National Collaborating Centre for Environmental Health



Centre de collaboration nationale en santé environnementale

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# Surface Cleaning and Disinfection in the Context of the COVID-19 Pandemic

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# COVID-19 resources for EH professionals

Full reports and more available at <u>NCCEH.CA</u>:

- A Rapid Review of Disinfectant Chemical Exposures and Health Effects During COVID-19 Pandemic
- Reducing COVID-19 Transmission Through Cleaning and Disinfecting Household Surfaces
- COVID-19 in indoor environments Air and surface disinfection measures
- Masking during the COVID-19 pandemic
- COVID-19 Risks and precautions for the performing arts
- Using Shared Laundry Facilities During the COVID-19 Pandemic



#### Reducing COVID-19 Transmission Through Disinfecting Household Surfaces

Prepared by Tina Chen

#### Background

The primary mode of human-to-human transmission for SARS-CoV-2, the viru coronavirus disease (COVID-19), is via direct contact with an infected person droplets, expelled during coughing, sneezing, speaking, or breathing.<sup>1,2</sup> These become deposited on surfaces such as door handles, light switches, chairs, fa touched surfaces.<sup>3</sup>

Contact with contaminated surfaces (fomites) followed by touching of the ey another important mode of SARS-CoV-2 transmission. The relative importanc pathways are still being investigated.<sup>45,6</sup> SARS-CoV-2 has been found to rema surfaces such as copper (four hours) and cardboard (24 hours) and for severa stainless steel under experimental conditions.<sup>7,8</sup> Other studies of coronavirus can remain viable for up to nine days on non-porous surfaces such as metal, I Interventions to reduce the transmission of SARS-CoV-2 via contact routes m and disinfecting to reduce viability of the virus on potentially contaminated s

Current guidance on the safe and appropriate use of cleaners and disinfectan across Canada, and accidental exposure to dangerous disinfection by-product have been reported (personal communication with colleagues at the Drug an British Columbia Centre for Disease Control, March 28, 2020, e-mail commun document provides information to public health professionals who may be co use of cleaning and disinfection products as well as frequency of cleaning and protect the health of the public. October 26, 2020

Disinfectant Chemical Exposures and Health Effects

During COVID-19 Pandemic



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#### A Rapid Review of Disinfectant Chemical Exposures and Health Effects During COVID-19 Pandemic

Prepared by

Tina Chen

#### **Primary Inquiry**

A public health practitioner raised a question about the misuse and overuse of disinfectants as a result of heightened concerns about SARS-CoV-2 transmission via environmental surfaces, and the potential for acute and chronic health impacts due to the use of certain disinfectant products. This document is a rapid review of literature to answer the following questions:

1. What are the potential health effects associated with exposure to disinfectants?

2. Are there safer substitutions for common disinfectants that have lower risks of long-term adverse health effects?

Disclaimer: The information provided here is for the purpose of addressing a specific inquiry related to an environmental health issue. This is not a comprehensive evidence review. The information offered here does not supersede federal, provincial, or local guidance or regulations.

#### Methods

A search was conducted in EBSCOhost databases and Google Scholar with variations of the following keywords: (disinfect OR disinfectant OR disinfection OR clean OR cleaning OR cleaner); (asthma OR respiratory OR chronic OR health effects OR health impacts); (sodium hypochlorite OR bleach OR quaternary); (domestic OR home OR house OR occupational OR work). A search for relevant regulations and grey literature was also conducted in Google Search Engine using variations of the above keywords. Only English language articles were included. A perusal of the title and abstract was performed before the article was included for review.

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# Outline

- 1. How is SARS-CoV-2 transmitted?
- 2. Understanding cleaning and disinfection
- 3. Potential acute and chronic health risks associated with exposure
- 4. Risk mitigation
- 5. Communication and education



# How is SARS-CoV-2 transmitted?

## **Characteristics and Transmission Routes**

- SARS-CoV-2 is the virus responsible for the disease COVID-19
- Enveloped, single-stranded RNA virus that is covered in protein spikes, which enable the virus to bind to and infect host cells
- Primarily transmitted via droplets and aerosols
- Other potential transmission routes include fomites and fecal-respiratory
- Research on characteristics such as infectious dose, transmission, and persistence on surfaces and air is still ongoing



