THE INTERIOR VIEW:
Staying INformed

Surfaces, Materials, and Disinfection: COVID-19 and Beyond

AMERICAN SOCIETY OF INTERIOR DESIGNERS

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Surface Materials & Finishes

Bridging the Gap Between Specification and Disinfection

The Interior View: Staying INformed

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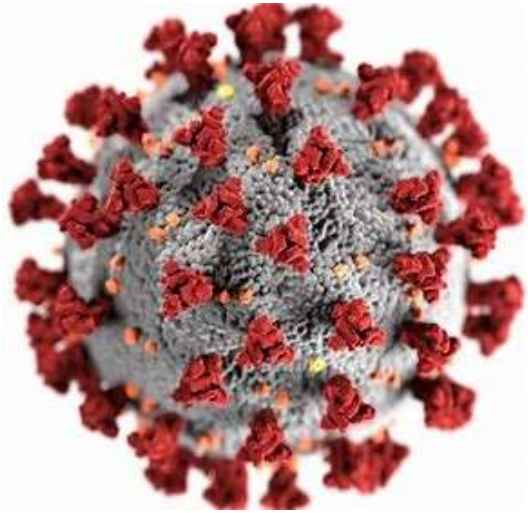
Learning Objectives

1. Understand the importance of basing product specifications on evidence.
2. Understand the importance of cleaning and disinfection of materials in relation to infectious disease.
3. Understand strategic maintenance processes for surface materials that promote health and safety.
4. Understand specifications based on performance requirements to avoid premature product failures.

Surface Contamination



Over the past decade, substantial scientific evidence has accumulated indicating that contamination of environmental surfaces plays an important role in the transmission of several key healthcare-associated pathogens

Understanding and Preventing Transmission of Healthcare-Associated Pathogens Due to the Contaminated Hospital Environment (Weber, 2013)

SARS-CoV-2 (COVID-19) compared to SARS-CoV-1

Media	SARS-CoV-1	SARS-CoV-2
Aerosols	3 hours	3 hours
Plastic	72 hours	72 hours
Stainless Steel	48 hours	48 hours
Cardboard	8 hours	24 hours
Copper	8 hours	4 hours

Holbrook, M.G., Gamble, A., Williamson, B.N., et al. (2020) Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. New England Journal of Medicine, Correspondence nejm.org.

Surface Material Performance Characteristics

Textiles

- Curtains, bedding, bath towels upholstery, wallcoverings

Nonwoven Fabrics – bonded fibers

- Polyethylene (PET), polypropylene – bonded thermally or with a resin

Woven Fabrics

- Typically synthetic in healthcare – nylon, polyester, acrylic, microfiber, aramid, thermoplastics

Durable Coated Fabrics

- Polyurethane, silicone, thermoplastic elastomers

Future of Textiles – smart textiles?

Photo by Henry Domke

Surface Material Performance Characteristics

Textiles

Durability

- Abrasion resistance
- UV resistance
- Crocking resistance
- Flame resistance
- Strength – tearing, seam, tensile
- Finishes for antimicrobial, flame resistance, stain resistance

Cleaning and Disinfection

- Is the textile flexible in cleaning chemicals to be used?
- Does it require “special” cleaners?
- Easy on / easy off?

Photo by Henry Domke

Surface Material Performance Characteristics

Work Surfaces and Casework

- Laminate, solid surface, stainless steel, copper, quartz

Durability

- Withstand impact from equipment
- Smooth surfaces
  - Easier to clean and disinfect
  - Tends to have heavier contamination
- Seams, grout, gaps – avoid

Surface Material Performance Characteristics

Flooring

Vinyl (homo-and heterogeneous), LVT, rubber, linoleum, carpet, wood

- Performance – easy to clean, minimize growth of microbes, durable to withstand cleaning and disinfection
- Smooth surfaces are easier to clean and disinfect, but may still be heavily contaminated
- Carpets have quality attributes but have been shown to act as a sink

Novel disinfection products may open the door to easier and more successful disinfecting of surface materials.

Photo by Henry Domke

Surface Material Performance Characteristics

- Heavy metals have antimicrobial properties.
- Destroys microorganisms at the cellular level
- Compliance – continually active if cleaned appropriately and not sealed.
- Copper – wound care, sinks, hardware, counters, disinfectants
- Silver – wound care, common health ailments, paint, textiles, disinfectants

Surface Material Specifications

- Know what the specifications are and the impact on environmental surface professionals (ESP).
- Work with ESP during planning to understand what their challenges are and how design can assist.
- Evaluate material choices for infection prevention, performance, life-cycle, life-cycle cost, and long-term impact.

