McMaster University | UNIVERSIDAD DE ANTIOQUIA Facultad de Medicina | Unidad de Evidencia y Deliberación para la toma de decisiones UNED

Living Evidence Synthesis 18.2: Effectiveness of Cleaning and Disinfecting for reducing transmission of Respiratory Infectious Diseases in non-healthcare community-based settings.

Date of Literature Search: 28 March 2024

This living evidence synthesis (LESs) is part of a suite of LESs of the best-available evidence about the effectiveness of public health and social measures (PHSMs) (quarantine and isolation, masks, ventilation, hand hygiene, cleaning, and disinfecting) in preventing transmission of respiratory infectious diseases. This is the 2nd version of this LES, which includes enhancements in scope from the first version by: 1) expanding the primary outcomes from COVID-19 transmission to include other prioritized Respiratory Infectious Diseases (Respiratory Syncytial Virus, Influenza and Group A Streptococcus); and 2) expanded searches to include these outcomes and to search further back in time. The next update to this and other LESs in the series is to be determined, but the most up-to-date versions in the suite are available here. We provide context for synthesizing evidence about public health and social measures in Box 1.

Suggested citation: Velásquez-Salazar P, Villatoro-Rodríguez SN, Garcia D, Ramirez CL, Rodriguez C, Patiño-Lugo DF, Florez IDLES 18.2: Effectiveness of Cleaning and Disinfecting for reducing transmission of Respiratory Infectious Diseases in non-healthcare community-based settings. Unit of Evidence and Deliberation for Decision Making (UNED), University of Antioquia, 28 March 2024.

Questions

What is the best available evidence about the effectiveness of cleaning and disinfecting products and strategies in reducing transmission of Respiratory Infectious Diseases (RIDs) (SARS-CoV-2, RSV, influenza, group A streptococcus [GAS]) in non-healthcare community-based settings?

What are the unintended consequences associated with the use of cleaning and disinfecting products and strategies to reduce the transmission of RIDs?

What is the best available evidence about the effectiveness of cleaning and disinfecting products and strategies for deactivating/eliminating RIDs on surfaces in non-healthcare community-based settings?

What is the best available evidence about the efficacy/effectiveness of cleaning and disinfecting products and strategies for deactivating/eliminating SARS-CoV 2 on surfaces assessed in vitro studies? *(Last updated LES 18.1)*

Executive summary

Background

- COVID-19 is a well-known respiratory infectious disease that has greatly impacted people's lives since its emergence. However, there are other respiratory infectious diseases (RIDs) that significantly affect human health, such as influenza, Respiratory Syncytial Virus (RSV) infection, and Group A Streptococcus (GAS) infections (1).
- Human influenza A and B viruses, which routinely spread among people, are responsible for seasonal influenza epidemics each year. Although avian influenza virus (AIV) primarily affects animals, it can cause sporadic infections in humans (2). RSV causes annual outbreaks of respiratory diseases in all age groups, but it primarily affects children and is the most common cause of hospitalization in infants (3). GAS can cause both non-invasive and invasive diseases. While it can affect people of all ages, populations that frequent or live in crowded environments such as schools, military training centers, and daycare centers, are at a higher risk of GAS infections (4).
- These RIDs are mainly transmitted from person to person through infectious respiratory particles that are generated when infected people breathe, talk, cough, sneeze, sing, or shout. However, environmental transmission through surfaces and fomites is another important route that can be intervened (1).
- Non-pharmaceutical interventions are part of the control measures for the transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), RSV, influenza, and GAS, and cleaning and disinfecting are recommended activities to reduce viral transmission (5).
- In March 2020, following the identification of SARS-CoV-2, the Centers for Disease Control and Prevention (CDC), and US Environmental Protection Agency (EPA) issued List N: Disinfectants for Use Against SARS-CoV-2, which initially identified 250 surface disinfectants that met EPA's criteria for efficacy under the Emerging Viral Pathogens Guide for Antimicrobial Pesticides (6). By August 2020, the List N included 482 surface disinfectants (7).
- 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 in community settings (8).

High level summary of key findings

Profile of included studies

- We identified 5,664 reports, from which we included 41 studies that addressed question 1 (n=9), question 2 (n=10), question 3 (n=8) and/or question 4 (n=14), and:
- For influenza virus, RSV and GAS, the search period included articles from January 1st 2016 to March 28th 2024. Searches for SARS-CoV-2 virus included articles from January 1st 2020. Most of the included studies were published between 2020-2022 (n=28), followed by 2023-2024 (n=9); and were commonly conducted in the U.S. (n=11), Italy (n=4), Bangladesh (n=4), and United Kingdom (n=4).
    - SARS-CoV-2 was the microorganism most studied (n=29), followed by AIV (10) and influenza/influenza-like illness (n=2). No studies addressed RSV or GAS.

  - Study designs included quasi-experimental (n=4), cohort (n=5), case-control (n=3), cross-sectional (n=15), and in vitro experiments (n=14)
  - Study settings included residential settings (n=5); surveys targeting workplace or households (n=8); educational settings (n= 1); transport, vehicles and hubs settings (n=2); Long Term Care facilities (LTCFs) (n=2); live bird markets (LBMs), duck abattoirs and farms (n=9); and laboratory settings (n=14).
- Studies provided information for the transmission/incidence outcome (n=9), deactivating/ eliminating virus on surfaces (n=24), and unintended consequences (n=8).
- Overall, there were several significant limitations across the studies included in this report, with nine studies ultimately being rated as critical risk of bias (RoB), eight as serious RoB, seven as moderate RoB and three as low RoB. Common limitations included poor adjustment for confounding factors; invalid or unclear exposure measurement; and lack of details about composition, dosage, and frequency of use of disinfectants and cleaners. In many cases, the significant limitations of the included studies made the determination of meaningful conclusions challenging.

Key findings in relation to question 1: Effectiveness of cleaning and disinfecting strategies on RIDs transmission reduction

- COVID-19 transmission
  - Two of six studies conducted in community settings found a benefit of cleaning and disinfecting strategies (implement cleaning and disinfecting strategies, increase cleaning frequency) in reducing SARS-CoV-2 transmission/infection.
  - Only one of four studies found a benefit from strategies related to increasing cleaning and disinfection frequency (using Chlorine dioxide once a day or more in floors, doors and window handles, indoor air, tables and toilets cleaning), while two studies found non-significant differences.
  - One study conducted in Spain, found that disinfectants containing ethanol or bleach didn't lower transmission except when applied to purchased products.
- Influenza/influenza-like illness transmission
  - One study found that increased frequent surface disinfection in Lebanese residential settings was associated with a lower influenza-like illness risk
- Transmission of other respiratory illnesses infections
  - Two of two studies found a benefit from implementing versus not implementing cleaning and disinfection strategies in farms and LBMs against AIV.

Key findings in relation to question 2: Effectiveness of cleaning and disinfecting strategies on deactivating/eliminating RIDs on surfaces in real life community settings

- SARS-CoV-2 deactivation/elimination
  - One study found that Proactive Cleaning and Hygiene Solution (PCHS) sanitation, which involved the use of a probiotic-based cleaning agent applied once a day compared to the use of conventional chlorine-based disinfectants, applied four times per day, reduced SARS-CoV-2 presence on subway trains.
- Influenza virus deactivation elimination

  - One study found that implementation of an educational strategy and PURELL™ Surface (An alcohol-based antimicrobial spray for hard surfaces; GOJO Industries Inc) eradicated the influenza virus from surfaces.
- Deactivation/elimination of other respiratory illnesses and infections
  - One study compared cleaning using detergent in Live-bird markets (LBMs) against cleaning with water founding detergent superior for viral elimination.
  - Comparisons between frequency of implementation of different cleaning/disinfecting strategies were addressed in one study that found more frequent cleaning and disinfecting practices in LBMs against AIV to be superior.
  - Five studies compared implementing versus not implementing cleaning/disinfecting strategies effects on AIV contamination. Two of these studies found benefits of implementing cleaning protocols and one study found benefits from monthly cleaning when compared to not implementing these strategies; while no differences were found for daily cleaning, weekly/monthly disinfection, FAO[1]-intervened LBMs compared with no implementation of these strategies.
  - One before and after study that compared initial viral loads with postintervention viral loads. found no important benefits from quaternary ammonium single use on eliminating AIV from trucks and crates.

Key findings in relation to question 3: Unintended consequences associated with the use of cleaning and disinfecting products

- COVID-19 pandemic unintended consequences related to the use of cleaning/disinfecting products
  - Five of six studies found an increase in poisoning control calls after the onset of the COVID-19 pandemic. Ingestion was the main route but a notable increase in inhalation cases, particularly with bleach-containing products, was noted. Increased cleaning frequency during the pandemic also led to skin disturbances and shortness of breath in adults
  - A global survey linked chlorine exposure to ocular effects, while alcohols and formaldehyde were associated with skin and neurological effects, respectively.
  - One study highlighted increased ocular injuries in children due to chemical burns from cleaning products, particularly laundry detergent and bleach

Key findings in relation to question 4: Efficacy of cleaning and disinfecting on SARS-CoV-2 deactivation/elimination from surfaces on controlled laboratory settings

- The evidence from in vitro studies, most of it comparing the active ingredient versus placebo of deactivating/eliminating SARS-CoV-2 addresses: Virusend™ on stainless steel (SS); ethanol 50% and 70% on Kraft paper, SS, and glass; sodium hypochlorite on parchment paper, glass, SS, polypropylene (PP), and kraft; bleach on 3D printed material, SS, styrene–butadiene rubber (SBR), and paint; quaternary ammonium on 3D printed material; hydrogen peroxide 3% on 3D printed material and SS; C360™ on SS, SBR, paint and bus seat fabric (SF); VO™ on SS, and SF; quaternary ammonium compound (QAC) disinfectant wipes on glass Petri dish; citric acid disinfectant wipes on glass Petri dish; ethanol/ QAC Disinfectant spray on glass Petri dish; Ready

[1] FAO: Food and Agriculture Organization

to use QAC cleaner on glass Petri dish; Sani-24™ on glass surfaces; PMMA-H2O2 MCs on nonwoven fabric samples; high ozone gas concentrations on polystyrene plastic, glass and steel; dry fogging of 8,700 ppm hypochlorous solution on plastic plates; dry fogging of 56,400 ppm hydrogen peroxide solution on plastic plates.

