

COVID-19 Living Evidence Synthesis 18.1: Effectiveness of Cleaning and Disinfecting for reducing transmission of COVID-19 and other respiratory infections in non-health care community-based settings

Date of Literature Search: December 16, 2022

Suggested citation: Velásquez-Salazar P, Marin-Orozco IC, Patiño-Lugo DF, Florez ID, COVID-END PHSM LES Working Group. Unit of Evidence and Deliberation for Decision Making (UNED), University of Antioquia, 23 December 2022.

Please note: This living evidence synthesis (LESs) is part of a suite of LESs of the best-available evidence about the effectiveness of six PHSMs (masks, quarantine and isolation, ventilation, physical distancing and reduction of contacts, hand hygiene and respiratory etiquette, cleaning, and disinfecting), as well as combinations of and adherence to these measures, in preventing transmission of COVID-19 and other respiratory infectious diseases in non-health care community-based setting. The LESs are updated every six weeks and include enhancements from the previous versions (e.g., inclusion of additional study designs and updated risk of bias assessments). The most up-to-date version of this and other [LESs in the suite are available on the COVID-END website](#).

Question

1. What is the best available evidence about the effectiveness of cleaning and disinfecting products and strategies in reducing transmission of COVID-19 and other respiratory illnesses (e.g. influenza, respiratory syncytial virus (RSV) in non-health care community based settings?

Executive summary

Background

- Non-pharmaceutical interventions are part of the control measures for the transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and the cleaning and disinfecting are activities thought to be effective on COVID-19 risk reduction ([Bojorquez-Chapela, 2022](#)).
- In March 2020, following the identification of SARS-CoV-2, the Centers for Disease Control and Prevention, and US Environmental Protection Agency (EPA) issued List N: Disinfectants for Use Against SARS-CoV-2 (EPA, 2020a), initially identified 250 surface disinfectants that met EPA's criteria for efficacy under the Emerging Viral Pathogens Guide for Antimicrobial Pesticides (EPA, 2016, 2020a). By August 2020, the List N included of 482 surface disinfectants ([Dotson, 2020](#)).
- However, there is little evidence to inform or support decision making about which types of cleaning and/or disinfecting products and strategies are most effective at reducing transmission of COVID-19 and/or other respiratory illnesses and how often cleaning and/or disinfecting affects the transmission of COVID-19 in community settings ([Wang, 2020](#)).

What has changed in this version?

- Data on chlorine and ethanol household disinfecting frequency for SARS-CoV-2 transmission reduction has been reported, with the data drawn from one study with serious RoB ([Wang, 2020](#)).

Key points

- In family members who had lived with primary cases, the use of disinfectants containing **chlorine or ethanol** once a day might reduce the SARS-CoV-2 household transmission compared to the use of the same disinfectants once in 2 or more days (77% [95% CI, 16 to 93%]).

Overview of evidence and knowledge gaps

- There is scarce evidence on the effectiveness of different cleaning and disinfecting products/strategies frequencies in community settings to reduce the SARS-CoV-2 transmission.
- There is a lack of evidence of cleaning/disinfecting strategies for the outcomes of ICU admission, ventilation, and death associated with COVID-19.
- There is a lack of evidence evaluating differences between cleaning/disinfecting and no cleaning/disinfecting.

Suggested Tweet

- What is the effectiveness of cleaning and disinfecting for SARS-CoV-2 transmission reduction? Read our latest living evidence synthesis (LES 18.1) [[Link](#)].

Findings

- One study was included providing information about SARS-CoV-2 transmission with a serious RoB.
- Overall, 1047 records were identified through evidence search, 830 were appraised in title and abstract, 175 in full text, and one study was used to complete this summary. The reasons for excluding the remaining 174 studies are reported in [Appendix 2](#). [Figure 1](#) presents the PRISMA flow diagram.

Summary of findings about the primary outcome: Reducing transmission of SARS-CoV-2

One study was included, reporting on reducing transmission of SARS-CoV-2 as an outcome. The characteristics, findings, and risk of bias assessment of this study are presented in [Table 1](#).

In family members who had lived with primary cases, the use of disinfectants containing chlorine or ethanol once a day reduced the SARS-CoV-2 household transmission compared to the use of disinfectants containing chlorine or ethanol once in 2 or more days. (Serious RoB)

Summary of findings about secondary outcome 1: Reducing COVID-19 ICU admission, ventilation and deaths

No studies were included that report on reducing COVID-19 associated ICU admission, ventilation, and deaths as an outcome, in this version of the LES. The characteristics, findings, and assessment of risk of bias for each study will be presented in [Table 2](#) when available.

Box 1: Our approach

We retrieved candidate studies by searching: 1) PubMed via COVID-19+ Evidence Alerts; and 2) pre-print servers. Searches were conducted for studies reported in English, conducted with humans and published since 1 January 2020 (to coincide with the emergence of COVID-19 as a global pandemic). Our detailed search strategy is included in [Appendix 1](#).

Studies were identified up to five days before the version release date. Studies that report on empirical data with a comparator were considered for inclusion, with modelling studies, simulation studies, cross-sectional studies, case reports, case series, and press releases excluded. Other study designs may be considered for future versions in the absence of other forms of evidence. A full list of included studies is provided in [Tables 1-3](#). Studies excluded at the last stages of reviewing are provided in [Appendix 2](#).

Population of interest: All population groups that report data related to all COVID-19 variants and sub-variants.

