COVID-19 Living Evidence Synthesis 18.2: 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: 3 January 2023

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?

2. What are the identified knowledge gaps in the scientific literature related to the effectiveness of cleaning and disinfecting products and strategies in reducing COVID-19 transmission?

3. What are the negative outcomes associated with the use of cleaning and disinfecting products and strategies to reduce the transmission of COVID-19 and/or other respiratory illnesses?

4. What is the best available evidence about the effectiveness of cleaning and disinfecting products and strategies for deactivating/eliminating SARS-CoV 2 on surfaces 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?

- Since there is lack of evidence on the effectiveness of cleaning and disinfecting products and strategies in reducing transmission of COVID-19 in community-based settings, a new question was introduced to this version: What is the best available evidence about the effectiveness of cleaning and disinfecting products and strategies for deactivating/eliminating SARS-CoV 2 on surfaces in non-health care community-based settings?

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%]).

- No analytical studies in real life community-based settings evaluating the deactivation/elimination of SARS-CoV-2 on surfaces were found.

Overview of evidence and knowledge gaps

- There is scarce evidence on the effectiveness of cleaning and disinfecting products/strategies in community settings to reduce the transmission of SARS-CoV-2. There is a lack of evidence for the outcomes of ICU admission, ventilation, and death associated with COVID-19.

- There is a lack of evidence for the outcome of deactivation/elimination of SARS-CoV-2 on surfaces in real life community-based settings.

Suggested Tweet

- What is the effectiveness of cleaning and disinfecting for SARS-CoV-2 transmission reduction? As with many PHSMs for reducing transmission of COVID-19, there is scarce evidence about effectiveness. Read our latest living evidence synthesis (LES 18.2) [Link].

Findings

- No new studies were included in this version.
- Overall, 1238 records were identified through evidence search, 954 were appraised in title and abstract, 193 in full text, and one study was used to complete this summary. The reasons for excluding the remaining 192 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

No studies were included in this version of the LES 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 of each study are presented in Table 1.

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.

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

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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. Deactivating/eliminating SARS-CoV-2 on surfaces.