Overview of evidence and knowledge gaps

- There is scarce evidence on the effectiveness of cleaning and disinfecting products/strategies, specifically in community settings, to reduce the transmission of SARS-CoV-2 (two cohort studies, two cross-sectional studies in residential settings, and two cross-sectional studies in LTCFs) and influenza (one study in residential settings for influenza-like illnesses, two AIV studies in poultry farms and markets). There is a lack of evidence regarding the effectiveness of cleaning and disinfecting products/strategies, specifically in community settings, to reduce the transmission of RSV and GAS (no studies were retrieved during this search).
- There is scarce evidence for the outcome of the deactivation/elimination of SARS-CoV-2 (one quasi-experimental study in urban subways) and influenza (eight quasi-experimental and observational studies mostly in poultry farms and markets) on surfaces in real-life community-based settings. There is a lack of evidence on the effectiveness of cleaning and disinfecting products/strategies on the deactivation/elimination of microorganisms on surfaces, specifically in community settings, to reduce the transmission of RSV and GAS (no studies retrieved during this search).
- The unintended consequences of using cleaning and disinfection products to mitigate RIDs in non-healthcare settings are not well-documented. Existing evidence, primarily from cross-sectional studies and surveys, lacks detailed information on exposure frequency, concentration, and specific chemical compounds, which hinders the assessment of health impacts. No analytical observational or experimental studies were found that evaluate the unintended consequences in these contexts.

<u>Box 1: Context for synthesizing evidence about public health and social measures (PHSMs)</u>

This series of living evidence syntheses was commissioned to understand the effects of PHSMs during a global pandemic to inform current and future use of PHSMs for preventing transmission of respiratory infectious diseases.

General considerations for identifying, appraising and synthesizing evidence about PHSMs

- PHSMs are population-level interventions and typically evaluated in observational studies.
  - Many PHSMs are interventions implemented at a population level, rather than at the level of individuals or clusters of individuals such as in clinical interventions.
  - Since it is typically not feasible and/or ethical to randomly allocate entire populations to different interventions, the effects of PHSMs are commonly evaluated using observational study designs that evaluate PHSMs in real-word settings.
  - As a result, a lack of evidence from randomized controlled trials (RCTs) does not necessarily mean the available evidence in this series of LESs is weak.
- Instruments for apprising the risk of bias in observational studies have been developed; however, rigorously tested and validated instruments are only available for clinical interventions.
  - Such instruments generally indicate that a study has less risk of bias when it was possible to directly assess outcomes and control for potential confounders for individual study participants.

  - Studies assessing PHSMs at the population level are not able to provide such assessments for all relevant individual-level variables that could affect outcomes, and therefore cannot be classified as low risk of bias.
- Given feasibility considerations related to synthesizing evidence in a timely manner to inform decision-making for PHSMs during a global pandemic, highly focused research questions and inclusion criteria for literature searches were required.
  - As a result, we acknowledge that this series of living evidence syntheses – about the effectiveness of specific PHSMs (i.e., quarantine and isolation; mask use, including unintended consequences; ventilation, reduction of contacts, physical distancing, hand hygiene and cleaning and disinfecting measures), interventions that promote adherence to PHSMs, and the effectiveness of combinations of PHSMs – does not incorporate all existing relevant evidence on PHSMs.
  - Ongoing work on this suite of products will allow us to broaden the scope of this review for a more comprehensive understanding of the effectiveness of PHSMs.
  - Decision-making with the best available evidence requires synthesizing findings from studies conducted in real-world settings (e.g., with people affected by misinformation, different levels of adherence to an intervention, different definitions and uses of the interventions, and in different stages of the pandemic, such as before and after availability of COVID-19 vaccines).

Our approach to presenting findings with an appraisal of risk of bias of included studies

To ensure we used robust methods to identify, appraise and synthesize findings and to provide clear messages about the effects of different PHSMs, we:

- acknowledge that a lack of evidence from RCTs does not mean the evidence available is weak
- assessed included studies for ROB using the approach described in the methods box
- typically introduce the ROB assessments only once early in the document if they are consistent across sub-questions, sub-groups and outcomes, and provide insight about the reasons for the ROB assessment findings (e.g., confounding with other complementary PHSMs) and sources of additional insights (e.g., findings from LES 20 in this series that evaluates combinations of PHSMs)
- note where there are lower levels of ROB where appropriate
- note where it is likely that risk of bias (e.g., confounding variables) may reduce the strength of association with a PHSM and an outcome from the included studies
- identify when little evidence was found and when it was likely due to literature search criteria that prioritized RCTs over observational studies.

Implications for synthesizing evidence about PHSMs

Despite the ROB for studies conducted at the population level that are identified in studies in this LES and others in the series, they provide the best-available evidence about the effects of interventions in real life. Moreover, ROB (and GRADE, which was not used for this series of LESs) were designed for clinical programs, services and products, and there is an ongoing need to identify whether and how such assessments and the communication of such assessments, need to be adjusted for public-health programs, services and measures and for health-system arrangements.

Findings

- Overall, 5664 records were identified through an evidence search, 5143 were screened in title and abstract, 667 in full text, and 41 studies were used to complete this summary. The reasons for excluding the remaining 626 studies are reported in Appendix 2. Figure 1 presents the PRISMA flow diagram.

Highlights of changes in this report

- Scope has been expanded to include respiratory syncytial virus (RSV), influenza, and Group A streptococcus (GAS).
- 26 new studies have been added since the previous edition of this living evidence synthesis, which is signaled by highlighting in yellow. The studies included results for SARS-CoV-2 (14) and influenza (12).
- New data on reducing transmission of RIDs, including SARS-CoV-2 and influenza, have been added, drawn from two studies with moderate RoB (9,10), three with serious RoB (11–13), and three with critical RoB (14–16).
- New data on deactivating/eliminating RIDs microorganisms from surfaces in non-healthcare community-based settings have been added, drawn from three studies with low RoB (17–19), four with moderate RoB (20–23), and three with critical RoB (24–26).
- New data on the unintended consequences of cleaning and disinfecting, primarily focusing on SARS-CoV-2, have been added, drawn from one study with moderate RoB (27), five with serious RoB (28–32), and two with critical RoB (33,34).
- Table 4 on in vitro studies reporting on deactivating/eliminating SARS-CoV-2 was not updated in this version of the report.

Box 2: Our approach

We retrieved studies by searching: 1) PubMed; 2) Science Direct; and 3) CINAHL. Searches were conducted for studies reported in English, conducted with humans and published since 1 January 2016. 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, case reports, case series, and press releases excluded. A full list of included studies is provided in **Tables 1-5**. Studies excluded at the last stages of reviewing are provided in **Appendix 2**.

Population of interest: All population groups that report data related to SARS-CoV-2, RSV, influenza, GAS.

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, RSV, influenza, GAS
Secondary outcomes: Reported unintended consequences attributed to the implementation of cleaning and disinfecting strategies; 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 of individual studies (by outcome) was assessed using validated ROB tools. For RCTs we used ROB-2, and for observational studies, we used ROBINS-I and, for In Vitro studies we used OHAT. Judgements for the domains within these tools were decided by consensus within synthesis team and undergo revision with subsequent iterations of the LES as needed. Once a study had met one criterion that makes it "critical" risk of bias, it was dropped from further risk of bias assessment (exception: if limited data available for an outcome). 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 appropriate.

Summary of findings about the primary outcome: Reducing transmission of RIDs (n=9)

Eight new studies have been added since the previous edition of this LES that reported on transmission/infection outcomes (9–16) (highlighted in yellow). The studies included results for SARS-CoV-2 (5) and influenza (3). The characteristics, findings, and assessment of the RoB of each study are presented in Table 1.

SARS-CoV-2

Overall, six studies reporting on transmission/infection reduction outcomes addressed SARS-CoV-2. All of the studies were observational (Cohort=3, Cross-sectional=2, Case-control=1), and were evaluated as critical to moderate RoB (RoB).

Studies reported on different settings: two cross-sectional studies of critical RoB (15) and moderate RoB (9) in LTCFs; and, four studies in residential settings, corresponding to two cohort studies with critical RoB (8,14), one cross-sectional study with serious RoB (11) and one case-control study with serious RoB (13).

Long-term care facilities (LTCFs): Two studies compared different frequencies of cleaning/ disinfecting. One study reported that daily versus less frequent floor washing during the Omicron dominance increased the risk of SARS-CoV-2 infection [aIRR 2.38 (95% CI, 1.03–5.52)], although no significant difference was found during pre-Omicron dominance [aIRR, 1.25 (95% CI, 0.49-3.17); p = 0.64] or with non-stratified results [aIRR, 1.63 (95% CI, 0.83-3.22) p = 0.16].(9). The second study found no differences in the frequency of cleaning and disinfection of high-contact surfaces between the LTCFs with the highest prevalence and those with the lowest prevalence of COVID-19. Of the five infection prevention and control categories explored, the disinfection indicators were the ones with the lowest compliance, and when the LTFCs with the highest and lowest prevalence were compared, the implementation of the recommendations for disinfection (daily frequency of cleaning of areas of high contact, training the person on cleaning, cleaning program registration, and certified personnel) did not show statistically significant differences (p=0.44) (15).