Intervention and control/comparator: Cleaning: Cleaning surfaces and objects with soap (or detergent) and water to reduce the amount of viral particles by physically removing them. Disinfecting: Disinfecting indicates use of a disinfectant product on surfaces or objects to deactivate COVID-19 or other viruses.

Primary outcome: Reduction in transmission of COVID-19; **Secondary outcomes:** Reduction in COVID-19 associated ICU admission, ventilation and deaths, and transmission of other respiratory infections.

Data extraction: Data extraction was conducted by one team member and checked for accuracy and consistency by another using the template provided in [Appendix 3](#).

Critical appraisal: Risk of Bias (ROB) of individual studies was assessed using validated ROB tools. For RCTs we used ROB-2, and for observational studies, we used ROBINS-I. Judgements for the domains within these tools will be decided by consensus within synthesis team and undergo revision with subsequent iterations of the LES as needed. Additional ROB tools will be added as needed to fit with other study designs. Once a study was deemed to meet one criterion that made it “critical” risk of bias, it was dropped without completing the full ROB assessment. Our detailed approach to critical appraisal is provided in [Appendix 4](#).

Summaries: We summarized the evidence by presenting narrative evidence profiles across studies by outcome measure. Future versions may include statistical pooling of results if deemed

Summary of findings about secondary outcome 2: Reducing transmission of other respiratory infections

No studies were included that report on reducing transmission of other respiratory infections as an outcome, in this version of the LES. The characteristics, findings and assessment of risk of bias for each study will be presented in [Table 3](#) when available.

Figure 1. PRISMA flow diagram ([Page, 2021](#))

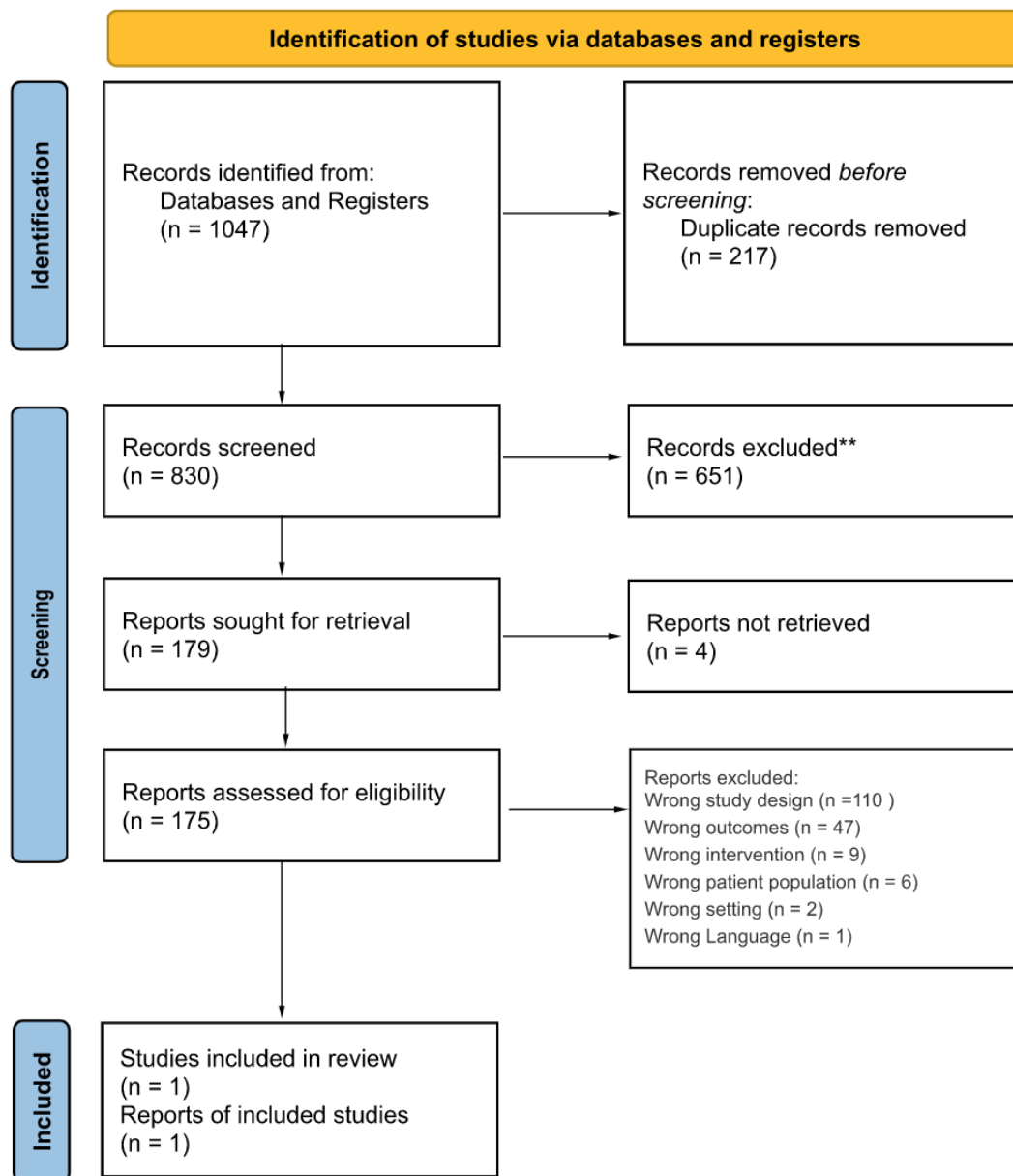


Table 1: Summary of studies reporting on effectiveness of cleaning and disinfecting in preventing COVID-19 infections