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 be 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 seemed 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
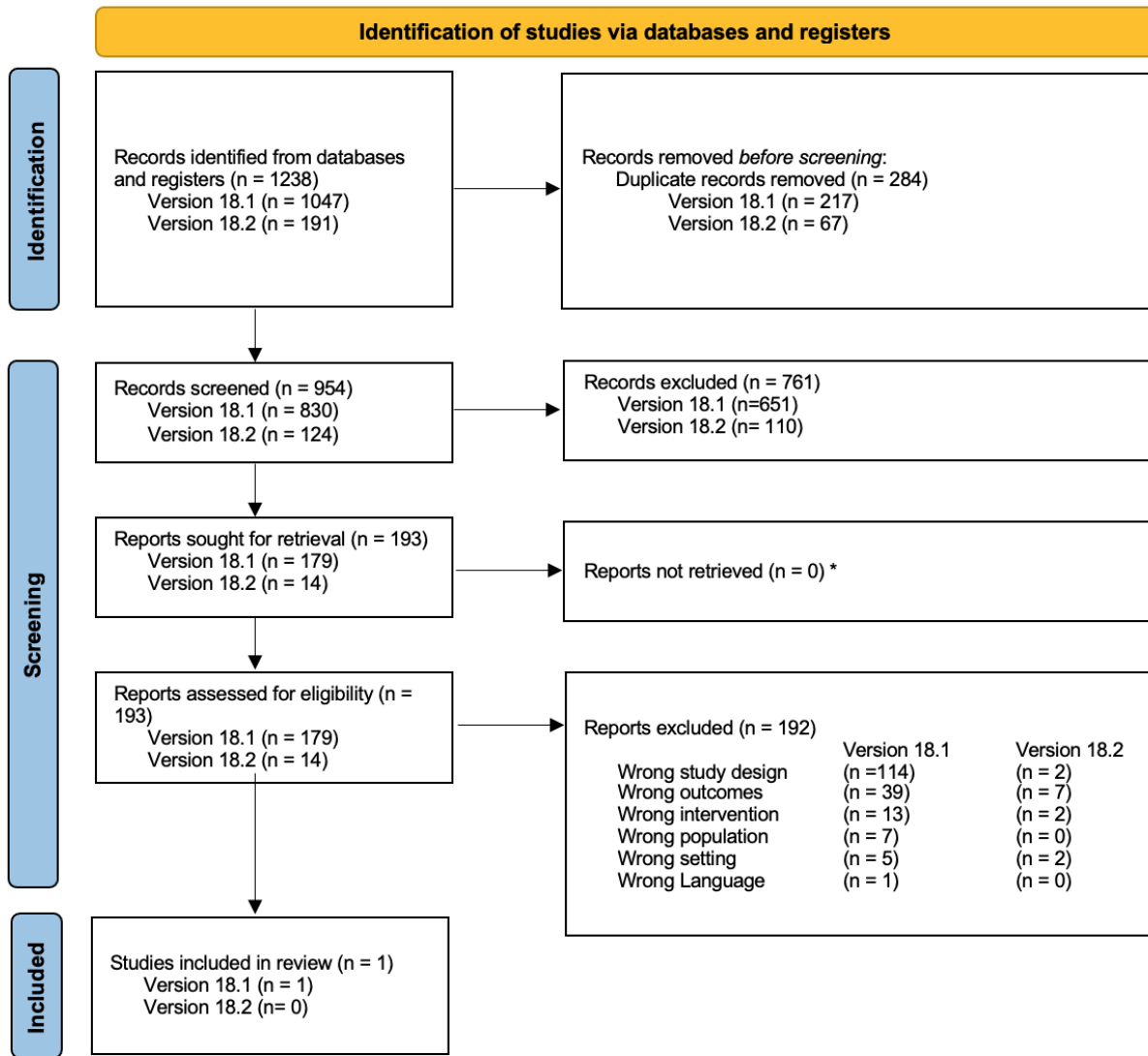
assessment of risk of bias for each study will be presented in Table 3 when available.

Summary of findings about secondary outcome 3: Deactivating/eliminating SARS-CoV 2 on surfaces in non-health care community-based settings.

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 4 when available.

Figure 1. PRISMA flow diagram (Page, 2021)

Identification of studies via databases and registers

Identification

Records identified from databases and registers (n = 1238)
    Version 18.1 (n = 1047)
    Version 18.2 (n = 191)

Records removed *before screening*:
    Duplicate records removed (n = 284)
    Version 18.1 (n = 217)
    Version 18.2 (n = 67)

Screening

Records screened (n = 954)
    Version 18.1 (n = 830)
    Version 18.2 (n = 124)

Records excluded (n = 761)
    Version 18.1 (n=651)
    Version 18.2 (n= 110)

Reports sought for retrieval (n = 193)
    Version 18.1 (n = 179)
    Version 18.2 (n = 14)

Reports not retrieved (n = 0) *

Reports assessed for eligibility (n = 193)
    Version 18.1 (n = 179)
    Version 18.2 (n = 14)

Reports excluded (n = 192)

	Version 18.1	Version 18.2
Wrong study design	(n =114)	(n = 2)
Wrong outcomes	(n = 39)	(n = 7)
Wrong intervention	(n = 13)	(n = 2)
Wrong population	(n = 7)	(n = 0)
Wrong setting	(n = 5)	(n = 2)
Wrong Language	(n = 1)	(n = 0)

Included

Studies included in review (n = 1)
    Version 18.1 (n = 1)
    Version 18.2 (n= 0)

*Reports were retrieved before LES 18.2 search was performed

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 et al., 2020	28 May 2020	Beijing, China	**Design**: Retrospective cohort **Intervention**: Disinfecting with chlorine or ethanol once a day compared to once in 2 or more days. **Sample**: 335 people in 124 families **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. **Setting:** Household disinfection of the floor, door and window handles, indoor air, tables and toilets. **Key outcomes**: COVID-19 transmission reduction **VOCs assessed**: 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.	Critical

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					

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					

Table 4: Summary of studies reporting on effectiveness of cleaning and disinfecting in deactivating/ eliminating SARS-CoV 2 on surfaces.