Residential settings: Two studies compared different frequencies of cleaning (8,13). One of two studies found a benefit from strategies related to increasing cleaning and disinfection frequency (using Chlorine dioxide once a day or more in floors, doors and window handles, indoor air, tables and toilets cleaning) (8), while the other one reported that cleaning objects that could have viruses was associated with an increased COVID-19 risk [aOR 1.34 (95% CI, 1.25–1.43)] (the type of cleaning done or whether any cleaning products were used was not specified) (13).

Two studies compared cleaning strategies versus no implementation of a cleaning strategy (11,14). When compared with not implementing the strategy, residential disinfection was found to reduce the risk of household transmission of SARS-CoV-2 [OR, 0.78 (95% CI 0.63–0.95)] (14). The other study reported that bleach or ethanol surface disinfection, disinfection of shoes, and washing clothes did not significantly affect COVID-19 risk. However, the application of a disinfectant to purchased products was associated with a lower prevalence of COVID-19 (11).

Influenza/influenza-like illness

One cross-sectional study with moderate RoB reported on this outcome in residential settings (10). The study compared different frequencies of surface disinfection, and reported that frequent surface disinfection in Lebanon residential settings was associated with a lower influenza-like illness risk among Lebanese adults [aOR 0.892 (95% CI, 0.632–0.911)] (10).

Avian Influenza Virus (AIV)

Two studies reported on this outcome in LBMs. The studies included one case-control with serious RoB (12) and one cohort with critical RoB (16). The two studies found a benefit from implementing versus not implementing cleaning and disinfection strategies in farms and LBMs against AIV. The risk of H9N2 infection on farms was reduced by both cage cleaning [OR, 0.24 (95% Cl, 0.1–0.57]) and the use of foot baths before entering the farm [OR, 0.24 (95% Cl, 0.08–0.79)] (16). Mandatory routine disinfection in LBMs decreased HPAI H5N1 infection risk [OR, 0.13 (95% Cl, 0.5–0.33)] (12).

Summary of findings about the primary outcome: Deactivating/eliminating RIDs on surfaces in non-healthcare community-based settings (n=10)

Ten new studies have been added since the previous edition of this LES that reported on deactivating/eliminating RIDs from surface outcomes (17–26) (highlighted in yellow). The studies included results for SARS-CoV-2 (1) and influenza (9). The characteristics, findings, and assessment of the RoB of each study are presented in Table 2.

SARS-CoV-2

Only one cohort study with low RoB (17) in transport vehicles or hubs settings was found. The study compared different products and found that PCHS sanitation, which involved the use of a probiotic-based cleaning agent applied once a day compared to the use of conventional chlorine-based disinfectants, applied four times per day, reduced SARS-CoV-2 RNA presence and total viral copy number in subway trains (9.6% samples were found positive in control train, whereas 3.7% were found positive in PCHS train), these differences were described as significant.

Influenza / influenza-like illness

One quasi-experimental study with critical RoB (25) in educational settings was found. Implementation of infection control measures in schools (Phase 1: Installation of PURELL™ Surface Spray at the point of care in athletic training rooms; Phase 2: Initiation of educational interventions with placement of posters and checklists; Phase 3: targeted educational material distribution) led to the eradication of the influenza virus from surfaces, indicating the efficacy of targeted interventions.

AIV

Overall, eight studies reported on this outcome. The studies included two quasi-experimental designs with critical RoB (24,26), three cross-sectional with moderate RoB (20–22), cohort with moderate RoB (23) and one case-control with low RoB (19) conducted in Live birds Markets (LBMs) and poultry farms. One quasi-experimental study with low RoB (18), addressed this outcome in transport, vehicles or hubs settings.

LBMs and poultry farms: One study compared enhanced cleaning with detergent with cleaning with water, finding detergent superior for viral elimination (21).

Comparisons between frequency of implementation of different cleaning/disinfecting strategies were addressed in one study that found that increasing cleaning frequency (daily), disinfection frequency (weekly) and use of running water in stalls significantly reduced AIV presence in LBMs ($p<0.01$) (20).

Three of five studies that compared implementing versus not implementing cleaning/disinfecting strategies found benefits on this outcome. Regular monthly cleaning practices in poultry shops were protective against environmental contamination with influenza A viruses (aOR, 0.47 (95% CI, 0.28–0.8); $p < 0.01$)(22). While Food and Agriculture Organization (FAO)-intervened LBMs had better biosecurity practices, there was no significant difference in HPAI H5N1 prevalence compared to non-intervened LBMs [RR, 1.1 (95% CI 0.44–2.76)] (23). Despite enhanced cleaning and disinfection protocols in duck abattoirs, variable efficacy was observed, indicating that factors such as the initial contamination load influenced cleaning and disinfection effectiveness (24). Improved protocols with multi-step cleaning and disinfection processes (cleaning with low-pressure soaking and detergent, quaternary ammonium + glutaraldehyde and virucides) in duck abattoirs showed variable efficacy, with some still testing positive for AIV genome post-intervention (26). Implementing cleaning and disinfection of hard-surfaced barn entry pads reduced the risk of HPAI H5N2 infection in egg layer farms [OR, 0.16, P = 0.01] (19).

Transport vehicles or hubs: The use of citric acid-based disinfectant with coverage greater than 70% on agricultural vehicles resulted in a 4-log viral reduction, regardless of the type of disinfection facilities and vehicles, and coverage of at least 99% with sufficient contact time resulted in a reduction of at least 5 logs of AIV ($R^2 = 0.4840$) (18).

Summary of findings about the secondary outcome: Unintended consequences of cleaning and disinfecting (n=8)

Eight new studies that report on unintended consequences have been added since the previous edition of this LES (27–34). (highlighted in yellow). The studies included results for SARS-CoV-2. The characteristics, findings and assessment of RoB of each study are presented in Table 3.

SARS-CoV-2

Eight cross-sectional studies reported on this outcome, including two studies with critical RoB (33,34), five with serious RoB (28–32), and one of moderate RoB (27).

Five of six studies found an increase in poisoning control calls after the onset of the COVID-19 pandemic (27,28,30,32,33). Italian Poison Control Center reported increased calls regarding disinfectants and decreased calls for cleaners, with significant changes in exposure frequencies (28). The Michigan Poison Center reported exposures rose by 50%, and disinfectant-related calls doubled. Disinfectant calls significantly increased by 42.8% ($P < 0.001$), whereas cleaner calls slightly increased from 5.1% to 5.4% ($P = 0.18$). Ingestion exposure calls decreased from 72.6% to 59.7% (P <0 .001), but inhalation and dermal exposure calls increased ($P < 0.001$). The ocular exposure calls remained stable (30). Italian poison control observed a 5% increase in the prevalence of exposure calls related to household disinfectants between 2019 and 2020 ($p<0.001$). The most frequently reported products contained bleach, ethyl alcohol, or hydrogen peroxide. Most of the exposures were accidental. The main route of exposure was ingestion, but the greatest increase occurred through inhalation (33). Pharmacy One Poison Center from Jordan, reported a significant increase in toxic exposure calls during the lockdown, particularly for household cleaners and alcohol, with notable shifts in call sources and exposure patterns, with the majority of exposures being at home and children aged below 5 years being the most affected (32).

One study analyzed ocular injuries in US children under 3 years of age. Chemical burn-related injuries, mainly from cleaning products, increased significantly during the pandemic (23.34% to 31.63%), with 71.75% attributed to cleaning products. Laundry detergents and bleach were the most common culprits (53.68%). Adjusting for confounders, the odds of chemical burns increased post-pandemic [aOR 1.51 (95% CI, 1.10–2.08)] (34).

One study among 91,056 participants from 154 member countries of the United Nations found that participants commonly reported skin and respiratory effects of disinfectants. Dry skin and neurological effects were the most frequent and least frequent, respectively. Chlorine compounds were significantly associated with all adverse effects, including ocular effects [OR, 1.83 (95% CI, 1.74–1.9)] and throat irritation [OR, 2.00 (95% CI, 1.90–1.93)]. Alcohol or alcohol-based materials and sodium hypochlorite were linked to skin irritation [OR, 1.98 (95% CI, 1.87–2.09)]. Formaldehyde was associated with neurological effects [OR, 2.17 (95% CI, 1.92–2.44)] (29).

A Turkish survey found that 46.9% of the participants reported at least one issue linked to cleaning products during the pandemic. Of these, 68% had skin issues, 23% had respiratory difficulties, 3% had asthma attacks, and 6% had experienced poisoning. Most of the participants (71.3%) reported a single issue. Monthly bleach consumption was higher among those with cleaning product-related problems (mean 2.02 DS ± 1.54) compared to those without cleaning product-related problems (mean 1.63 DS ± 1.46), with no difference observed for other cleaning products ($p = 0.001$). The majority of complaints were mild skin problems, but severe issues such as breathing difficulties and asthma attacks were also reported (31).

Summary of findings about secondary outcome: Deactivating/eliminating SARS-CoV-2 on surfaces in in vitro studies (n=14). *Last updated LES 18.1*

Fourteen in vitro studies were included, reporting on deactivating/eliminating SARS-CoV-2 on surfaces as an outcome. The characteristics, findings and assessment of RoB of these studies are presented in Table 4.

SARS-CoV-2

Nine in vitro studies with probably low RoB (35–43), and five in vitro studies with probably high RoB (44–48) were found.