Photo by Henry Domke

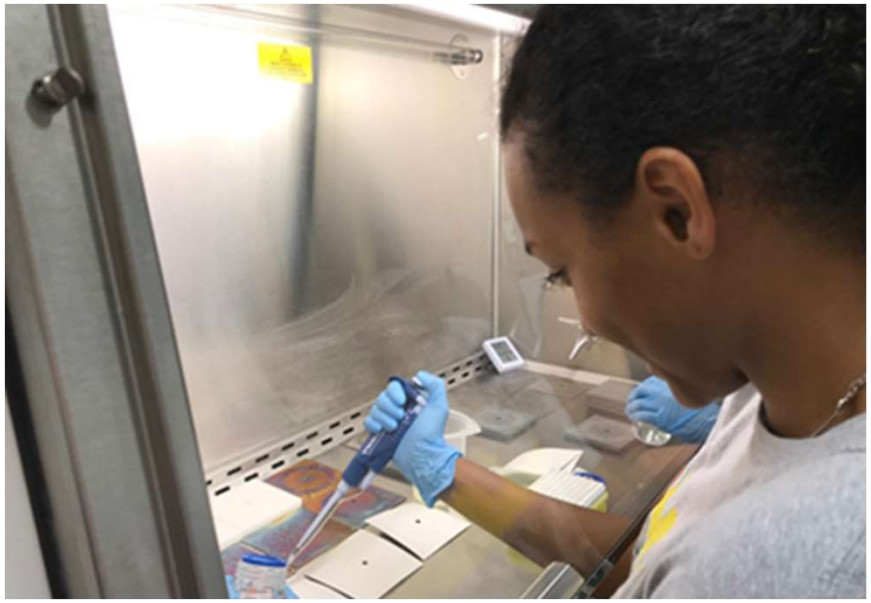
Surface Materials Role in Environmental Infection: MRSA

Study of MRSA on environmental surface materials

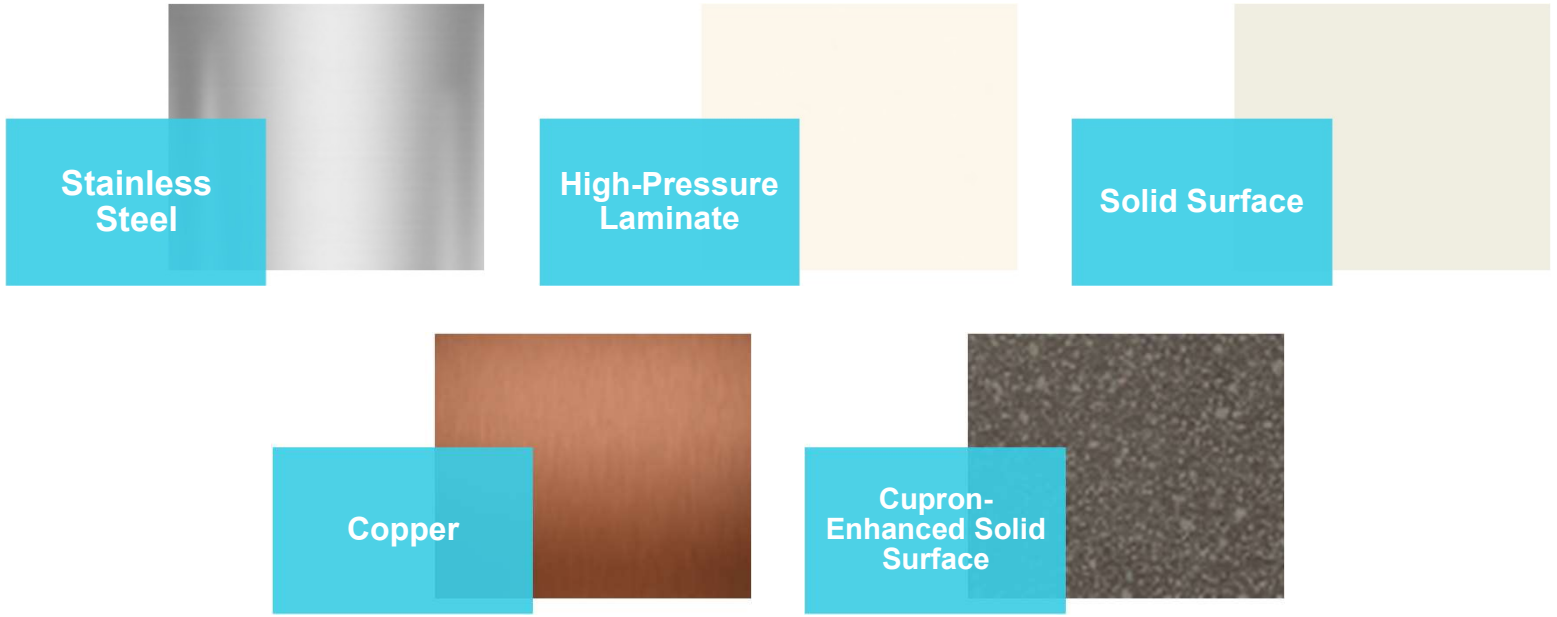
- Stainless steel, HPL, solid surface, solid surface with cupric oxide, and copper sheet

Methods

- Material Testing – Wear Study
- MRSA Survival Time in Lab Conditions
- Disinfectants: Compared bleach and Decon7