Reference	Date released	Setting and time covered	Study characteristics	Summary of key findings in relation to the outcome	RoB
Wang, 2020	28 May 2020	Beijing, China	<p>Design: Retrospective cohort</p> <p>Intervention: Disinfecting with chlorine or ethanol once a day compared to once in 2 or more days.</p> <p>Sample: 335 people in 124 families</p> <p>Population: Family members who had lived with primary cases in a house for 4 days before and for more than 24 hours after the primary cases developed illness related to COVID-19. All laboratory confirmed COVID-19 cases reported in Beijing until 21 February 2020, were enrolled in our study and followed-up.</p> <p>Setting: Household disinfection of the floor, door and window handles, indoor air, tables and toilets.</p> <p>Key outcomes: COVID-19 transmission reduction</p> <p>VOCs assessed: None</p>	<ul style="list-style-type: none"> In family members who had lived with primary cases, the use of disinfectants containing chlorine or ethanol once a day reduced the SARS-CoV-2 household transmission compared to the use of disinfectants containing chlorine or ethanol once in 2 or more days. [OR 0.23 (95% CI, 0.07, 0.84)] 14 days after the intervention. 	Serious

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Table 2: Summary of studies reporting on effectiveness of cleaning and disinfecting in reducing COVID-19 associated ICU admissions, ventilation and deaths

Reference	Date released	Setting and time covered	Study characteristics	Summary of key findings in relation to the outcome(s)	RoB
No data yet					

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Table 3: Summary of studies reporting on effectiveness of cleaning and disinfecting in reducing other respiratory infections

Reference	Date released	Setting and time covered	Study characteristics	Summary of key findings in relation to the outcome	RoB
No data yet					

Acknowledgements

To help Canadian decision-makers as they respond to unprecedented challenges related to the COVID-19 pandemic, COVID-END in Canada is preparing evidence syntheses like this one. This living evidence synthesis was commissioned by the Office of the Chief Science Officer, Public Health Agency of Canada. The development and continued updating of this living evidence synthesis has been funded by the Canadian Institutes of Health Research (CIHR) and the Public Health Agency of Canada. The opinions, results, and conclusions are those of the team that prepared the evidence synthesis, and independent of the Government of Canada, CIHR, and the Public Health Agency of Canada. No endorsement by the Government of Canada, Public Health Agency of Canada or CIHR is intended or should be inferred.

Appendices

Appendix 1: Detailed search strategy

Databases searched:

- PubMed <https://pubmed.ncbi.nlm.nih.gov/>
- iCITE (searches Research Square, MedRxiv, arXiv, bioRxiv, Preprints.org, ChemRxiv, Peer Review (PubMed), and Qeios) <https://icite.od.nih.gov/covid19/search/>
- Embase via OVID Embase 1996 to 2022 December 05
- Compedex <https://www.engineeringvillage.com/>
- Web of Science - <https://www.webofscience.com/wos/woscc/basic-search>

Search Limits: English language, Human, searched from 01/01/2020

PubMed Search:	
#1	("COVID 19"[MeSH] OR "COVID 19"[All Fields] OR "sars cov 2"[All Fields] OR "sars cov 2"[MeSH] OR "severe acute respiratory syndrome coronavirus 2"[All Fields] OR ncov[All Fields] OR "2019 ncov"[All Fields] OR "coronavirus infections"[MeSH] OR coronavirus[MeSH] OR coronavirus[All Fields] OR coronaviruses[All Fields] OR betacoronavirus[MeSH] OR betacoronavirus[All Fields] OR betacoronaviruses[All Fields] OR "wuhan coronavirus"[All Fields] OR 2019nCoV[All Fields] OR Betacoronavirus*[All Fields] OR "Corona Virus*" [All Fields] OR Coronavirus*[All Fields] OR Coronovirus*[All Fields] OR CoV[All Fields] OR CoV2[All Fields] OR COVID[All Fields] OR COVID19[All Fields] OR COVID-19[All Fields] OR HCoV-19[All Fields] OR nCoV[All Fields] OR "SARS CoV 2"[All Fields] OR SARS2[All Fields] OR SARSCoV[All Fields] OR SARS-CoV[All Fields] OR SARS-CoV2[All Fields]) AND English[la])
#2	(Environmental Health[MeSH] OR Environmental Monitoring[MeSH] OR fomites[MeSH] OR Housekeeping[MeSH] OR "Housekeeping, Hospital"[MeSH] OR housekeeping[TIAB] OR housework[TIAB] OR surface[TIAB] OR fomite[TIAB] OR surface[TIAB] OR "public