One study compared different products and reported that the addition of anionic surfactants improves the virucidal efficacy of twelve fluids (ethanol, isopropanol, dodecylbenzenesulfonate [SDBS], sodium laureth sulfate [SLS], glycerin, liquid hand soap, dish soap, and water of standardized hardness [WSH]). Fluid S8 (70% isopropanol, 3% hand soap, and 27% WSH) showed the greatest virucidal efficacy on Polyvinyl chloride (PVC) material with polyurethane (PUR) surface coating after one minute of contact time (38).

Compared with initial viral titers single application of QAC Disinfectant wipes QAC, Citric acid Disinfectant wipes, Ethanol/QAC Disinfectant spray, and ready to use (RTU) QAC cleaner reduced SARS-CoV-2 titers in ≥3.0 log in glass Petri dish, achieving the greatest reductions with Ethanol/QAC disinfectant and QAC RTU cleaner (41).

When compared with placebo or untreated controls, studies reported that single application of Ethanol 50% and 70% in Kraft paper, SS, and glass, after 1 minute of contact time; Ethanol 70% in LPDE, after 5 minutes of contact time; Sodium hypochlorite 1000 ppm in parchment paper, glass, SS, PP, and kraft after 5 minutes of contact time achieved elimination of SARS-CoV-2 titer (46); after 5 minutes of the intervention Bleach, Quaternary ammonium and Hydrogen peroxide 3% achieved elimination of SARS-CoV-2 titer on 3D printed material; after 5 minutes, single application of Isopropyl alcohol (IPA) did not achieve elimination of SARS-CoV-2 titer, although there was >95% inactivation of viruses (47).

Single application by spray method of C360™ on SS, styrene–butadiene rubber (SBR), paint and Bus seat fabric (SF); peroxide on SS; Vital Oxide™ (VO) on SS and SF; CDC bleach™, on SS, SBR, and paint, reduced SARS-CoV-2 titer compared to hard water. No difference between C360™ and hard water by Spray & Wipe method was observed on SS, SF, SRB and paint. No difference between hard water and peroxide or CDC bleach™ was observed on SF (40).

Pretreated SS discs with spray application of SiQAC-C18 product reduced SARS-CoV-2 titers after 10 minutes of exposure (39).

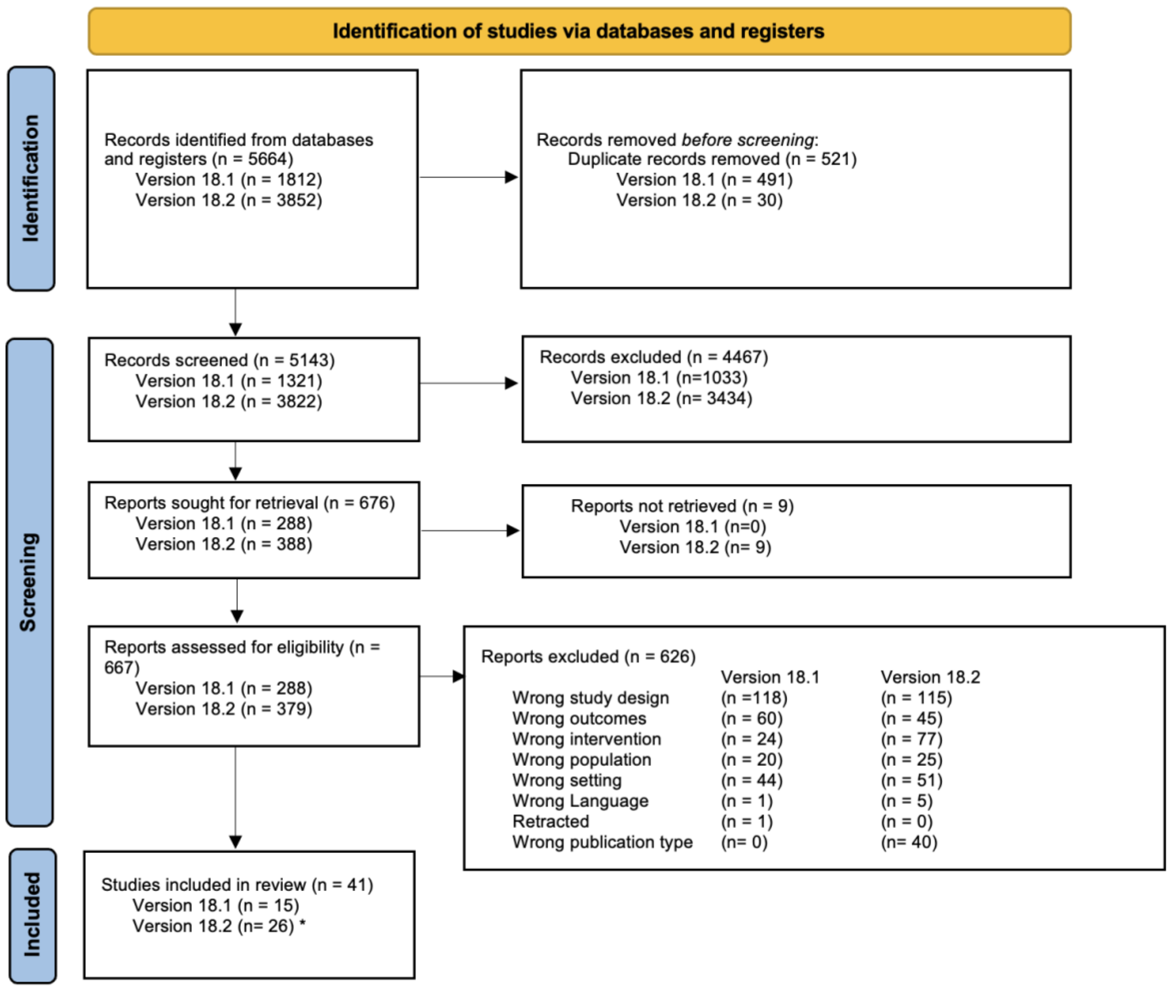
Application of Sani-24™ reduced SARS-CoV-2 titer in ≥4.22 log in glass surfaces after 48 hours of the intervention (48).

Single application of PMMA-H_2O_2 MCs reduced SARS-CoV-2 DNA in nonwoven fabric samples by 62.27% after 10 minutes of the intervention; by 75% after 30 minutes of the intervention and by 97.26% after one hour of the intervention (42). .

Dry fogging of 8,700 ppm hypochlorous and 56,400 ppm hydrogen peroxide solution reduced the SARS-CoV-2 titers on plastic plates compared to distilled water at 16 minutes of the intervention. Dry fogging of lower concentration of hypochlorous solution did not achieve reduction of SARS-CoV-2 titers on plastic plates compared to distilled water at any time point of the intervention (36).

Gaseous ozone 0.2 ppm application reduced SARS-CoV-2 titer in >99.9% in fleece, 96.8% in gauze, 93.3% in wood, 90% in glass and 82.2% in plastic, after 2 hours of the intervention (35). At high concentrations (5.0 g.min/m^3) and 70% relative humidity, ozone gas application reduced the SARS-CoV-2 titers on polystyrene plastic well compared to air after one hour of the intervention. At high concentrations (15.0 g.min/m^3) and 70% relative humidity, ozone gas application reduced the SARS-CoV-2 titers on glass and steel compared to air after one hour of the intervention. Lower concentrations of ozone gas application achieved limited of SARS-CoV-2 titers on glass and steel compared to air after one hour of the intervention(45).

Figure 1. PRISMA flow diagram (Page, 2021)



*Three studies previously excluded

Table 1: Summary of studies reporting on effectiveness of cleaning and disinfecting in preventing RIDs. (n=9)

Last updated March 28th 2024

<table>
<tr><th>RIDs</th><th>Reference and Country</th><th>Setting and time covered</th><th>Study characteristics</th><th>Summary of key findings in relation to the outcome</th><th>RoB</th></tr>
<tr>
<td>SARS-CoV-2

VOCs assessed: Omicron</td>
<td>Krutikov et al, 2023 (9)

England</td>
<td>Long-term care facilities (LTCFs) floors, between September 1, 2020, and March 31, 2022.</td>
<td>Design: Cross-sectional survey with linkage to routine surveillance data from staff and residents. The study focuses on observational data regarding the incidence of SARS-CoV-2 in LTCFs and how various factors, including building characteristics and ventilation, are associated with infection rates.