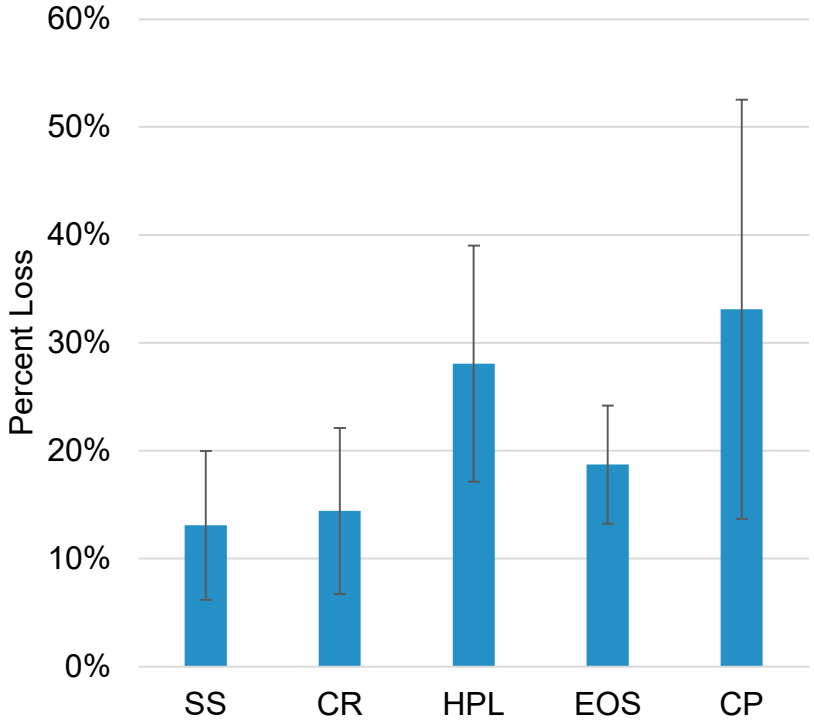
Surface Materials Role in Environmental Infection: MRSA



Surface Materials Role in Environmental Infection: MRSA

Percent Mass Loss

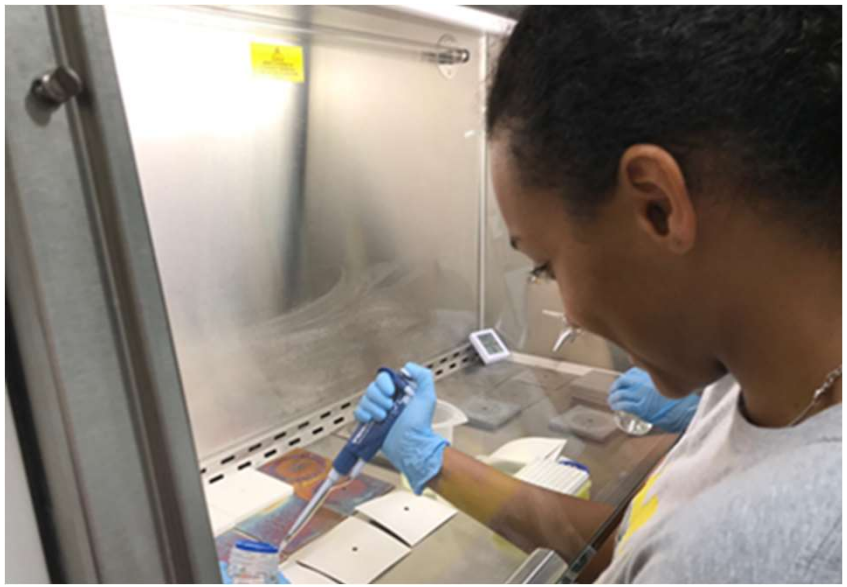
- Copper lost the greatest percent mass at 33%
- High pressure laminate followed closely behind at 28%
- Stainless steel had the least percent loss at 13%
- There was a significant difference between CP, SS and HLP, SS (p<.0001)



Surface Materials Role in Environmental Infection: MRSA

MRSA Viability & Disinfection

- Copper sheet and EOScu had fewer CFUs prior to disinfection, suggesting an active mitigation of pathogen destruction
- Bleach and Decon7, a combination disinfectant, were equally effective in killing MRSA on all 5 environmental surface materials



SARS-CoV-2 Surface Viability & Efficacy of a Disinfectant

Material testing

Work surfaces

- High pressure laminate, Solid surface (acrylic, polymer with cupric oxide), Copper sheet, Quartz, Stainless steel

Flooring

- Vinyl (homogeneous & heterogeneous), LVT, Rubber, Carpet (residential and commercial), Wood Laminate

Vinyl Wall Covering

Non-woven textile (upholstery)

Decon7 disinfectant efficacy against SARS-CoV-2

- 100% (full strength)
- 1:5 ratio diluted with water

Methods

- Virus survival rates on materials
- D7 disinfection efficacy
  - Disinfection of materials at 1 (m), 3 (m), 5 (m), 10 (m) contact time

Completion expected May 30, 2020

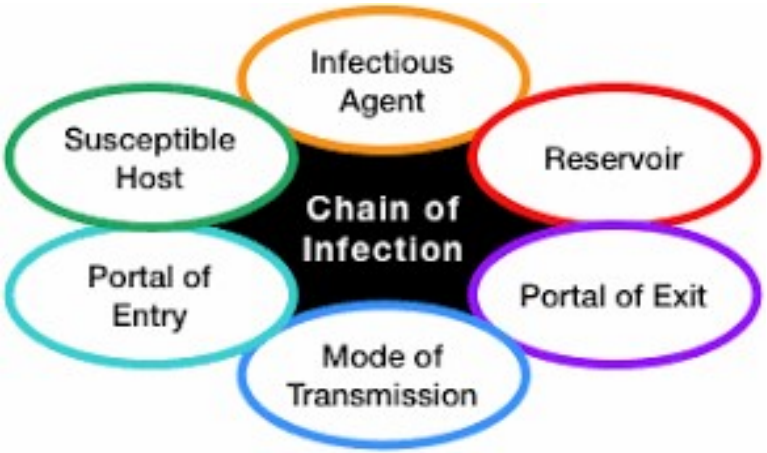
Cleaning & Disinfection

Real-World Procedures For Combatting SARS-CoV-2

What is a HAI/CAI?