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	space*[TIAB] OR "public transport"[TIAB] OR "public facilities"[TIAB] OR bathroom[TIAB] OR washroom[TIAB] OR toilet[TIAB] OR "light switch"[TIAB] OR "household hygiene"[TIAB] OR "household cleaning"[TIAB]) AND ("Disease Transmission, Infectious"[Mesh] OR "transmi*" [TIAB] OR infect*[TIAB] OR contagi*[TIAB] OR outbreak*[TIAB] OR spread*[TIAB]) AND (clean*[TIAB] OR disinfect*[TIAB] OR Infection control*[MeSH] OR steril*[TIAB] OR sanitis*[TIAB] OR sanitation[TIAB] OR sanitiz*[TIAB])
#3	#1 and #2
#4	search*[Title/Abstract] OR meta-analysis[Publication Type] OR meta analysis[Title/Abstract] OR meta analysis[MeSH Terms] OR review[Publication Type] OR diagnosis[MeSH Subheading] OR associated[Title/Abstract]
#5	(clinical[TIAB] AND trial[TIAB]) OR clinical trials as topic[MeSH] OR clinical trial[Publication Type] OR random*[TIAB] OR random allocation[MeSH] OR therapeutic use[MeSH Subheading]
#6	comparative study[pt] OR Controlled Clinical Trial[pt] OR quasiexperiment[TIAB] OR "quasi experiment"[TIAB] OR quasiexperimental[TIAB] OR "quasi experimental"[TIAB] OR quasi-randomized[TIAB] OR "natural experiment"[TIAB] OR "natural control"[TIAB] OR "Matched control"[TIAB] OR (unobserved[TI] AND heterogeneity[TI]) OR "interrupted time series"[TIAB] OR "difference studies"[TIAB] OR "two stage residual inclusion"[TIAB] OR "regression discontinuity"[TIAB] OR non-randomized[TIAB] OR pretest-posttest[TIAB]
#7	cohort studies[mesh:noexp] OR longitudinal studies[mesh:noexp] OR follow-up studies[mesh:noexp] OR prospective studies[mesh:noexp] OR retrospective studies[mesh:noexp] OR cohort[TIAB] OR longitudinal[TIAB] OR prospective[TIAB] OR retrospective[TIAB]
#8	Case-Control Studies[Mesh:noexp] OR retrospective studies[mesh:noexp] OR Control Groups[Mesh:noexp] OR (case[TIAB] AND control[TIAB]) OR (cases[TIAB] AND controls[TIAB]) OR (cases[TIAB] AND controlled[TIAB]) OR (case[TIAB] AND comparison*[TIAB]) OR (cases[TIAB] AND comparison*[TIAB]) OR "control group"[TIAB] OR "control groups"[TIAB]
#9 (retrieve Reviews)	#3 and #4
#10 (retrieve RCTs)	#3 and #5
#11 (retrieve Quasi-experimental studies)	#3 and #6
#12 (retrieve Cohort studies)	#3 and #7
#13	#3 and #8
#14	#9 or #10 or #11 or #12 or #13
#15	#14 NOT (Animals[Mesh] NOT (Animals[Mesh] AND Humans[Mesh]))

Appendix 2: Studies excluded at the last stages of reviewing

Excluded studies during full text assessment		
Author, year	Reason for exclusion	Version of exclusion
Abdullahi, 2020	Wrong study design	Excluded in LES 18.1
Abney, 2021	Wrong study design	Excluded in LES 18.1
Aghajanzadeh, 2022	Wrong outcomes	Excluded in LES 18.1
Ainsworth, 2021	Wrong outcomes	Excluded in LES 18.1
Al-Ansari, 2021	Wrong intervention	Excluded in LES 18.1
Al-Gheethi, 2020	Wrong study design	Excluded in LES 18.1
Anan, 2021	Wrong intervention	Excluded in LES 18.1
Anand, 2022	Wrong study design	Excluded in LES 18.1
Ansari, 2021	Wrong study design	Excluded in LES 18.1
Ardura, 2021	Wrong outcomes	Excluded in LES 18.1
Arefi, 2020	Wrong study design	Excluded in LES 18.1
Aydogdu, 2021	Wrong study design	Excluded in LES 18.1
Azelee, 2020	Wrong study design	Excluded in LES 18.1
Badri, 2021	Wrong outcomes	Excluded in LES 18.1
Barbato, 2022	Wrong population	Excluded in LES 18.1
Basu, 2021	Wrong outcomes	Excluded in LES 18.1
Bayarri, 2021	Wrong outcomes	Excluded in LES 18.1
Bazaid, 2020	Wrong intervention	Excluded in LES 18.1
Bedrosian, 2021	Wrong study design	Excluded in LES 18.1
Bergman, 2021	Wrong study design	Excluded in LES 18.1
Bhutta, 2021	Wrong study design	Excluded in LES 18.1
Bono, 2021	Wrong study design	Excluded in LES 18.1
Bregnocchi, 2022	Wrong study design	Excluded in LES 18.1
Bueckert, 2020	Wrong outcomes	Excluded in LES 18.1
Buklaha, 2022	Wrong study design	Excluded in LES 18.1
Butot, 2021	Wrong outcomes	Excluded in LES 18.1
Cai, 2022	Wrong study design	Excluded in LES 18.1
Cajar, 2022	Wrong outcomes	Excluded in LES 18.1
Ceresa, 2021	Wrong study design	Excluded in LES 18.1
Chen, 2021	Wrong study design	Excluded in LES 18.1
Chen, 2022	Wrong study design	Excluded in LES 18.1
Chiappa, 2021	Wrong outcomes	Excluded in LES 18.1
Chirani, 2021	Wrong study design	Excluded in LES 18.1
Cimolai, 2020	Wrong study design	Excluded in LES 18.1
Cimolai, 2022	Wrong study design	Excluded in LES 18.1
Claus, 2021	Wrong study design	Excluded in LES 18.1