Intervention: Floor cleaning frequency - daily compared to less than daily

Sample: 134 of 151 LTCFs participated, with data for 13,010 residents and 17,766 staff

Population: LTCFs caring for adults ≥ 65 years old

Funding: Public

Key outcomes: Incidence rate of resident infections and outbreaks, outbreak size, and duration.</td>
<td>• In LTCFs, daily floor washing was compared to less than daily cleaning for infection risk. In the non-stratified results, no association was found between the frequency of floor washing and the risk of infection [aIRR, 1.63 (95% CI, 0.83-3.22) p = 0.16]. During Omicron dominance, daily vs less frequent floor washing was associated with increased risk infection rate [aIRR, 2.38 (95% CI, 1.03–5.52); p = 0.043], although no significant difference was found during pre-Omicron dominance [aIRR, 1.25 (95% CI, 0.49-3.17); p = 0.64]. Other aspects of the outbreak did not show statistically significant associations with the risk of infection: outbreak incidence [IRR, 1.20 (95% CI, 0.82-1.76) p = 0.34], outbreak size [aIRR, 1.20 (95% CI, 0.84-1.71); p = 0.31], outbreak duration [aIRR, 1.24 (95% CI, 0.86-1.77); p = 0.25].
<table>
<tr><th>Cleaning frequency–washing floor (% responses)</th><th>108 (80.6)</th></tr>
<tr><td>Daily</td><td>91 (84.3%)</td></tr>
<tr><td>Several times a week</td><td>8 (7.4%)</td></tr>
<tr><td>Weekly</td><td>7 (6.5%)</td></tr>
<tr><td>Several times a month</td><td>1 (0.9%)</td></tr>
<tr><td>Monthly</td><td>1 (0.9%)</td></tr>
</table>
<table>
<tr><th colspan="2">Level</th><th>Washing floor frequency</th><th>aIRR (95% CI)</th><th>p</th></tr>
<tr><td rowspan="6">Person level</td><td rowspan="2">Unstratified</td><td>Less than daily</td><td>Ref</td><td rowspan="2">0.16</td></tr>
<tr><td>Daily</td><td>1.63 (0.83-3.22)</td></tr>
<tr><td rowspan="2">Pre-Omicron</td><td>Less than daily</td><td>Ref</td><td rowspan="2">0.64</td></tr>
<tr><td>Daily</td><td>1.25 (0.49-3.17)</td></tr>
<tr><td rowspan="2">Omicron</td><td>Less than daily</td><td>Ref</td><td rowspan="2">0.04</td></tr>
<tr><td>Daily</td><td>2.38 (1.03-5.52)</td></tr>
<tr><td rowspan="2">Facility level</td><td rowspan="2">Incidence of outbreaks</td><td>Less than daily</td><td>Ref</td><td rowspan="2">0.34</td></tr>
<tr><td>Daily</td><td>1.20 (0.82-1.76)</td></tr>
</table>
</td>
<td>Moderate</td>
</tr>
</table>

<table>
<tr><th>RIDs</th><th>Reference and Country</th><th>Setting and time covered</th><th>Study characteristics</th><th>Summary of key findings in relation to the outcome</th><th>RoB</th></tr>
<tr><td></td><td></td><td></td><td></td><td>
<table>
<tr><td rowspan="4"></td><td rowspan="2">Outbreak size</td><td>Less than daily</td><td>Ref</td><td rowspan="2">0.31</td></tr>
<tr><td>Daily</td><td>1.20 (0.84-1.71)</td></tr>
<tr><td rowspan="2">Outbreak duration</td><td>Less than daily</td><td>Ref</td><td rowspan="2">0.25</td></tr>
<tr><td>Daily</td><td>1.24 (0.86-1.77)</td></tr>
</table>

Limitations: In this study, 21 variables that could be associated with the risk of transmission of the SARS-CoV-2 virus were evaluated. Regarding the variable washing floors, of 108 respondents, 91 responded that they did it daily and 17 less than daily, so the size of both comparison groups is limiting to evaluate the effect. Due to the study design, susceptibility to different biases, and multiple comparisons, these results may be affected by residual confounding, reverse causality, and chance associations.
</td><td></td></tr>
<tr><td>SARS-CoV-2

VOCs assessed: Omicron</td><td>Liu et al, 2023 (14)

China</td><td>Residential settings in Shanghai during the COVID-19 pandemic, from March 10, 2022, to April 30, 2022</td><td>Design: Retrospective cohort. The study compared patients who had direct contact with cohabitants and those who did not, as well as the effect of residential disinfection practices on the transmission rate.

Intervention: Residential disinfection practices. It is not specified what disinfectant or substance was used.

Sample: A total of 2,334 confirmed COVID-19 patients were included.

Population: Patients who were confirmed with COVID-19 by a positive nucleic acid test and were subsequently transferred to Fangcang shelter hospital.

Funding: Public</td><td>

Direct contact with cohabitants was identified as an independent risk factor for the transmission of COVID-19 among all cohabitants within the same house during home quarantine [OR, 1.36 (95%CI, 1.09–1.71); p = 0.008]. Residential disinfection practices were found to reduce this risk [OR, 0.78 (95% CI, 0.63–0.95)].
In all cohabitants within the same house during home quarantine, residential disinfection practices could reduce this risk [OR, 0.78 (95% CI, 0.63–0.95); p = 0.016].

Association between disinfection (Yes) and outcomes
<table>
<tr><th></th><th>OR</th><th>p value</th><th>aOR</th><th>p value</th></tr>
<tr><td>Cohabitants transmission of COVID-19</td><td>0.812 (0.650–1.015)</td><td>0.068</td><td>0.925 (0.729–1.172)</td><td>0.516</td></tr>
<tr><td>COVID-19 infection in all cohabitants within the same house during home quarantine</td><td>0.753 (0.615–0.923)</td><td>0.006</td><td>0.777 (0.632–0.954)</td><td>0.016</td></tr>
</table>

Limitations: Compliance with protective behaviors/interventions was assessed by asking participants via a telephone interview about their cleaning habits before being diagnosed, which is susceptible to recall and social desirability bias. The overall RoB of the study was rated as critical
</td><td>Critical</td></tr>
</table>

RIDs	Reference and Country	Setting and time covered	Study characteristics	Summary of key findings in relation to the outcome	RoB
			Key outcomes: Household Transmission Rate		
SARS-CoV-2 **VOCs assessed**: None	Francis et al, 2023 (13) United Kingdom	Residential setting. November 2020 until the end of June 2021.	**Design**: Cross-sectional study. The authors conducted an online questionnaire study recruiting members of the UK public from November 2020 to May 2021. They assessed the association between self-reported COVID-19 illness and reported NPI use. **Intervention**: Non-pharmaceutical interventions (NPIs) including cleaning things that might have virus on them (e.g. doors, taps) during the last two weeks. Measured using a five-point Likert scale: 'Never (or almost never)', 'Sometimes', 'Quite often', 'Very often', 'Always (or almost always). **Sample**: 36,199. Over 848,000 text message invitations were sent. **Population:** Adult participants who completed the survey registered with 116 practices in all parts of England	• In people in the United Kingdom, between November 2020 and June 2021, cleaning objects that could have viruses was a risk factor for COVID-19 infection [aOR 1.34 (95% CI 1.25–1.43)] (see tables below) Limitations: This study evaluated the association of multiple self-reported non-pharmaceutical interventions with the risk of SARS-CoV-2 infection. The interpretation of the results must be read in light of the limitations. The authors state that many of the results obtained were unexpected, including those found on cleaning things, since there is no plausible explanation for why these non-pharmaceutical interventions could increase the risk of infection, so they explain that these results may be due to uncontrolled confounding or information biases. Therefore, the most appropriate interpretation of the results of this study is that they did not	Serious

NPI	COVID-19 infection	Never	Sometimes	Quite often	Very often	Always
Cleaning things	Yes (n = 2337)	209 (8.9)	452 (19.3)	471 (20.2)	582 (24.9)	623 (26.7)
	No (n = 23,346)	3024 (13.0)	6093 (26.1)	5101 (21.9)	5436 (23.3)	3692 (15.8)

Association between use of cleaning things, and exposure to crowded places

	COVID-19 Illness				
	N & OR	**Unadjusted**	**Model 1[2]**	**Model 2[3]**	**Model 3[4]**
Any use of NPIs, and any exposure to crowded places	N	25,683	22,270	16,819	12,566
	OR (95% CI)	**1.52 (1.31 to 1.76)**	**1.39 (1.19 to 1.63)**	**1.38 (1.15 to 1.64)**	**1.39 (1.06 to 1.81)**
Reported frequency of use of NPIs, and frequency of exposure to crowded places	N	25,683	22,270	16,819	12,566
	OR (95% CI)	**1.26 (1.22 to 1.31)**	**1.24 (1.19 to 1.29)**	**1.24 (1.19 to 1.30)**	**1.34 (1.25 to 1.43)**

[2] Model 1: controlling for demographics (age, gender, ethnicity, socioeconomic status), month of questionnaire completion, and vaccination status.

[3] Model 2: as per model 1 plus controlling for money problems; working outside home; number of people in the household; having pets; pregnancy; number of comorbid conditions; history of a mental health problem; self-reported regular use of steroids or immunosuppressant medication; statins; medications for diabetes; self-reported weight; smoking status; anxiety; depression; U.K. region; and month of questionnaire completion interacted with region.

[4] Model 3: as per model 2 plus controlling for other NPIs and being in crowded places.

RIDs	Reference and Country	Setting and time covered	Study characteristics	Summary of key findings in relation to the outcome	RoB
			Funding: Public **Key outcomes**: COVID-19 illness.	find sufficient evidence to support these non-pharmacological interventions, other than to indicate that they increased risk.	
SARS-CoV-2 **VOCs assessed**: None	Wang et al., 2020 (8) China	Residential setting of all laboratory confirmed COVID-19 cases reported in Beijing until 21 February 2020	**Design**: Retrospective cohort **Intervention**: Disinfecting with chlorine or ethanol once a day compared to once in 2 or more days (floor, door and window handles, indoor air, tables and toilets) Room cleaning (wet type) once every one to two days compared to once every more than two days. Wet type was not defined. **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. **Funding:** Public **Key outcomes**: COVID-19 transmission reduction	• In this study, the characteristics and practices of primary cases, healthy family contacts, and multiple home hygiene practices were analyzed as predictors of secondary transmission. Within these practices, room cleaning (wet type) and home disinfection were investigated. The authors do not define room cleaning (wet type); however, they differentiate it from disinfection: "When cleaning the house, disinfectant which contains chlorine or ethanol is used to disinfect the floor, door and window handles, indoor air, tables and toilets". • 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. • Performing wet room cleaning once in one to two days showed no statistically significant differences with wet cleaning once in more than two days	Critical
SARS-CoV-2	Telford et al., 2021 (15)	LTCFs in Fulton County, Georgia.	**Design:** Cross-sectional **Interventions:** Infection prevention and control	• Facilities with lower COVID-19 prevalence demonstrated significantly greater implementation of infection prevention and control recommendations compared to those with higher prevalence in the Social Distancing and PPE categories. However, regarding cleaning and disinfection practices, the difference between facilities was not significant:	Critical

LES 18.2: Effectiveness of Cleaning and Disinfecting for reducing transmission of RIDs in non-healthcare community-based settings.