- **Healthcare-Associated Infections (HAIs) (nosocomial infections):** Infections which are a result of treatment in a hospital or a healthcare service unit, but secondary to the patient's original condition.

- **Community-acquired infection**: An infection acquired in the community. In contrast to a nosocomial (healthcare-associated) infection.

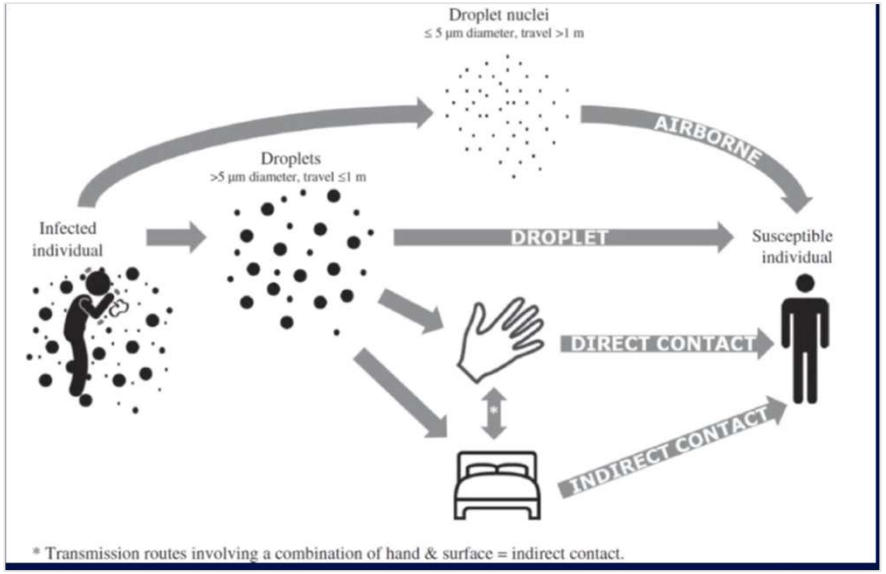


How does COVID-19 Spread?

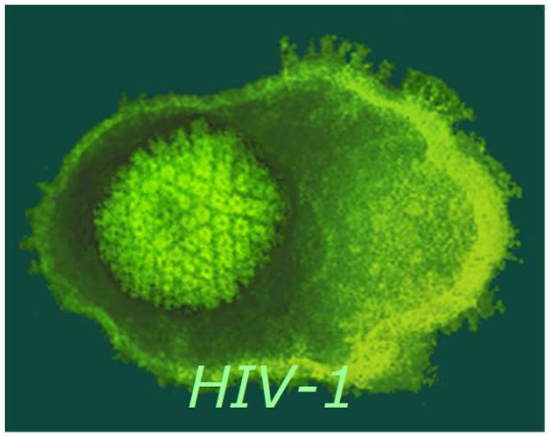
- Person-to-person
  - Between people who are in close contact with one another (within about 6 feet)
  - Via respiratory droplets produced when an infected person coughs or sneezes.
- Contact with infected surfaces or objects
- Through feces

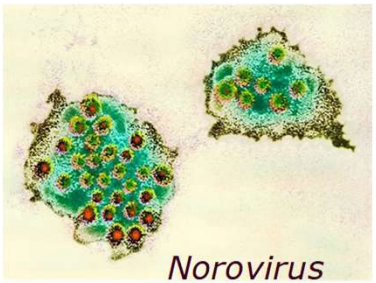
"This virus has many routes of transmission, which can partially explain its strong transmission and fast transmission speed."