#### Primary transmission: Droplets and aerosols

#### Large-medium droplets (> 5-10 µm)

• Expelled during forceful actions

such as coughing or sneezing

Tend to travel 1 meter or less before

dropping to the ground

Small droplets and aerosols (< 5 µm)

• Expelled during all forms of respiratory

actions including breathing, speaking, singing, and shouting

- May travel over longer distances and remain suspended in air for longer periods of time
- May accumulate in poorly ventilated indoor spaces



during pandemics

## Secondary transmission: Fomites and more



Source: Castaño et al. Fomite transmission and disinfection strategies for SARS-CoV-2 and related viruses

- Fomite transmission via direct and indirect contact •
  - Not a primary transmission route •
- Fecal-oral/respiratory route is still debated

#### "HIGH-TOUCH" SURFACE SAFETY **CLEAN & DISINFECT THOROUGHLY & FREQUENTLY:**







DOORKNOBS

**FAUCETS &** BATHROOM FIXTURES

COUNTERTOPS & TABLETOPS







PHONES



TRASH CANS

TERMINALS

**CREDIT CARD** 

SHOPPING CART CAR DOOR HANDLES HANDLES

Source: Twitter. LA Public Health



## Understanding Cleaning and Disinfection

Types of Surfaces			
Food contact surfaces	Environmental Surfaces		
	High-touch	Low-touch	
<ul> <li>Counter tops</li> <li>Utensils</li> <li>Pots and pans</li> <li>Cutting boards</li> <li>Appliances such as stoves, refrigerators, toaster ovens, microwaves</li> </ul>	<ul> <li>Door handles</li> <li>Light switches</li> <li>Faucets</li> <li>Stair banisters</li> <li>Toilet seats and flush levers</li> <li>Mobile devices and electronics</li> <li>Kitchen cabinet handles</li> </ul>	<ul> <li>Walls</li> <li>Floors</li> <li>Windows</li> <li>Windowsills</li> <li>Thermostats</li> <li>Blinds</li> </ul>	

## What are cleaners and disinfectants?



#### Cleaners

Physical removal of dirt, debris, dust, bodily fluids, and other organic materials from a surface using surfactants such as detergents (soaps) or abrasive cleaners and water. May inactivate certain microorganisms but do not fully eliminate all of them from surfaces.



#### Hard, non-porous surface disinfectants

Kill or inactivate different types of microorganisms depending on concentration and contact time. Categorized into low, intermediate, and high levels depending on intended use and targeted organisms. SARS-CoV-2 requires intermediate to intermediate-high level disinfectants.

### **Disinfectant Levels**

Low-level disinfectants	Intermediate-level disinfectants	High-level disinfectants
Able to destroy vegetative bacteria, some fungi, and viruses, but not mycobacteria or spores. These products are used on non-critical surfaces that only come into contact with intact skin.	Able to destroy vegetative microorganisms, mycobacteria, all fungi, and inactivates most viruses, but not spores. These disinfectants can also be used on non-critical surfaces that only come into contact intact skin and for household disinfection.	Able to destroy vegetative microorganisms and inactivate viruses but not necessarily bacterial spores unless they are specifically designed for such purpose. With longer contact time (6–10 hours), they are capable of sterilization. These products are typically used on medical devices or to clean up a blood or bodily fluid spill.

## Registration and Regulation in Canada

#### Canadian Consumer Product Safety Act

#### **Cleaning products**

 Required to provide clear usage, safety, and cautionary labels in both languages

#### Food and Drugs Act

#### Surface disinfectants

- Required to demonstrate efficacy against the target microorganisms
- Required to provide clear usage and cautionary labels to prevent and mitigate acute health hazards
- Comprehensive evaluation of potential longterm chronic health impacts from exposure is not required

## Disinfectants for use against SARS-CoV-2

Health Canada regularly updates two lists of approved products:

- Hard-surface disinfectants and hand sanitizers (COVID-19)
- Disinfectants and hand sanitizers accepted under COVID-19 interim measure
  - These products may not be fully compliant with labelling requirements, or are not authorized for sale in Canada but are authorized or registered in other jurisdictions with similar regulatory frameworks and quality assurances as Canada



#### Hard-surface disinfectants and hand sanitizers (COVID-19)

Overview	List of disinfectants (COVID-19)	List of hand sanitizers
Information for manufacturers	Products accepted under interim measure	

#### On this page

- What we are doing
- <u>Hygiene and hand sanitizers</u>
- Hard-surface disinfectants
- <u>Surface sanitizers</u>
- <u>Contact and more information</u>

#### What we are doing

The health and safety of Canadians is our priority. Along with measures reported in the Government of Canada's <u>response to COVID-19</u>, Health Canada introduced <u>innovative and agile regulatory measures</u> to make health products available to Canadians and health care workers.