<table>
<tr><th>RIDs</th><th>Reference and Country</th><th>Setting and time covered</th><th>Study characteristics</th><th>Summary of key findings in relation to the outcome</th><th>RoB</th></tr>
<tr>
<td>VOCs assessed: None</td>
<td>United States</td>
<td>United States

Between June and July 2020.</td>
<td>implementation across five categories: Hand Hygiene, Disinfection, Social Distancing, PPE, and Symptom Screening.

Sample: 24 LTCFs

Population: 2,580 LTCF residents, among whom 1,004 (39%) were infected with COVID-19.

Funding: public

Key Outcomes: COVID-19 prevalence

Site visits to LTCFs to evaluate infection prevention and control implementation, provide real-time feedback, and identify potential contributors to viral transmission.</td>
<td>

The frequency per day cleaning high-touch areas in the facilities with higher prevalence had a mean of 4.5 and 3.9 in the one with lower prevalence. This difference was not statistically significant (p= 0.64)
Frequently training staff on cleaning product wet times was carried out in 18% of the facilities with higher prevalence and in 4% of those with lower prevalence. This difference was not statistically significant (p= 0.48)
Presence of records of the shared equipment cleaning schedule was found in 18% of facilities with higher prevalence and in 8% of those with lower prevalence. This difference was not statistically significant (p= 0.44)
There is a certified infection preventionist on staff in 45% of the facilities with higher prevalence and in 69% of the facilities with lower prevalence. This difference was not statistically significant (p= 0.24)
Overall cleaning and disinfection implementation was implemented in 45% of the facilities with higher prevalence and in 69% of the facilities with lower prevalence. This difference was not statistically significant (p= 0.24)

<table>
<tr><th colspan="4">Implementation of infection Prevention and Control Key Indicators Across Higher- and Lower-Prevalence LTCFs</th></tr>
<tr><th></th><th>Higher Prevalence Group (n = 11)</th><th>Lower Prevalence Group (n = 13)</th><th>P value</th></tr>
<tr><td>Frequency per day cleaning high-touch areas</td><td>Mean = 4.5</td><td>Mean = 3.9</td><td>0.64</td></tr>
<tr><td>Frequently training staff on cleaning product wet times</td><td>2 (18%)</td><td>4 (31%)</td><td>0.48</td></tr>
<tr><td>Presence of records of the shared equipment cleaning schedule</td><td>2 (18%)</td><td>1 (8%)</td><td>0.44</td></tr>
<tr><td>There is a certified IP on staff</td><td>5 (45%)</td><td>9 (69%)</td><td>0.24</td></tr>
<tr><td>Overall cleaning and disinfection implementation</td><td>27%</td><td>36%</td><td>0.44</td></tr>
</table>

Limitations: It is important to note that the sample sizes were small, making it more difficult to find statistically significant differences. Therefore, it cannot be concluded that cleaning and disinfection practices have no effect on the transmission of the risk of infection by the virus.
</td>
<td></td>
</tr>
</table>

LES 18.2: Effectiveness of Cleaning and Disinfecting for reducing transmission of RIDs in non-healthcare community-based settings.

<table>
<tr><th>RIDs</th><th>Reference and Country</th><th>Setting and time covered</th><th>Study characteristics</th><th>Summary of key findings in relation to the outcome</th><th>RoB</th></tr>
<tr>
<td>SARS-CoV-2

VOCs assessed: None</td>
<td>Rodríguez-Barranco, 2020 (11)

Spain</td>
<td>Residential settings in Spanish territory, during a period of maximum confinement measures, from April 4th to May 5th, 2020.</td>
<td>Design: Cross-sectional. The study utilized a mass online survey distributed via email, social networks, and mobile phone devices to a wide audience.

Intervention: recommended hygiene measures such as the use of bleach for disinfecting surfaces, and the disinfection of clothing and shoes upon returning home.

Sample: A total of 2086 individuals completed the survey

Population: Spanish population during the stage of maximum confinement in the state of alarm decreed in Spain. A significant portion of the participants being women (66.8%) and the majority living in single-family homes (72%). The age distribution showed that more than 40% of the participants were between 40 and 54 years old, and 44% had completed university studies.

Funding: Public

Key outcomes: association of various factors with the prevalence of COVID-19 among the surveyed population.</td>
<td>
No effect was found that reaches statistical significance to disinfecting with ethanol or bleach, disinfecting shoes and washing clothes when returning home.
<table>
<tr><th colspan="2" rowspan="2">Measure</th><th rowspan="2">Total (%)</th><th colspan="2">COVID-19</th><th rowspan="2">P value</th></tr>
<tr><th>Yes (%)</th><th>No (%)</th></tr>
<tr><td rowspan="2">Used bleach to disinfect the floor of their home</td><td>Yes</td><td>77.2</td><td>4.7</td><td>95.3</td><td rowspan="2">0.902</td></tr>
<tr><td>No</td><td>22.8</td><td>4.9</td><td>95.1</td></tr>
<tr><td rowspan="2">Used bleach to disinfect doorknobs and other surfaces</td><td>Yes</td><td>64.2</td><td>4.7</td><td>95.3</td><td rowspan="2">0.915</td></tr>
<tr><td>No</td><td>35.8</td><td>4.8</td><td>95.2</td></tr>
<tr><td rowspan="2">Disinfected or isolated their footwear after return from the street</td><td>Yes</td><td>67</td><td>4.2</td><td>95.8</td><td rowspan="2">0.427</td></tr>
<tr><td>No</td><td>26.2</td><td>5.5</td><td>94.5</td></tr>
<tr><td rowspan="2">Washed clothes every time they come back from the street</td><td>Yes</td><td>37,8</td><td>5,1</td><td>94.9</td><td rowspan="2">0.618</td></tr>
<tr><td>No</td><td>55,3</td><td>4,3</td><td>95.7</td></tr>
<tr><td rowspan="2">Applied a disinfectant product on purchased products</td><td>Yes</td><td>67,9</td><td>3,8</td><td>96.2</td><td rowspan="2">0.004</td></tr>
<tr><td>No</td><td>32,1</td><td>6,7</td><td>93.3</td></tr>
</table>
After adjusting for potential confounding between variables, applying a disinfectant product on the products purchased from the market upon arrival home compared with other hygiene practices such as the` use of gloves, masks, and hydroalcoholic formulas showed a significant effect in reducing the risk of COVID-19. Not disinfecting the products increased the risk by 94% [OR, 1.94 (95% CI, 1.18–3.19); p= 0.009].
Limitations: Valid and reliable methods were not used to measure both exposure and outcome. The method used to measure the result, or the main outcome variable, was self-reported COVID-19 infection. Participants were asked, "Have you suffered the COVID-19 disease?", with responses categorized into four options: Yes, I suspect yes, No, I don’t know. For statistical analysis, affirmative responses (yes and I suspect yes) were combined, and negative responses (no and I do not know) were considered negative.
</td>
<td>Serious</td>
</tr>
</table>

LES 18.2: Effectiveness of Cleaning and Disinfecting for reducing transmission of RIDs in non-healthcare community-based settings.

RIDs	Reference and Country	Setting and time covered	Study characteristics	Summary of key findings in relation to the outcome	RoB
Influenza AIV **Subtype**: H9N2	Chaudhry et al., 2017 (16) Pakistan	Commercial poultry farms located in Punjab Province and Islamabad Capital Territory of Pakistan from November 2013 to February 2014	**Design**: Prospective cohort **Intervention**: Cleaning of Cages Before Delivery Foot Bath Dipping Area at the Entrance For each intervention, the comparator was the absence of the respective practice. No details of these practices or the substances used are provided. **Sample**: Out of the 400 farms, 109 submitted samples to a laboratory for suspected infection with AIV **Population:** Poultry farms of different production categories (breeders, broiler, and layer farms) located in Punjab Province and Islamabad Capital Territory of Pakistan were enrolled in the study. The study was conducted from November 2013 to February 2014. **Funding:** Not reported **Key outcomes**: H9N2 Infection H9 status (i.e., infected and non-infected farms)	**Cleaning of Cages Before Delivery:** • In commercial poultry farms, cleaning cages before entering the farm, compared to farms that did not clean cages before entering resulted in reduced odds of H9N2 infection [OR, 0.24 (95% Cl, 0.1–0.57)] **Foot Bath Dipping Area at the Entrance:** • In commercial poultry farms, the use of a footbath/dipping area at the entrance, compared to farms without it, resulted in reduced odds of H9N2 infection [OR, 0.24 (95% Cl, 0.08–0.79)] Limitations: This study had critical RoB in the assessment of compliance with protective behaviors/interventions, the overall RoB of the study was rated as critical.	Critical
Influenza AIV	Fasanmi et al., 2016 (12)	LBMs, in Nigeria and Egypt. The	**Design**: Case-control. Biosecurity compliance level and risk factor assessments in 155	• Overall compliance with biosafety measures in LBMs in both countries was poor. Approximately 39.4% of the markets surveyed were confirmed infected. Which LBM was infected was determined by taking tissue samples from the dead birds.	Serious