-China CDC

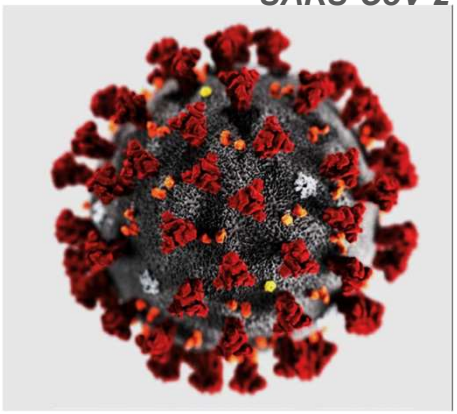


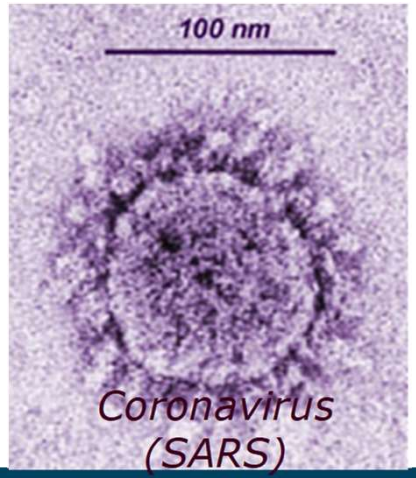
Viruses

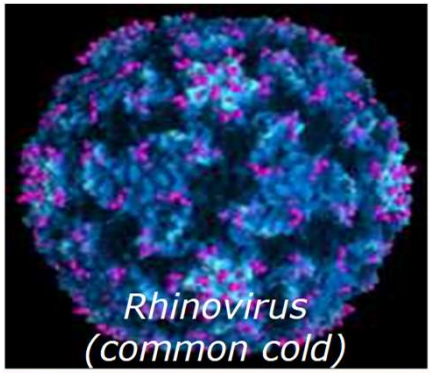


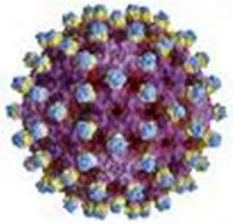


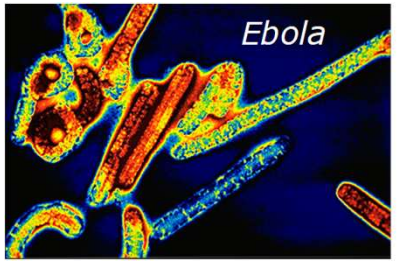
SARS-CoV-2



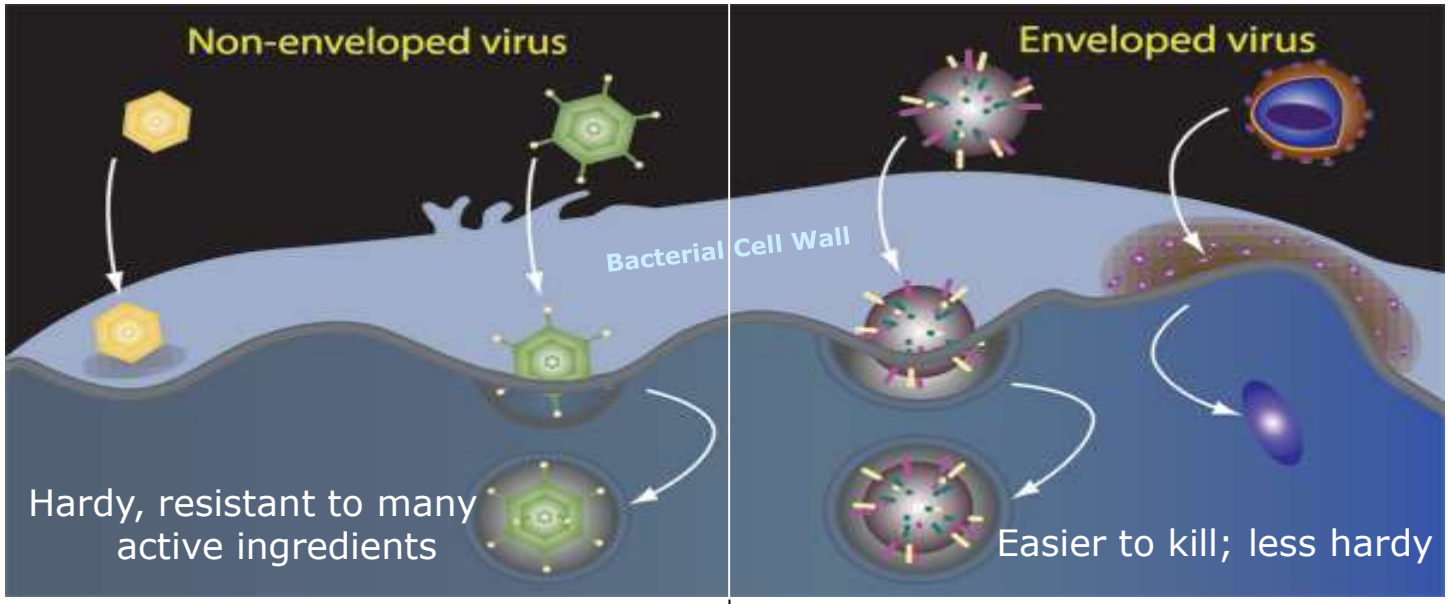








Virus Structures



- Picornoviridae (Polio, Enterovirus, Hepatitis A, Rhino)
- Parvovirus
- Calicivirus, Norovirus
- Adenovirus
- Rotavirus

- Coronavirus
- Hepatitis C
- Herpesviridae (Herpes, CMV)
- Hepatitis B
- Influenza
- HIV-1

Cleaning vs. Sanitizing vs. Disinfecting

Cleaning

- The removal of material like dust, soil, blood and body fluid
- Physically removes rather than kills microorganisms. Accomplished with water, detergents, and mechanical action
- Always essential prior to disinfection or sterilization
- A surface that has not been cleaned effectively cannot be properly disinfected or sterilized.

Sanitizing

- Carry a general claim of germ control, but generally not organism specific
- There are two basic kinds of sanitizers, food contact and non-food contact sanitizers.
  - food contact surfaces 99.999% (a 5-log reduction)
  - nonfood contact a reduction of 99.9% (3 logs)

within 30 seconds.