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Cortes, 2020	Wrong outcomes	Excluded in LES 18.1
Costa, 2022	Wrong outcomes	Excluded in LES 18.1
DelBrutto, 2021	Wrong intervention	Excluded in LES 18.1
DeLeo, 2020	Wrong study design	Excluded in LES 18.1
Delikhoon, 2021	Wrong outcomes	Excluded in LES 18.1
DevKumar, 2020	Wrong study design	Excluded in LES 18.1
Dewey, 2022	Wrong study design	Excluded in LES 18.1
Deyab, 2020	Wrong study design	Excluded in LES 18.1
DiFiore, 2022	Wrong setting	Excluded in LES 18.1
DiMaria, 2020	Wrong study design	Excluded in LES 18.1
Dietz, 2020	Wrong study design	Excluded in LES 18.1
DiLorenzo, 2021	Wrong study design	Excluded in LES 18.1
Donde, 2021	Wrong study design	Excluded in LES 18.1
Dorgham, 2021	Wrong study design	Excluded in LES 18.1
Dotson, 2020	Wrong study design	Excluded in LES 18.1
Ehsani, 2023	Wrong outcomes	Excluded in LES 18.1
England, 2021	Non available article	Excluded in LES 18.1
Epelle, 2023	Wrong study design	Excluded in LES 18.1
Escamilla, 2021	Wrong study design	Excluded in LES 18.1
Ezzatpanah, 2022	Non available article	Excluded in LES 18.1
Fantozzi, 2022	Wrong population	Excluded in LES 18.1
Farahmandfar, 2021	Wrong study design	Excluded in LES 18.1
Farid, 2022	Wrong study design	Excluded in LES 18.1
Farooq, 2023	Wrong study design	Excluded in LES 18.1
Filipe, 2021	Wrong study design	Excluded in LES 18.1
Fiore, 2021	Wrong outcomes	Excluded in LES 18.1
Fotsa-Mbogne, 2021	Wrong study design	Excluded in LES 18.1
GarcíadeAbajo, 2020	Wrong study design	Excluded in LES 18.1
Gardezi, 2020	Wrong study design	Excluded in LES 18.1
Gharpure, 2020	Wrong study design	Excluded in LES 18.1
Ghosh, 2021	Wrong outcomes	Excluded in LES 18.1
Gokce, 2022	Wrong study design	Excluded in LES 18.1
Gold, 2021	Wrong outcomes	Excluded in LES 18.1
Graça, 2022	Wrong study design	Excluded in LES 18.1
Greenhalgh, 2021	Wrong intervention	Excluded in LES 18.1
Gwenzi, 2022	Wrong study design	Excluded in LES 18.1
Halperin, 2021	Wrong study design	Excluded in LES 18.1
Hamilton, 2022	Wrong outcomes	Excluded in LES 18.1
Han, 2022	Wrong study design	Excluded in LES 18.1
Han, 2022	Wrong study design	Excluded in LES 18.1
Hata, 2021	Wrong study design	Excluded in LES 18.1

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Henderson, 2022	Wrong study design	Excluded in LES 18.1
Hora, 2020	Wrong study design	Excluded in LES 18.1
Howard, 2020	Wrong study design	Excluded in LES 18.1
JameleddineChtioui, 2020	Wrong Language	Excluded in LES 18.1
Janik, 2021	Wrong study design	Excluded in LES 18.1
Jefri, 2022	Wrong study design	Excluded in LES 18.1
Kampf, 2020	Wrong study design	Excluded in LES 18.1
Kampf, 2020	Wrong intervention	Excluded in LES 18.1
Kampf, 2020	Wrong outcomes	Excluded in LES 18.1
Kchaou, 2020	Wrong study design	Excluded in LES 18.1
Kersh, 2021	Wrong outcomes	Excluded in LES 18.1
Kewat, 2022	Wrong study design	Excluded in LES 18.1
Khatib, 2020	Wrong study design	Excluded in LES 18.1
Kivuti-Bitok, 2020	Wrong study design	Excluded in LES 18.1
Kolanthai, 2022	Non available article	Excluded in LES 18.1
Kumar, 2022	Wrong study design	Excluded in LES 18.1
Kumar, 2022	Wrong study design	Excluded in LES 18.1
Kumar, 2021	Wrong study design	Excluded in LES 18.1
Kunduru, 2022	Wrong study design	Excluded in LES 18.1
Kwon, 2021	Wrong study design	Excluded in LES 18.1
Lesho, 2022	Wrong outcomes	Excluded in LES 18.1
Lishchynskiy, 2022	Wrong study design	Excluded in LES 18.1
Liu, 2022	Wrong outcomes	Excluded in LES 18.1
Liu, 2021	Wrong study design	Excluded in LES 18.1
Lu, 2021	Wrong study design	Excluded in LES 18.1
Mahdavi, 2021	Wrong intervention	Excluded in LES 18.1
Maher, 2022	Wrong study design	Excluded in LES 18.1
Mallakpour, 2021	Wrong study design	Excluded in LES 18.1
Marques, 2021	Wrong study design	Excluded in LES 18.1
Marshall, 2020	Wrong outcomes	Excluded in LES 18.1
Marteinson, 2022	Wrong outcomes	Excluded in LES 18.1
Martins, 2022	Wrong outcomes	Excluded in LES 18.1
Masai, 2021	Wrong population	Excluded in LES 18.1
Masotti, 2022	Wrong study design	Excluded in LES 18.1
Memarzadeh, 2021	Wrong study design	Excluded in LES 18.1
Milella, 2021	Wrong outcomes	Excluded in LES 18.1
Miri, 2020	Wrong outcomes	Excluded in LES 18.1
Mirzay-Razaz, 2022	Wrong outcomes	Excluded in LES 18.1
Morrison, 2021	Wrong study design	Excluded in LES 18.1
Neuberger, 2022	Wrong study design	Excluded in LES 18.1
Nguyen, 2021	Wrong study design	Excluded in LES 18.1

