on inanimate surfaces as well as inactivation strategies with biocidal agents used for chemical disinfection, e.g. in healthcare facilities. The analysis of 22 studies reveals that human coronaviruses such as Severe Acute Respiratory Syndrome (SARS) coronavirus, Middle East Respiratory Syndrome (MERS) coronavirus or endemic human coronaviruses (HCoV) can persist on inanimate surfaces like metal, glass or plastic for up to 9 days, but can be efficiently inactivated by surface disinfection procedures with 62-71% ethanol, 0.5% hydrogen peroxide or 0.1% sodium hypochlorite within 1 minute. Other biocidal agents such as 0.05-0.2% benzalkonium chloride or 0.02% chlorhexidine digluconate are less effective. As no specific therapies are available for SARS-CoV-2, early containment and prevention of further spread will be crucial to stop the ongoing outbreak and to control this novel infectious thread.

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