Disinfecting

- The inactivation of pathogens.
- Usually involves chemicals, heat or UV.
- Sterilization destroys microbial life including bacteria, viruses, spores and fungi
- Most common disinfectants used as quaternary ammonium compound products, hydrogen-based products, and sodium hypochlorite (bleach)

Used with permission from Kimberly-Clark PROFESSIONAL

Resistance of pathogens to disinfectants

Hard-to-Kill

Easy-to-Kill

Pathogens	Example	Disinfectants			
		Low-level Disinfection	Intermediate-level Disinfection		High-level Disinfection
Prions	Mad Cow Disease				
Bacterial Spores	Clostridium difficile				Peracetic acid / hydrogen peroxide blends
Mycobacteria	Tuberculosis		Quat / alcohol	Bleach and Hydrogen peroxide	
Nonlipid or small viruses	Norovirus				
Fungi	Athletes foot		Quat / alcohol blends		
Vegetative bacteria	MRSA, VRE	Quats			
Lipid or medium viruses	HIV				

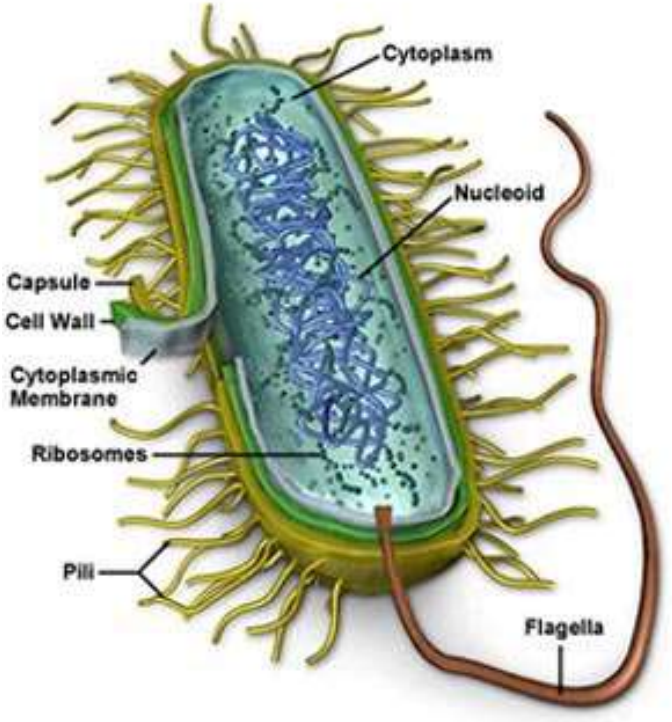
How Disinfectants Work

Surface Disinfectants

- Break down outer and inner cell walls
- Disrupt the physical properties of the cell
- Literally fry the inner cell components and do so much damage that the cell dies

To Work Properly, Disinfectants Need

- Proper Concentration
- Dwell Time
- Kill Claims
- PROPER APPLICATION PROCESS!



Example Disinfection Technologies

Hydrogen Peroxide Vapor

- Advantage: Simultaneous disinfection of room surfaces, furniture, and complex equipment
- Disadvantage: Potential damage of some plastic and polymer surfaces

Ultraviolet light

- Advantage: No residue after use, Simultaneous disinfection of room surfaces, furniture, and equipment
- Disadvantage: Destructive effect over time on plastics and vinyl's and fading of paints and fabrics

High Touch Surface Areas

Surfaces with regular hand-contact are called high touch surfaces.

These surfaces must be cleaned and disinfected daily to protect the patient and reduce the spread of HAIs


If you want to avoid germs in your office, you'd probably be better off licking the shared toilet seat than the phone receiver right in front of you. Here are some of the most — and least — germ-ridden spots in your office, according to research from Charles Gerba (aka "Dr. Germ"), who is a professor of soil, water and environmental science at the University of Arizona in Tucson.
At least 15x germier than the office toilet seat
At least 10x germier than the office toilet seat
Less than 10x germier than the office toilet seat

U.S. Centers for Disease Control and Prevention

Environmental Cleaning and Disinfection Recommendations

- Interim Recommendations for US Community Facilities with Suspected/Confirmed Coronavirus Disease 2019

  https://www.cdc.gov/coronavirus/2019-ncov/community/organizations/cleaning-disinfection.html

CDC Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Definitions

Community facilities such as schools, daycare centers, and businesses comprise most non-healthcare settings that are visited by the general public outside of a household.

CDC Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Cleaning and Disinfection After Persons Suspected/ Confirmed to Have COVID-19 Have Been in the Facility

Timing and Location

Facility that does not house people overnight:

- Close off areas and wait as long as practical. If possible, wait up to 24 hours before beginning cleaning and disinfection.
- Open outside doors and windows to increase air circulation.
- Clean and disinfect all areas, focusing especially on frequently touched surfaces.

CDC Centers for Disease Control and Prevention
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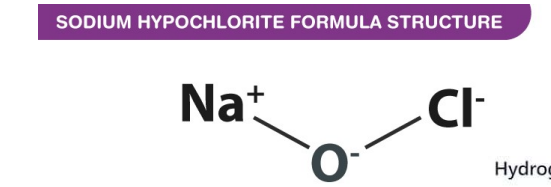
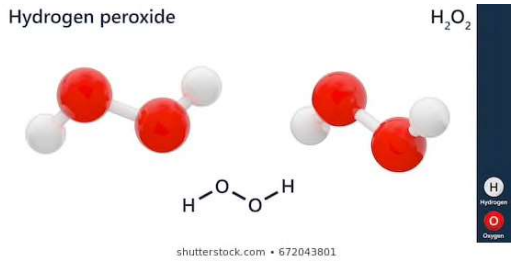
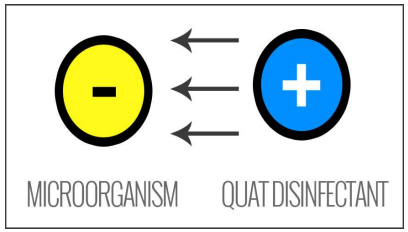
How to Clean and Disinfect