## Common active ingredients in disinfectants

Three main classes of active ingredients in disinfectants are effective against a broad range of microorganisms:



- Different products require different concentrations and contact times to ensure efficacy
- Each active ingredient reacts differently with chemicals in other cleaning and disinfecting products

#### Common cleaning and disinfection practices

- Follow guidelines established in your province or jurisdiction
- In general:
  - Use a Health Canada-approved disinfectant and follow manufacturer's instructions
  - Clean and disinfect high-touch surfaces twice a day
  - Clean and disinfect low-touch surfaces once every few days
- When developing routine cleaning and disinfection policies, take the following into consideration
  - Local context and prevalence of the virus
  - Characteristics of the setting such as occupancy, and duration and proximity of contact
  - Characteristics of the population in the setting

# Caution against overemphasis on surface cleaning and disinfection

- SARS-CoV-2 is primarily transmitted via droplets and aerosols during prolonged close contact, or extended duration of interactivity in a poorly ventilated indoor space
- Currently there is minimal epidemiological evidence to support fomite transmission
- Research studies on persistence of SARS-CoV-2 on surfaces have been criticized for real-life applicability and variance in experimental conditions
- Cleaning and disinfection is only one of the myriad of non-pharmaceutical control measures
- Overuse and misuse of products may increase the risk of acute and chronic adverse health impacts



# Potential acute and chronic health risks associated with exposure to disinfectants

#### Potential acute health risks

Misuse: Improper mixing or preparation of disinfectant solutions (e.g. mixing bleach with other products containing ammonia or acids)

- Bleach + ammonia  $\rightarrow$  chloramine gases
- Bleach + acids  $\rightarrow$  chlorine gas
- Bleach + hot water  $\rightarrow$  chlorine gas
- $\rightarrow$  Exposure to excessive concentrations of the disinfectant or dangerous by-products

Overuse: Excessive use of disinfectants over the recommended frequency

 $\rightarrow$  Acute adverse reactions and chronic health impacts

#### Confounding factors in research

- Ingredients such as perfumes and other sensitizers in cleaning products may trigger asthma and/or allergies
- Indoor contaminants include volatile organic compounds from furniture, carpets, and paint, as well as tobacco smoke, mould, dust, and other allergens and airborne particulates may also trigger asthma and other adverse respiratory health outcomes



#### **Occupational exposures**

- Research shows association between spray disinfectants and asthma symptoms
- Exposure to cleaning and disinfectant products is associated with an increase in the risk of asthma, new-onset asthma, and rhinitis
- Exposure to bleach and quaternary ammonium compounds is associated with adverse respiratory health impacts
- A dose-response relationship was found between asthma and new-onset asthma and exposure to certain disinfectants and cleaning sprays

#### Non-occupational exposures (domestic)

- Evidence appears to show a dose-response relationship between frequency of use of bleach and ammonia products and asthma symptoms
- Low-use of disinfectants (1-3 times a week) appears to alleviate asthma and allergic reactions related to common indoor and outdoor allergens
- Frequent use (4-7 times a week) is associated with increased risk of asthma in young adults

#### Indoor exposures in children

- Children whose mothers used chemical-based household products during pregnancy were more likely to experience wheeze
- Children who were exposed to bleach as a disinfectant at home and in school experienced an increased frequency of respiratory symptoms such as respiratory inflammation and recurrent bronchitis, as well as other related infections
- Children who live in homes with higher disinfectant use experienced higher frequency of adverse skin and respiratory effects and sensitization to disinfectants (PHAC, 2020)
- A study found chloroform at unacceptable concentrations in several early childhood education centres that use bleach regularly (PHAC, 2020)
- Disinfecting once a week in homes was found to have a protective effect against the development of asthma for children, possibly due to reduction of indoor allergens