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

Acknowledgements

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 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*
Cai, 2023	Wrong study design	*Excluded in ==LES 18.2==*
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*

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

Claus, 2021	Wrong study design	*Excluded in LES 18.1*
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*
El Megharbel, 2021	Wrong outcomes	*Excluded in ==LES 18.2==*
Elbadawy, 2021	Wrong outcomes	*Excluded in ==LES 18.2==*
England, 2021	Wrong intervention	*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	Wrong study design	*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*
Ghoroghi, 2022	Wrong study design	*Excluded in ==LES 18.2==*
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*
Guo, 2023	Wrong setting	*Excluded in ==LES 18.2==*
Gwenzi, 2022	Wrong study design	*Excluded in LES 18.1*

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

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*
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*
Jana, 2023	Wrong intervention	*Excluded in LES 18.2*
Janik, 2021	Wrong study design	*Excluded in LES 18.1*
Jefri, 2022	Wrong study design	*Excluded in LES 18.1*
Jung, 2023	Wrong outcomes	*Excluded in LES 18.2*
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	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*
Kumar, 2022	Wrong study design	*Excluded in LES 18.1*
Kunduru, 2022	Wrong study design	*Excluded in LES 18.1*
Kwok, 2021	Wrong setting	*Excluded in LES 18.2*
Kwon, 2021	Wrong study design	*Excluded in LES 18.1*
Lesho, 2022	Wrong outcomes	*Excluded in LES 18.1*
Lishchynskyi, 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*
Nakito, 2023	Wrong outcomes	*Excluded in* ==*LES 18.2*==
Neuberger, 2022	Wrong study design	*Excluded in LES 18.1*
Nguyen, 2021	Wrong study design	*Excluded in LES 18.1*
Noorimotlagh, 2021	Wrong outcomes	*Excluded in LES 18.1*
Oguma, 2021	Wrong study design	*Excluded in LES 18.1*
Oksanen, 2022	Wrong outcomes	*Excluded in* ==*LES 18.2*==
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*
Schwartz, 2023	Wrong intervention	*Excluded in* ==*LES 18.2*==
Seethalakshmi, 2022	Wrong study design	*Excluded in LES 18.1*
Sellera, 2021	Wrong outcomes	*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*
Subpiramaniyam, 2021	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*
Tao, 2021	Wrong outcomes	*Excluded in LES 18.1*
Tarka, 2021	Wrong outcomes	*Excluded in* ==LES 18.2==
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*
Wong, 2022	Wrong outcomes	*Excluded in* ==LES 18.2==
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 06 Feb 2023)

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
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. 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 <mark>Deactivating/ eliminating SARS-CoV 2 on surfaces.</mark>
<mark>Outcome measurement (separated by VOC type) for deactivating/ eliminating SARS-CoV 2 on surfaces</mark>	<mark>SARS-CoV-2 RT-PCR</mark> <mark>Culture</mark>
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)
<mark>Comparison</mark>	<mark>Hypothesis test used</mark>
	<mark>Result</mark>
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 <mark>(Revised 06 Feb 2023)</mark>

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.

Study Characteristics that may introduce bias	Description
Study design **ROBINS-I: Bias in selection of participants into study** People who choose to use a cleaning/disinfection intervention may differ in risk-taking and health-seeking behavior from people who do not choose to use a cleaning/disinfection intervention	**Were both study groups recruited from the same population during the same time period?** Examples and typical judgment: ● Same country/province/state measured at same time = moderate ● Same or different country/province/state measured at a different time <u>during</u> pandemic = serious ● Same or different country/province/state measured at a different time <u>prior</u> to pandemic = critical ● Not applicable = no information **Were the COVID protective interventions implemented prior to period of data collection?** (Prevalent users) Examples and typical judgment: ● Start of data collection at same time as implementation with no prevalent users = low ● Prevalent users likely but appropriately controlled for = moderate