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Noorimotlagh, 2021	Wrong outcomes	Excluded in LES 18.1
Oguma, 2021	Wrong study design	Excluded in LES 18.1
Paul, 2021	Wrong study design	Excluded in LES 18.1
Peddinti, 2021	Wrong outcomes	Excluded in LES 18.1
Pedreira, 2021	Wrong study design	Excluded in LES 18.1
Peters, 2021	Wrong study design	Excluded in LES 18.1
Petrosino, 2021	Wrong study design	Excluded in LES 18.1
Phuna, 2022	Wrong outcomes	Excluded in LES 18.1
Pourfarzi, 2021	Wrong outcomes	Excluded in LES 18.1
Prakash, 2022	Wrong study design	Excluded in LES 18.1
Probst, 2021	Wrong study design	Excluded in LES 18.1
Qin, 2022	Wrong outcomes	Excluded in LES 18.1
Raeiszadeh, 2020	Wrong study design	Excluded in LES 18.1
Raffee, 2021	Wrong study design	Excluded in LES 18.1
Rahimi, 2021	Wrong study design	Excluded in LES 18.1
Rai, 2020	Wrong study design	Excluded in LES 18.1
Raza, 2022	Wrong study design	Excluded in LES 18.1
Renninger, 2021	Wrong outcomes	Excluded in LES 18.1
Renson, 2022	Wrong study design	Excluded in LES 18.1
Rodriguez-Martinez, 2020	Wrong study design	Excluded in LES 18.1
RomanoSpica, 2020	Wrong outcomes	Excluded in LES 18.1
Romeo, 2022	Wrong outcomes	Excluded in LES 18.1
Salonga, 2022	Wrong study design	Excluded in LES 18.1
Sarangi, 2021	Wrong outcomes	Excluded in LES 18.1
Sarfraz, 2022	Wrong intervention	Excluded in LES 18.1
Saxena, 2021	Wrong study design	Excluded in LES 18.1
Seethalakshmi, 2022	Wrong study design	Excluded in LES 18.1
Sellera, 2021	Wrong outcomes	Excluded in LES 18.1
Sivakumar, 2021	Non available article	Excluded in LES 18.1
Shah, 2021	Wrong study design	Excluded in LES 18.1
Shah, 2020	Wrong study design	Excluded in LES 18.1
Shao, 2022	Wrong study design	Excluded in LES 18.1
Shen, 2020	Wrong study design	Excluded in LES 18.1
Shimabukuro, 2020	Wrong outcomes	Excluded in LES 18.1
Shimizu, 2022	Wrong intervention	Excluded in LES 18.1
Shukla, 2021	Wrong study design	Excluded in LES 18.1
Soave, 2021	Wrong outcomes	Excluded in LES 18.1
Sobolik, 2022	Wrong study design	Excluded in LES 18.1
Su-Velez, 2020	Wrong outcomes	Excluded in LES 18.1
Sun, 2021	Wrong study design	Excluded in LES 18.1
Sunkari, 2021	Wrong study design	Excluded in LES 18.1

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Tao, 2021	Wrong outcomes	Excluded in LES 18.1
Tewari, 2022	Wrong population	Excluded in LES 18.1
Thaper, 2021	Wrong study design	Excluded in LES 18.1
Thomas, 2021	Wrong study design	Excluded in LES 18.1
Thomas, 2022	Wrong setting	Excluded in LES 18.1
Tiwari, 2022	Wrong outcomes	Excluded in LES 18.1
Torres-Costa, 2020	Wrong study design	Excluded in LES 18.1
Trmcico, 2021	Wrong study design	Excluded in LES 18.1
Valsamatzi-Panagiotou, 2022	Wrong study design	Excluded in LES 18.1
Wang, 2020	Wrong outcomes	Excluded in LES 18.1
Wiktorczyk-Kapischke, 2021	Wrong study design	Excluded in LES 18.1
Wu, 2022	Wrong study design	Excluded in LES 18.1
Xiao, 2022	Wrong study design	Excluded in LES 18.1
Yang, 2022	Wrong study design	Excluded in LES 18.1
Yeung, 2022	Wrong population	Excluded in LES 18.1
Youssef, 2022	Wrong study design	Excluded in LES 18.1
Zhai, 2022	Wrong intervention	Excluded in LES 18.1
Zhang, 2021	Wrong outcomes	Excluded in LES 18.1
Zhang, 2022	Wrong study design	Excluded in LES 18.1
Zuniga-Montanez, 2022	Wrong outcomes	Excluded in LES 18.1

Appendix 3: Data extraction form **(Revised 19 Dec 2022)**

Study ID	
Included study	Author, year
PMID or URL or DOI	DOI, URL or PubMed ID
Publication date	In format YYYY/MM/DD
Preprint?	Y/N
Country	Country
Funding	Public or industry
Study design	Parallel RCT/crossover RCT/ cluster RCT/quasi-experimental/cohort/case-control/cross-sectional/modelling-simulation
Population and descriptive characteristics of the study	
Population	Description of population
Total (N)	Number of all study participants
Female n (%)	Number and %
Any PROGRESS+ consideration	Any PROGRESS+ consideration
Additional information on age groups and comments	Additional information on age groups and comments
Intervention, comparators, outcomes and setting	
Procedure	Cleaning/Disinfecting/Cleaning and disinfecting