RIDs	Reference and Country	Setting and time covered	Study characteristics	Summary of key findings in relation to the outcome	RoB
Subtype HPAI H5N1 (Highly Pathogenic Avian Influenza H5N1).	Nigeria and Egypt	outbreak and subsequent assessments occurred during 2006–2008.	LBMs was evaluated in Nigeria and Egypt through the administration of a 68-item biosecurity checklist. **Intervention**: Biosafety measures. Compliance with 68 biosafety measures is compared and its association with the risk of influenza infection was analyzed. Interventions and surfaces are not clearly detailed. **Sample**: 155 LBMs. **Population:** Influential Live Bird Market (popular markets with high traffic and turnout of poultry and also patronage), including 24 weekly and 51 daily in Southwest Nigeria. 80 LBMs from Alexandria, Beheira, Kafr El Sheik, Menofyia and Gharbia governorates were selected from Egypt. **Funding:** Public **Key outcomes**: Avian Influenza H5N1 status	• Markets with routine disinfection showed better protection against HPAI H5N1 infection compared to those without such practices [OR, 0.13 (95% Cl, 0.5–0.33)]. • Other cleaning and disinfection practices did not appear to be significant in the multivariate analysis (proper cleaning and disinfection in the market, proper cleaning and disinfection at slaughtering points, disinfection facilities for trucks, disinfection of infrastructure and equipment, disinfection of premises, alternative use of disinfectants, cleaning of cages done routinely, disinfection of cages done routinely, disinfection of shared equipment, cleaning of equipment used for slaughtering, disinfection of equipment used for slaughtering). Limitations: It is important to note that compliance with biosafety measures was very low in both countries, which affects the analysis of the association between these measures and the risk of infection. On the other hand, concerns arise mainly from the lack of information on whether the cases and controls were adequately matched, as the authors indicate that when the laboratory result could not confirm the positivity of the test, the LBM was considered negative, which generated differential misclassification bias. The appropriateness of the exposure period is still unclear, which could influence the study's conclusions about the effectiveness of biosafety measures over time. The article focuses on the comparison between the LBM of Nigeria and that of Egypt, and the comparison between cases and controls is superficial. They indicate supplementary material where details of the comparison between cases and controls are found, but the material is not found on the page.	
Influenza-like illnesses (specific viruses not detailed) but SARS-	Youssef et al., 2022 (10) Lebanon	Residential settings in Lebanon during 2020–2021 flu season (from	**Design**: Retrospective cross-sectional observational study. Adherence to personal protective measures against COVID-19 (wearing face masks, hand hygiene, physical distancing, avoiding crowded places)	• Lebanese adults who disinfected surfaces frequently or always were less likely to suffer from symptoms of influenza-like illnesses compared to those who did disinfection rarely, or did not [aOR 0.892 (95%CI, 0.632–0.911)]	Moderate

LES 18.2: Effectiveness of Cleaning and Disinfecting for reducing transmission of RIDs in non-healthcare community-based settings.

RIDs	Reference and Country	Setting and time covered	Study characteristics	Summary of key findings in relation to the outcome	RoB
CoV-2 confirmed cases excluded		October 2020 to the end of March 2021)	compared to Lebanese adults who did not frequently wear face masks or adopt other protective measures. **Intervention**: Surface disinfection practices frequency (Never/rarely, Sometimes, Frequently/always). It is not specified what disinfectant or substance was used. **Sample**: Convenience sampling method used; data collected through an online survey from 1019 respondents. **Population:** All Arab-speaking Lebanese adults aged 18 years or above from all the eight Lebanese governorates (Bekaa, Baalbeck-Hermel, Beirut, Mount Lebanon, North, Akkar, Nabatieh, South) having internet access and literacy and who gave their consent to participate. **Funding:** Public **Key outcomes**: Cases of influenza-like illnesses	• No significant difference was founded in symptoms of influenza-like illnesses between Lebanese adults who disinfect surfaces sometimes compared to those who did disinfection rarely, or did not [aOR 0.832 (95% Cl, 0.724–1.571)]. Limitations: Concerns arise regarding the validity and reliability of exposure and outcome measurements. The study utilized self-reported data for assessing personal protective measures and influenza-like illnesses (ILI), which could be subject to recall bias and social desirability bias, potentially overestimating the effectiveness of these measures. Additionally, the study's reliance on self-evaluation using subjective terms for the frequency of implementing protective measures against COVID-19 might affect the accuracy of the data collected. The content validity of the questionnaire was assessed, but the reliability and objectivity in measuring exposure and outcomes remain unclear.	

Table 2: Summary of studies reporting on effectiveness of cleaning and disinfecting in deactivating/eliminating RIDs on surfaces assessed in real life community settings (n=10).

Last updated March 28th 2024

RIDs	Reference	Setting and time covered	Study characteristics	Summary of key findings in relation to the outcome	RoB
SARS-CoV-2 **VOCs assessed**: None	D'Accolti et al., 2023 (17) Italy	Urban subway environment in Italy. The study period lasted for a total of 12 weeks from September to December 2021.	**Design**: Quasi-experimental **Intervention**: PCHS in one of the urban subway trains, which involved the use of probiotic-based cleaning agent applied once a day compared to continue to use conventional chlorine-based disinfectants, applied four times per day in the first 2 weeks of the study. **Sample**: Two underground driverless trains with superimposable characteristics. Each sampling campaign involved collecting samples from twelve points on each train, corresponding to different areas such as floors, seats, handrails, doors, and air filters. In total, 272 samples were collected and analyzed, including 136 Tryptic Soy Broth swabs and 136 Phosphate-Buffered Saline swabs, with 120 samples from surfaces and 16 from air filters. **Population:** microbial communities present on various surfaces and in the air of the subway trains **Funding:** Public **Key outcomes**: Assessment of the presence of SARS-CoV-2 RNA genome in surface samples from both the PCHS and control trains.	• The implementation of PCHS sanitation led to a significant decrease in the presence of SARS-CoV-2 RNA, with a lower percentage of positive samples (3.7% vs. 9.6%) and total viral copy number (230–470 copies/ml vs. 340–1350 copies/ml) in the PCHS-treated train compared to the chemically disinfected control train during the T1–T5 period. • Thus, the data suggest that PCHS sanitation could maintain the environment free of SARS-CoV-2 virus with an effectiveness comparable or superior to chemicals. Limitations: A low RoB was found in the development of this study; the main impact was the reduced sample size.	Low
Influenza AIV **Subtype**	Islam et al, 2023 (21) Bangladesh	Dhaka and Rajshahi districts in Bangladesh	**Design:** Cross-sectional Between 2017 and 2018, fecal and offal samples were collected from 200 stalls in 63 LBMs. Samples were analyzed for the AIV matrix gene	• Enhanced hygiene practices were associated with lower AIV prevalence ($P < 0.05$). • Cleaning Agent: Vendors using water only had a significantly higher prevalence of AIV (54.41%) compared to those using detergent (17.19%).	Moderate

LES 18.2: Effectiveness of Cleaning and Disinfecting for reducing transmission of RIDs in non-healthcare community-based settings.

<table>
<tr><th>RIDs</th><th>Reference</th><th>Setting and time covered</th><th>Study characteristics</th><th>Summary of key findings in relation to the outcome</th><th>RoB</th></tr>
<tr>
<td>H5, H7, and H9</td>
<td></td>
<td>Between 2017 and 2018</td>
<td>(M gene) followed by H5, H7, and H9 subtypes by rRT-PCR. A descriptive analysis of market cleaning and sanitation practices was conducted to further elucidate the relationship between LBM biosecurity and AIV subtypes by species, sample types, and landscape. Subsequently, univariate analysis and generalized linear mixed model (GLMM) were performed to determine the risk factors associated with AIV contamination at individual positions within the LBMs.

Intervention: using water only vs. detergent for cleaning.

Population: Vendors operating within LBMs across selected peri-urban and rural areas. Specifically, the study sites included 25 LBMs from Savar and 21 from Dhamrai in the Dhaka district, 13 from Fulbaria in Mymensingh, and four from Pabna Sadar in Pabna district.

Sample: 200 stalls in 63 LBMs across four sub-districts.

Funding: Public

Key outcomes: Prevalence of AIV in LBMs

Specifically, the investigation targeted the detection of AIV matrix gene (M-gene) followed by subtypes H5, H7, and H9</td>
<td>

Implementing effective cleaning routines, was associated with a reduced risk of AIV contamination. ($P < 0.05$).
The investigation into the risk factors of AIV in Bangladeshi LBMs found a high prevalence of AIV, particularly subtypes A/H5 and A/H9. The study concluded that the integration of improved waste disposal, proper disinfection methods, and the avoidance of mixing poultry breeds could significantly reduce AIV transmission risks.