	● Not addressed and highly likelihood of prevalent users = critical **Were the study groups balanced with respect to participant adherence (based on internal and external factors unrelated to COVID)?** (For example, people who are less likely to adhere to PHSMs anyway may be more likely to be exposed to COVID and require quarantine & isolation but then are less likely to adhere. Similar for e.g., people who work are essential workers without paid time off.) Examples and typical judgment: ● Adherence confirmed to be same in both groups at start of study = low ● Difference in adherence likely but appropriately controlled for = moderate ● Not addressed and highly likelihood of difference in adherence = critical ● Not applicable = no information
Method for confirming the use of cleaning/disinfection products and strategies **ROBINS-I: Bias in classification of interventions** An appropriate comparison of interventions requires that the interventions are well defined.	**Was the method for confirming the intervention (e.g., type, setting, dose, frequency, intensity and/or timing of intervention) clearly defined and applied consistently across study samples (e.g., districts within a country)?** Examples and typical judgment: ● Well defined and solely based on information collected at time of intervention = low ● Well defined but some aspects of assignment of intervention status determined retrospectively = moderate ● Intervention status not well defined or applied inconsistently = serious ● Not addressed = critical ● Not applicable = no information **In periods of co-occurring interventions, do the authors clearly classify each individual intervention?** Examples and typical judgment: ● All co-interventions well defined and solely based on information collected at time of intervention = low ● Co-intervention classification well defined but some aspects of assignment of status determined retrospectively = moderate ● Co-intervention classification not well defined or applied inconsistently = serious ● Not addressed and co-interventions present = critical ● Not applicable = no information **Does classification into intervention/control group depend on self-report in a way that might introduce bias?** (For example, where negative consequences of providing truthful responses may lead to negative consequences e.g., self-reporting COVID symptoms would trigger 14 day quarantine and loss of income) Examples and typical judgment: ● Not reliant on self-report = low ● Reliant on self-report but appropriately controlled for/analyzed separately = moderate ● Not addressed and reliant on self-report = critical

	● Not applicable = no information **For household transmission studies, was it clear that exposure to the index case was the most likely the only exposure to COVID for household or close contacts?** Examples and typical judgment: ● All participants isolated to same house or hospital prior to index case identification = low ● All participants isolated to same house or hospital from time of index case identification = moderate ● High risk occupational and social exposures likely and not accounted for = serious ● Not addressed = critical ● Not applicable = no information
Accounting for calendar time **ROBINS-I: Bias due to confounding (time-varying confounding)** Accounting for calendar time reduces bias in outcome estimation due to differences in intervention accessibility and risk of exposure over time.	**Did the study adjust for calendar time (implications for circulating variant, season)?**** Examples and typical judgment: ● 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 ● Not applicable = no information
Adjustment for prognostic factors **ROBINS-I: Bias due to confounding** 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.	**Did the study adjust for demographics, prognostic factors and other relevant factors?**** Examples and typical judgment: ● All known important confounding domains measured and sufficient adjustment for all considered important prognostic factors = moderate ● At least one known important domain not measured or controlled for (e.g., socioeconomic status, number of persons according to the setting) = serious ● No adjustment for other relevant factors = critical ● Not applicable = no information **Did the study adjust for other COVID protective interventions (including vaccination)?**** Examples and typical judgment: ● All known important interventions controlled for = moderate ● One co-intervention not controlled for = serious ● Multiple co-interventions with no controlling or adjustment = critical ● Not applicable = no information **Were participants free of confirmed COVID infection at the start of the study?****