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Intervention	1,2-Hexanediol/ Ammonium bicarbonate/ Ammonium carbonate/ Chlorine dioxide/ Citric acid/ Dodecylbenzenesulfonic acid/ Ethanol (Ethyl Alcohol)/ Glutaraldehyde/ Glycolic acid/ Hydrochloric acid/ Hydrogen chloride/ Hydrogen peroxide/ Hypochlorous acid/ Iodine/ Isopropanol (Isopropyl alcohol)/ L-Lactic Acid/ Octanoid acid/ PHMB/ Peroxyacetic acid (Peracetic acid)/ Peroxyoctanoic acid/ Phenolic/ Potassium peroxymonosulfate/ Quaternary ammonium/ Silver/ Silver ion/ Sodium carbonate/ Sodium carbonate peroxyhydrate/ Sodium chloride/ Sodium chlorite/ Sodium dichloroisocyanurate/ Sodium dichloroisocyanurate dihydrate/ Sodium hypochlorite/ Tetraacetyl ethylenediamine/ Thymol/ Triethylene glycol/ Other
Frequency of intervention	Frequency of intervention
Product concentration	Product concentration
Control group	Self-reported use of cleaning and disinfecting products (including comparison of different cleaning/disinfecting frequencies and/or different types of products), cleaning and disinfecting policies
Comparator:	1,2-Hexanediol/ Ammonium bicarbonate/ Ammonium carbonate/ Chlorine dioxide/ Citric acid/ Dodecylbenzenesulfonic acid/ Ethanol (Ethyl Alcohol)/ Glutaraldehyde/ Glycolic acid/ Hydrochloric acid/ Hydrogen chloride/ Hydrogen peroxide/ Hypochlorous acid/ Iodine/ Isopropanol (Isopropyl alcohol)/ L-Lactic Acid/ Octanoid acid/ PHMB/ Peroxyacetic acid (Peracetic acid)/ Peroxyoctanoic acid/ Phenolic/ Potassium peroxymonosulfate/ Quaternary ammonium/ Silver/ Silver ion/ Sodium carbonate/ Sodium carbonate peroxyhydrate/ Sodium chloride/ Sodium chlorite/ Sodium dichloroisocyanurate/ Sodium dichloroisocyanurate dihydrate/ Sodium hypochlorite/ Tetraacetyl ethylenediamine/ Thymol/ Triethylene glycol/ Other
Frequency of comparator	Frequency of comparator
Product concentration	Product concentration
Other information about the products or the process	Other information about the products or the process
Co Interventions	Co Interventions
Setting: include non-health care community-based settings	Residential settings/ Retail/ Restaurants/ Gyms and other athletic facilities/ Bars/ Workplaces/ Public parks/ Schools, universities or other education facilities/ Other
High contact surface	Y/N
Surface characteristics (Mark as many as apply)	Indoor/ Outdoor/ Soft surfaces such as carpets, rugs and drapes/ Laundry such as clothing, towels and linens/ Electronics such as tablets, touch screens, keyboards, remote control and ATM machines/ Food surfaces that may have touched flood water.

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	Examples: Countertops, plates/ Food cans that are not bulging, open, or damaged/ Non-food contact surfaces that do not soak up water and that may have touched floodwater. Examples: Floors, sinks, certain toys, and tools/ Other
Outcome (separated by VOC type)	COVID-19 transmission reduction (i.e., attack rates, reproduction number, etc.)/ Other RIDs transmission reduction/ Negative physiological health impact/ Negative emotional/psychological impact/ Negative socio-economic impact/ Negative social impact/ Negative environmental impact/ Reduction in COVID-19 associated ICU admission/ Reduction in COVID-19 ventilation/ Reduction in COVID-19 deaths/ Reduction in COVID-19 hospitalizations
Results	
Variant (Only if applies)	Alpha: variant of concern B.1.1.7 / Beta: variant of concern B.1.351 / Delta: variant of concern B.1.617.2 / Gamma: variant of concern P.1 / Epsilon: variant of concern B.1.427/B.1.429 / Omicron: variant of concern B.1.1.529 / Omicron: variant of concern B.1.1.529 Sublinage BA.1 / Omicron: variant of concern B.1.1.529 Sublinage BA.2 / Other
Effectiveness (with 95% CI)	Effect estimate (with 95% CI)
Time of the effectiveness reporting	Time of the effectiveness reporting in days
Adjusted (Regression, stratification, matching and associated variables) Y or N, and explain.	Adjusted (Regression, stratification, matching and associated variables) Y or N, and explain.
Critical appraisal	See appendix 4

Appendix 4: Approach to critical appraisal (Revised 21 Dec 2022)

We appraise the RoB of the individual non-randomized studies using an adapted version of [ROBINS-I](#). This tool classifies the Risk of Bias of a study as Low, Moderate, Serious, Critical, or No Information. Low Risk of Bias indicates High Quality, and Critical Risk of Bias indicates Very Low (insufficient) Quality. ROBINS-I appraises 7 bias domains and judges each study against an ideal reference randomized controlled trial. To improve the utility of ROBINS-I for assessing studies reporting cleaning and disinfecting products/strategies, we have focused on study characteristics that introduce bias specifically for these interventions. Once a study has met one criterion that makes it “critical” risk of bias, it will be dropped from further risk of bias assessment (exception: if limited data available for an outcome). An overall judgment of “serious” or “critical” is given when the study is judged to be at serious or critical risk of bias in at least one domain or “serious” in 3 separate ROBINS-I domains.