### Application methods of disinfectants



Trigger sprayer



Manual application



Electrostatic sprayer



Fogger

- Spray applications may facilitate accidental respiratory exposure to airborne disinfectant particles
- The size, shape, and density of aerosols, the characteristics of the target surfaces, and environmental factors such as relative humidity and temperature will influence how long aerosols stay airborne and where the aerosols eventually deposit in the respiratory tract
- Electrostatic sprayers and foggers may also cause acute health risks for occupants due to the small size of aerosols generated from these machines



# Options to lessen unintended health impacts

### **Risk assessment**

Prior to implementing a routine disinfection policy, a proper risk assessment should take the following into consideration:

- Local context and prevalence of the virus
- Characteristics of the setting such as occupancy, and duration and proximity of contact
- Characteristics of the population in the setting



## Reducing health risks from exposure

Several recommendations have been suggested in the literature to reduce health risks from disinfectant exposure and improve respiratory health:

- Substitute cleaning and disinfectant sprays with liquid products that are manually applied with a cloth
- Substitute sodium hypochlorite and quaternary ammonium compounds with other disinfectants that have lower health risks
- Improve personal protective equipment worn by users
- Increase ventilation during and following treatment
- Provide proper worker training in safe cleaning and disinfection practices
- Avoid using cleaning and disinfectant products around children
- Allow the area being treated to air out following application
- Follow label usage instructions and avoid mixing cleaning and disinfectant products
- Clearly label disinfectants and store away from children and pets



# Opportunities for communication and education

### Lack of knowledge about appropriate use

- US and Canadian poison information centres observed a sharp increase in total number of calls related to accidental exposures to cleaning and disinfectant products in March 2020 compared to previous years
- Survey of Americans reported knowledge gaps in several areas including safe preparation of disinfectant solutions, use of personal protective equipment while using disinfectants, and safe storage of disinfectant products



#### **Effective communication**

Public health communication during the COVID-19 pandemic should follow several basic principles:

Messages should be kept as simple and clear as possible.

The most important information should be prioritized in the message as long lists of recommendations may not maintain the reader's interest.

Identify target audience and tailor messages to the group.

Messages should be designed with the final intended outcomes in mind. Messages should be inclusive of all identified affected populations and communities in the target group or site/setting.

# Working with operators



Provide clear COVID-19 public health measures specific to various facilities in your jurisdictions



Review existing cleaning and disinfection policies and identify high-touch surfaces in customer, kitchen, storage, and staff areas that require enhanced disinfection

Provide clear instructions to avoid accidental misuse or overuse

Ensure appropriate PPE is used when cleaning and disinfecting



Inform operators of the potential health risks associated with cleaning and disinfection products. Support them if they are interested in seeking safer alternatives

Third-party certifiers of less hazardous and more environmentally friendly products: EcoLogo, Green Seal, and the US EPA's Design for the Environment program

## Working with retailers



Work with retailers to provide informational signage or pamphlets near the product shelves to inform consumers of the appropriate usages, precautions, and potential health risks of cleaning and disinfectant products



Include additional resources such as disinfectant alternatives that are identified by third-party certifiers such as EcoLogo, Green Seal, and the US EPA's Design for the Environment program to be less hazardous to health and more environmentally friendly

## Working with other public health teams



Collaborate with other departments in your public health agency, such as long-term care, childcare, infection control specialists, health and safety, and communications to develop guidance, policies, and messages on enhanced cleaning and disinfection, among other public health measures

# Working with community organizations



Reach out to community organizations who may be interested in guidance on enhancing cleaning and disinfection practices for their target audiences or clients



Provide information about how to prevent the potential health risks from misuse and overuse of cleaning and disinfectant products



May also include the importance of balancing the use of disinfectants with other public health control measures including physical distancing, face coverings, increased ventilation, and reallocation of indoor spaces

#### Other suggestions?



We welcome other suggestions of opportunities for collaboration, communication, and education with other key stakeholders

## Knowledge gaps

- Infectious dose
- Interactivity and transfer rate to and from fomites, and from hands to mucosal membranes
- Survivability and persistence in air and on surfaces in real-world scenarios
- Re-suspension from various types of surfaces
- ... and much more

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