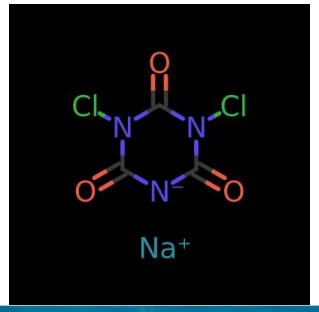
Surfaces

- Cleaned with detergent or soap and water prior to disinfection
- For disinfection:
  - EPA-registered household disinfectants
  - Diluted household bleach solutions (sodium hypochlorite) can also be used









Soft (Porous) Surfaces

- For soft (porous) surfaces such as carpeted floor, rugs, and drapes, remove visible contamination if present and clean with appropriate cleaners indicated for use on these surfaces. After cleaning:
  - If the items can be laundered, launder items in accordance with the manufacturer's instructions using the warmest appropriate water setting for the items and then dry items completely.
    - Otherwise, use products that are EPA-approved for use against the virus that causes COVID-19 and that are suitable for porous surfaces

List N: Disinfectants for Use Against SARS-CoV-2

https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2

- List N includes products that meet EPA's criteria for use against SARS-CoV-2, the novel coronavirus that causes the disease COVID-19.
- When purchasing a product, check if its **EPA registration number** is included on this list. If it is, you have a match and the product can be used against SARS-CoV-2. Products may be marketed and sold under different brand names.
- **Note: Inclusion on this list does not constitute an endorsement by EPA.**

Cleaning & Disinfection: Policy & Procedures

- Increased frequency of cleaning and disinfection in high density and high-touch areas
- Staff training
- Staff roles and responsibilities
- Cleaning frequencies
- Cleaning and disinfection protocols
- Selection of tools, supplies, equipment and chemicals
- Validation of cleanliness

Product Specification

Multi-attribute Review

Balancing Criteria

- Single Attribute Selection – not a comprehensive evaluation – can create unintended consequences
- Evaluation of all characteristics – required to meet project requirements
- There are some trade-offs – realizing that some will take precedent over others
- Product Service Life to be identified and tied to Use Phase – based upon performance through maintenance, durability, etc.
- COVID-19 – cleaning, sanitizing, and disinfection for human health and safety are front and center

Owner Project Requirements (OPR)

Project Type: Healthcare Setting Urban Hospital

Building Service Life: Exterior: 50 years
Building Service Life: Systems: 20 years – 2 ½ Cycle Renovations based on System Service Life
Building Service Life: Interior: 12 years – 4+ Cycle Renovations based on Product Service Life

Outcome: Mitigate Infection Risk
Outcome: Reduce Readmission Rates
Outcome: Improved Discharge Planning Process
Outcome: Maximize Reimbursement Rates
Outcome: Improve HCAHPS Scores
Outcome: Care Staff Retention
Outcome: Staff Satisfaction

Design Firm Recommendations to Owner

Urban Hospital – site constraints dictates orientation and location of building

LEED® v4.1 Silver Certification

Fitwel® Two Stars Certified

Operational cost savings is key to the Client

Environmental: Energy and Water Savings

Material Selection: Product Service Life and Indoor Environmental Quality

Health & Wellness: Thermal, Acoustic, and Lighting Comfort and Quality, Healthy Nutritional Focus, Water Availability and Water Quality