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Study Characteristics that may introduce bias	Description
<p>Study design</p> <p>ROBINS-I: Bias in selection of participants into study</p>	<p>In cohort studies, people who choose to use a cleaning/disinfecting intervention may differ in risk-taking and health-seeking behavior from people who do not choose to use a cleaning/disinfecting intervention</p> <p><u>Examples and typical judgment:</u></p> <ul style="list-style-type: none"> ● Cohort design with no concerns = low ● Cohort design (with some concerns about risk of exposure to COVID or unclear) = moderate ● Controlled quasi-experimental or case-control design with no concerns = moderate ● Non-controlled quasi-experimental design with no concerns or case-control or cohort design (with any concerns about risk of exposure to COVID or unclear) = serious ● Cross-sectional design (without any concerns about risk of exposure to COVID) = serious ● Surveillance cross-sectional or any cross-sectional (with any concerns about risk of exposure to COVID) or survey = critical
<p>Method for confirming the use of cleaning/disinfecting products and strategies</p> <p>ROBINS-I: Bias in classification of interventions</p>	<p>An appropriate comparison of interventions requires that the interventions are well defined. Data used in retrospective studies may lead to bias in the classification of participants.</p> <p><u>Examples and typical judgment:</u></p> <ul style="list-style-type: none"> ● Prospective study with a reported objective adherence to the intervention measure = low ● Prospective studies that present clear information about type, setting, dose, frequency, intensity and/or timing of intervention, in settings where there is an objective registry of procedures = low ● Prospective studies that present clear information about type, setting, dose, frequency, intensity and/or timing of intervention = moderate ● Retrospective studies that present clear information about type, setting, dose, frequency, intensity and/or timing of intervention; in settings where there is an objective registry of procedures = moderate ● Retrospective studies that present clear information about type, setting, dose, frequency, intensity and/or timing of intervention; without an objective registry of procedures = serious

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	<ul style="list-style-type: none"> ● Retrospective studies with any concerns about definition of interventions or without information = critical
<p>Accounting for calendar time</p> <p>ROBINS-I: Bias due to confounding (time-varying confounding)</p>	<p>Accounting for calendar time reduces bias in outcome estimation due to differences in intervention accessibility and risk of exposure over time.</p> <p><u>Examples and typical judgment:</u></p> <ul style="list-style-type: none"> ● Studies with explicit mention of calendar time adjustment if there are concerns about risk, prevalence, outbreaks = low ● Use of time-varying statistics without explicit mention of adjustment for calendar time = moderate ● Not taken into account but no concerns about risk exposure affecting the intervention = moderate ● Not taken into account and concerns about risk exposure affecting the intervention = critical
<p>Adjustment for prognostic factors</p> <p>ROBINS-I: Bias due to confounding</p>	<p>Adjustment for prognostic factors for COVID transmission, and the intervention, such as age, gender, socioeconomic factors, occupation (HCW, LTC), use of other PHSMs, number of persons in the setting (in studies where population is not an individual), prior COVID-19 infection within the past 90 days, close contact with index case, etc.</p> <p><u>Examples and typical judgment:</u></p> <ul style="list-style-type: none"> ● Sufficient adjustment for all considered important prognostic factors = low ● Insufficient adjustment for few important prognostic factors for the study setting = moderate ● Insufficient adjustment for some important prognostic factors, e.g., socioeconomic status, number of persons according to the setting = serious ● No or insufficient adjustment for other PHSMs = critical

<p>Testing frequency</p> <p>ROBINS-I: Bias in measurement of outcomes</p>	<p>Similar frequency of testing between groups reduces risk of bias introduced by detecting asymptomatic infection in one group but not in another (e.g., when only one group undergoes surveillance screening)</p> <p><u>Examples and typical judgment:</u></p> <ul style="list-style-type: none"> ● As needed through PCR = low ● As needed through other SARS-CoV-2 test = moderate ● Systematic screening with consistent methods for SARS-CoV-2 detection in both groups through PCR = low ● Systematic screening with consistent methods for SARS-CoV-2 detection in both groups through other SARS-CoV-2 test different than PCR = moderate ● No systematic screening but consistent methods for detection in one group vs. the other, e.g., within health networks = moderate ● Screening performed for a subset of both study groups = serious ● Screening performed routinely in one study group but not in the other = critical ● Not applicable = no information
<p>Missing data</p> <p>ROBINS-I: Bias due to missing data</p>	<p>Missing data can introduce bias due to differences in the comparison groups that are related to the outcome. Evidence for robustness may come from how missing data was handled in the study analysis.</p> <p><u>Examples and typical judgment:</u></p> <ul style="list-style-type: none"> ● Less than 10% of data missing = low ● More than 10% of data missing but correctly analyzed = low ● More than 10% of data missing but demonstration of no important differences between comparison groups = low ● More than 10% of data missing and no demonstration of no important differences between comparison groups = critical ● No information but it does not seem that there are important losses of data = no information

Appendix 5: Glossary (Revised 21 Dec 2022)

HCW: Healthcare workers

LTC: Long-term care

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LTCF: Long-term care facility

OR: odds ratio

PHSMs: public health and social measures

RoB: risk of bias

RSV: respiratory syncytial virus

VOC: variant of concern

VOI: variant of interest