	Examples and typical judgment: ● Negative COVID status of both groups known at study start (lab confirmed)= low ● COVID status of intervention group known but unclear for control group OR COVID status of both groups known by self-report only = serious ● Unclear or high likelihood pts had COVID at start of study = critical ● Not applicable = no information
Testing frequency **ROBINS-I: Bias in measurement of outcomes** 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).	**Was the outcome of COVID confirmed by laboratory testing?**** Examples and typical judgment: ● All participants had PCR = low ● Most participants had PCR = moderate ● All participants had other SARS-CoV-2 test = serious ● Only sample or subset of population had PCR = serious ● Not reported = critical ● Only sample or subset of population had other SARS-CoV-2 test = serious ● Not applicable = no information **If the outcomes were derived from databases, were the databases constructed specifically for the collection of COVID data?**** Examples and typical judgment: ● National/state/province level surveillance database or specifically for COVID = low ● Database for non-COVID purpose with individual level data (e.g., health records, employee records) = moderate ● Database for non-COVID purpose without individual level data = serious ● No or unclear = critical ● Not applicable = no information **Were appropriate tools/methods with validated/justified cut-points used to determine outcomes of interest (other than COVID infection/transmission which is covered under laboratory testing)? **** Examples and typical judgment: ● Objective validated measure used consistently across all groups = low ● Objective measure applied but validation uncertain = moderate ● Outcomes solely dependent on self-report without a validated measure = serious ● Not reported = critical **If the outcome was self-reported, did the authors attempt to control for social desirability?**** Examples and typical judgment: ● Outcome not influenced by social desirability = low ● Attempt made to control for social desirability = moderate ● Not reported and outcome likely to be influenced by social desirability = critical ● Not applicable = no information

	Was the frequency of testing for the outcome different between the study groups? Examples and typical judgment: • No difference in frequency of testing between groups = low • Some differences but rationale appropriate = moderate • Routinely done more frequently in one group more than the other = critical **If outcome was observed, was there more than one assessor and if so, was interrater agreement reported?** Examples and typical judgment: • Reported with excellent agreement = low • Reported with moderate agreement = moderate • Reported with low agreement = serious • Not reported = critical
Missing data **ROBINS-I: Bias due to missing data** 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.	**Was outcome data at the end of the study period available for all or nearly all participants?** Examples and typical judgment: • No missing data = low • Missing data did not differ between groups or was accounted for by appropriate statistical methods = moderate • Critical differences in missing data between groups = critical **Were participants excluded due to missing data?** Examples and typical judgment: • No exclusions due to missing data = low • Participants excluded due to missing data, but rationale was appropriate and applied the same across all groups = moderate • Participants excluded based on data missing unevenly across groups = critical
Bias due to deviations from intended intervention? **ROBINS-I: Bias due to deviations from intended intervention**	**Did the authors assess adherence to the protective behaviours/interventions after intervention implementation?**** Examples and typical judgment: • Adherence verified in all study participants = low • Adherence verified in at least a subset of each study group or appropriately adjusted for = moderate • Reliant on self-report of adherence without verification or adjustment = serious • Not addressed = critical • Not applicable = no information

**relevant to single arm cohort studies

We appraise the methodological quality of the individual analitytical cross-sectional studies using an adapted version of JBI tool.

Study Characteristics that may introduce bias	Description
Bias in selection of participants into study	Were the criteria for inclusion in the sample clearly defined? ● Yes ● No ● Unclear ● Not applicable
Bias in selection of participants/classification of interventions	Were the study subjects and the setting described in detail? ● Yes ● No ● Unclear ● Not applicable
Bias in measurement of outcomes	Was the exposure measured in a valid and reliable way? ● Yes ● No ● Unclear ● Not applicable
Bias due to confounding	Were confounding factors identified? ● Yes ● No ● Unclear ● Not applicable
Bias due to confounding	Were strategies to deal with confounding factors stated? ● Yes ● No ● Unclear ● Not applicable
Bias in measurement of outcomes	Were the outcomes measured in a valid and reliable way? ● Yes ● No ● Unclear ● Not applicable
	Was appropriate statistical analysis used? ● Yes ● No ● Unclear ● Not applicable

Overall appraisal:	● Include ● Exclude ● Seek further info

Appendix 5: Glossary (Revised 21 Dec 2022)

HCW: Healthcare workers

LTC: Long-term care

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