Product Evaluation

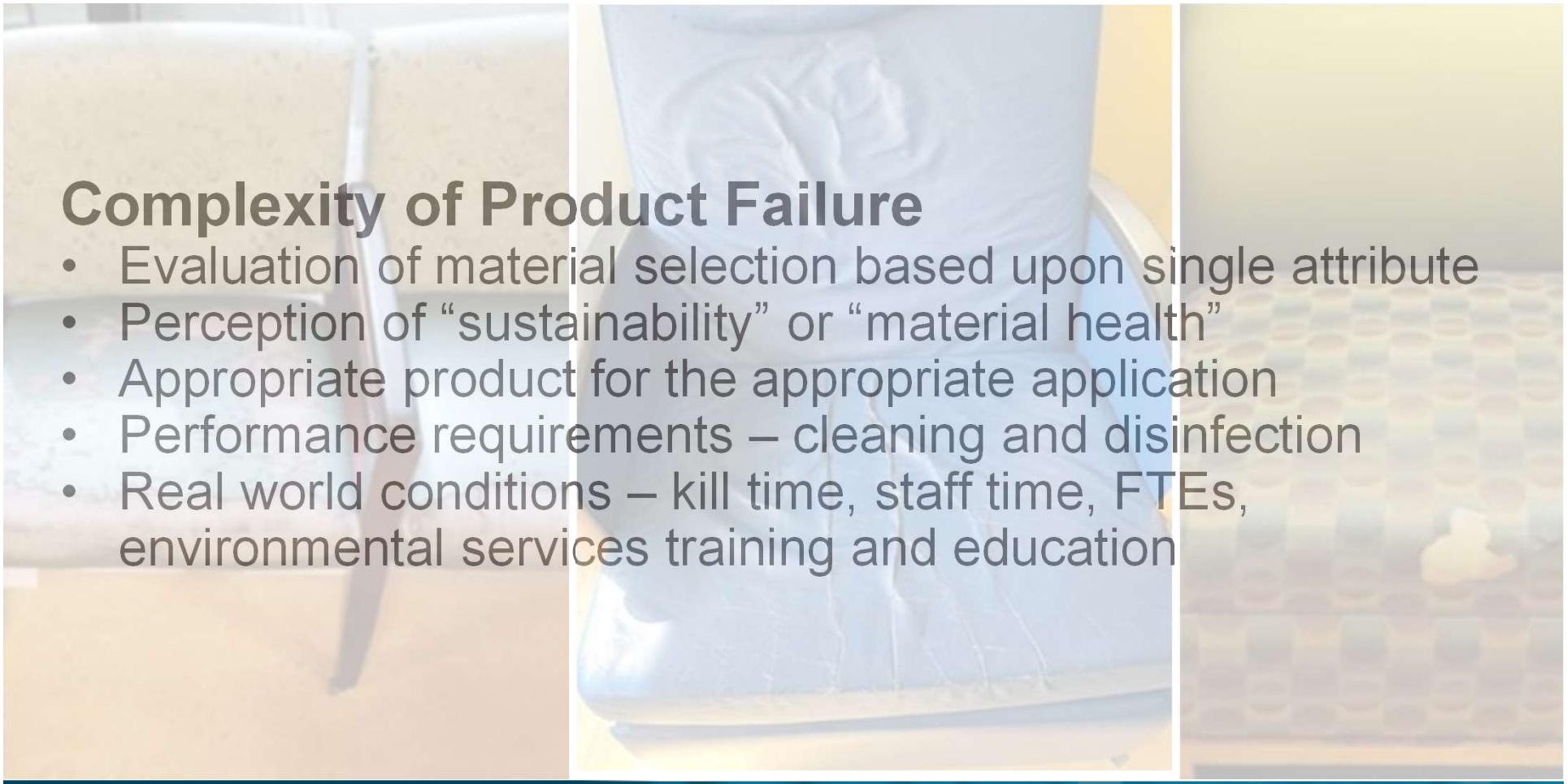
OPR: Building Service Life: 12 years

OPR: Reduce / Mitigate Spread of Infection

Upholstery Materials 

Green Building Rating System: Building Product Disclosure and Optimization – Material Ingredients

The Notorious Chair Graveyard



Complexity of Product Failure

- Evaluation of material selection based upon single attribute
- Perception of “sustainability” or “material health”
- Appropriate product for the appropriate application
- Performance requirements – cleaning and disinfection
- Real world conditions – kill time, staff time, FTEs, environmental services training and education

Magnitude of Financial Impacts

University-based Hospital System

The Numbers:

The information below is a quick tally of the approximate number of units from the original project order with polyurethane fabrics that are experiencing rolling failures:

- Inpatient sleep settees and overnight sleep chairs, patient recliners – 1,053
- Large scale lounge seating, fully upholstered arms, seats, backs – 540
- Infusion recliners and exam /infusion room guest seating – 923
- (ED only) modular and exam room seating – 130
- Upholstered task chairs & stools – 1,623

$9 Million for one hospital setting as the start of rolling failures.
Estimated at multiple hospitals potential total: $100+ Million!

Magnitude of Health and Safety Impacts

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AMERICAN SOCIETY OF INTERIOR DESIGNERS

Durable Coated Fabrics Task Group

- American Academy of Healthcare Interior Designers (AAHID)
- Healthcare Designers (inhouse to healthcare systems)
- Healthcare Designers (firmed based)
- Environmental Services (EVS) – Cleaning / Disinfection Experts
- BIFMA (Business and Institutional Furniture Manufacturers Association)
- CFFA (Chemical Fabrics and Film Association)
- VI (The Vinyl Institute)
- Chemists / Technical Representatives
- Manufacturers / Distributors of Durable Coated Fabrics
- www.durablecoatedfabrics.com

AAHID American Academy of Healthcare Interior Designers

DCF TASK GROUP

Result of Collaboration of All Stakeholders

- Development of toolkit is underway
- Fabric selection guide
- Questions for distributors / manufacturers of product
- CFFA – Healthcare Standard – minimum performance standards
- Certification to Healthcare Standard
- Opportunity for replication of toolkit for other interior product families
- Resource development that now impacts ALL spaces – as a result of COVID-19
- www.durablecoatedfabrics.com

AAHID American Academy of Healthcare Interior Designers

DCF TASK GROUP

Selection of Materials & Products

Post-COVID-19: Pre-occupancy / Functional Programming Process – Materials & Surfaces Review

- Understand performance requirements
- Multiple attributes evaluated for specifications – performance, sustainability, health & safety
- Identify product service life
- Match product application to appropriate product use
- Understand impacts and requirements of cleaning and disinfection

Pre-opening in Context of COVID-19

- Develop policies and procedures for re-opening
- Complete operational program for “a day in the life”
- Determine policy for testing option(s)
- Determine policy for wearing masks / PPE while at work
- Provide self-directed scheduling opportunities
- Determine number of returning employees
- Determine tele-work policy including accountability
- Provide break and respite spaces with social distancing
- Create and implement policy on cleaning and disinfection
- Redevelop layout, furnishings, HVAC filtration plan based on policies and procedures

Summary

- Evidence-based Solutions
- Importance of Product Performance – Multi-attribute Specifications
- Request Relevant Performance Testing Results
- High Touch Surfaces Cleaning and Disinfection
- Training and Education
- Encourage Interior Designers to Request Cleaning & Disinfection Information from Manufacturers / Distributors

Photo Credit: Mannington Commercial
Inova Children's Hospital

Questions & Answers

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Thank you!

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