<table>
<tr><th colspan="5">Univariable analysis of factors to check association with AIV circulation (results from Pearson’s chi-square test).</th></tr>
<tr><td>Cleaning agent</td><td>Total</td><td>Prevalence (%)</td><td>95% CI</td><td>p value</td></tr>
<tr><td>Detergent</td><td>64</td><td>11 (17.19)</td><td>8.9–28.68</td><td rowspan="2"><0.01</td></tr>
<tr><td>Water only</td><td>136</td><td>74 (54.41)</td><td>45.66–62.97</td></tr>
</table>
<table>
<tr><th colspan="3">Stall level generalized linear mixed model (GLMM) model of bio-security practices and AIV circulation in peri-urban and rural LBM.a</th></tr>
<tr><td>Cleaning agent</td><td>aOR (95% CI)</td><td>p value</td></tr>
<tr><td>Detergent</td><td>Reference</td><td></td></tr>
<tr><td>Water only</td><td>5.99 (2.26–15.82)</td><td><0.01</td></tr>
</table>
Limitations: Concerns about the strategies to deal with confounding factors were stated, as no direct mention of such strategies was found in the provided excerpts. This could potentially impact the interpretation of the study's results if confounding factors were not adequately addressed. Finally, it is not specified how the exposure measurement was carried out.
</td>
<td></td>
</tr>
<tr>
<td>Influenza

AIV
Subtype:</td>
<td>Islam et al, 2023 (20)

Bangladesh</td>
<td>The study was conducted in peri-urban and rural LBMs across four sub-districts in</td>
<td>Design: Cross-sectional
Between 2016 and 2017, faecal or offal samples were collected from 1008 stalls in 113 LBMs in Dhaka and Rajshahi districts of Bangladesh. For each position, samples were pooled and analyzed</td>
<td>

Stalls that improved cleaning frequency and had running water showed a significant reduction in the presence of AIV compared to those that did not.
Stalls that adhered to daily cleaning and weekly disinfecting showed a significant reduction in AIV prevalence compared

</td>
<td>Moderate</td>
</tr>
</table>

<table>
<thead>
<tr><th>RIDs</th><th>Reference</th><th>Setting and time covered</th><th>Study characteristics</th><th>Summary of key findings in relation to the outcome</th><th>RoB</th></tr>
</thead>
<tbody>
<tr>
<td>H5, H7, and H9</td>
<td></td>
<td>Bangladesh, various settings within Bangladesh, including upazillas, unions, and village areas.

Between 2016 and 2017</td>
<td>for the AIV array gene, followed by H5 and H9 subtyping by rRT-PCR. Influenza A viral RNA was detected in 49% of the posts. Of the samples positive for avian influenza virus, 52% and 24% were determined to be H5 and H9 viruses, respectively, which are subtypes of considerable health concern. Generalized linear mixed effects models were used to study the presence of AIV in individual positions within LBMs based on 13 of the 20 risk factors identified by the FAO.

Intervention: Small and feasible improvements in cleaning and disinfection frequency, installing running water in stalls, not mixing different breeds of chicken in the same cages, cleaning vehicles used in poultry transport, not selling waterfowl with chickens in the same stall, buying stock directly from commercial farms, separating sick birds from healthy ones, and avoiding access by wild birds like house crows. It is not specified what disinfectant or substance was used.

Sample: 1008 stalls

Population: Stalls within LBMs

Funding: Public

Key outcomes: Prevalence of AIV in LBMs. Specifically, the investigation targeted the detection of AIV matrix gene (M-gene) followed by subtypes H5, H7, and H9.</td>
<td>to those that did not maintain these biosecurity measures. (No specific P-values provided).

<table>
<tr><td colspan="6">Estimates with standard error and p-value of generalized linear mixed effect model to find out the risk factors of AIV contamination in LBM stalls in Bangladesh during 2016–17.</td></tr>
<tr><th>Variable</th><th>Category</th><th>Estimates</th><th>Std. error</th><th>Statistic</th><th>P value</th></tr>
<tr><td rowspan="2">Frequency of cleaning [Ref: Weekly]</td><td>Twice a week</td><td>−1.87</td><td>0.37</td><td>−5.06</td><td><0.01</td></tr>
<tr><td>Daily</td><td>−3.55</td><td>0.45</td><td>−7.93</td><td><0.01</td></tr>
<tr><td rowspan="2">Frequency of disinfection [Ref: Infrequently]</td><td>Twice a month</td><td>−2.57</td><td>0.44</td><td>−5.9</td><td><0.01</td></tr>
<tr><td>Weekly</td><td>−3.63</td><td>0.46</td><td>−7.8</td><td><0.01</td></tr>
<tr><td>Cleaning of poultry vehicles at marketplace</td><td>Yes</td><td>−1.83</td><td>0.39</td><td>−4.74</td><td><0.01</td></tr>
</table>

Limitations: Concerns about the strategies to deal with confounding factors were stated, as no direct mention of such strategies was found in the provided excerpts. This could potentially impact the interpretation of the study's results if confounding factors were not adequately addressed. Finally, it is not specified how the exposure measurement was carried out.</td>
<td></td>
</tr>
<tr>
<td>Influenza

AIV</td>
<td>Huneau-Salaün, 2021 (24)

France</td>
<td>Duck abattoirs (4 abattoirs and at the temporary platform) in France</td>
<td>Design: Quasi-experimental. Pre-cleaning and disinfection AIV genome detection vs. post-cleaning and disinfection AIV genome detection were compared.
This study was conducted to evaluate the cleaning and disinfection of trucks and cages used for duck</td>
<td>After cleaning and disinfection, 29% of the crates (23/80) were positive for AIV genome vs. 75% before cleaning and disinfection (chi-square test, P < 0.001). After cleaning and disinfection, 31% of the samples taken on truck surfaces (6/19) were positive for AIV genome.</td>
<td>Critical</td>
</tr>
</tbody>
</table>

RIDs	Reference	Setting and time covered	Study characteristics	Summary of key findings in relation to the outcome	RoB
		From January 18 to January 20, 2021	depopulation and whether practices had changed since 2017. **Intervention**: Cleaning and disinfection protocols applied by the abattoir in charge of the decontamination of the vehicle. The comparison is made between the levels of avian influenza virus genome detection on duck transport crates and trucks before and after the application of the cleaning and disinfection protocols. Disinfectant solution: commercial solutions of QAC with glutaraldehyde **Sample**: In 5 abattoirs (4 abattoirs and at the temporary platform). A total of 8 trucks and their crates were sampled by swabbing to detect AIV genome. **Population:** Duck abattoirs: Trucks and crates used for duck depopulation **Funding**: Public **Key outcomes**: Frequencies of AIV genome detection on duck transport crates and trucks before and after decontamination. Three methods were used to evaluate decontamination: 1) AIV genome detection , 2) visual inspection of cleanliness, and 3) microbial counts, considering that 2 and 3 are commonly used in slaughterhouses.	• Eighty crates were visually assessed for cleanliness after cleaning and disinfection. Sixty-seven crates out of 80 (84%) were considered clean. 28% of the crates that were considered clean were positive for AIV genome. • Despite the application of enhanced cleaning and disinfection protocols, the efficacy varied among different abattoirs, suggesting that the effectiveness of the intervention depended on factors such as the initial contamination load, specific cleaning and disinfection protocols used, and the fidelity of protocol implementation. Limitations: Although the same cleaning and disinfection protocols are applied across abattoirs, the authors find differences in compliance with these protocols and do not make adjustments in the statistical analysis. No adjustments are made in the analysis for other conditions in the flow and organization of the trucks that could generate cross contamination.	
Influenza AIV	Chung, 2021(18) South Korea	Vehicle disinfection facilities. The setting aimed to simulate real-world conditions where vehicles used in	**Design**: Quasi-experimental A controlled setting that assessed the efficacy of disinfection systems for transportation vehicles against the AIV. The virus used for the assessment was a low pathogenic AIV strain, specifically A/chicken/Korea/MS96/1996. This strain was inoculated into the allantoic fluid of 10-day-old	• The study found that viral reductions of at least 4 log could be expected when the disinfectant solution coverage ratios were at least 66% for 1 minute, 56% for 5 minutes, and 50% for 10 minutes. The correlation between the disinfectant solution coverage and AIV reduction was significant, with Pearson r values of 0.7367 (1 min), 0.6904	Low

RIDs	Reference	Setting and time covered	Study characteristics	Summary of key findings in relation to the outcome	RoB
		livestock farming, potentially contaminated with pathogens like AIV, undergo disinfection procedures to prevent the spread of infectious diseases such as highly pathogenic avian influenza (HPAI) and foot-and-mouth disease (FMD). South Korea Study period not stated	chicken embryonic eggs and incubated to obtain a virus solution for the experiments. **Intervention**: The intervention involved the use of tunnel-type disinfection facilities where disinfectant solution was sprayed on vehicles (passenger vehicles and trucks) for specified durations (30 seconds for passenger vehicles and 60 seconds for trucks). The study compared the efficacy of different spray durations (1 minute, 5 minutes, and 10 minutes) and their impact on viral reduction. **Sample**: The sample consisted of two representative types of disinfection facilities, tunnel-type and U-type, with vehicles such as passenger vehicles and trucks passing through these facilities. The vehicles were divided into four sections (front, back, bottom, and side) for the assessment, and numerous water-sensitive papers were attached to these sections to ascertain the disinfectant solution coverage. **Population:** included domestic livestock farms and related facilities that already have disinfection facilities installed and operated. **Funding**: Public **Key outcomes**: Viral Reduction Efficacy	(5 min) (5-day-old chicken embryonic eggs, the eggs were incubated at 37°C for 72 hours). • The results suggest that disinfectant solution coverage ratios not lower than 71% are necessary to obtain minimum viral reduction values of 4 log, regardless of the types of disinfection facilities and vehicles, and at least a 5-log reduction can be expected when the coverage is at least 99% (R^2 = 0.4840). Authors concluded that: • The use of citric acid-based disinfectant in tunnel-type and wall-type disinfection facilities resulted in significant reductions of AIV on vehicle surfaces, with at least 4-log reductions achieved after vehicles passed through the facilities. • The correlation between disinfectant solution coverage and AIV reductions was established, showing that higher coverage ratios significantly correlate with greater viral reductions. Limitations: Due to the design of the study and the control of disinfection methods and measurement of results, the RoB was low; however, it is noted that although it is not a laboratory study, the conditions were highly controlled.	
Influenza AIV	Huneau-Salaün 2020 (26) France	Duck abattoirs in France. From January to March 2017	**Design**: Quasi-experimental. This observational study aimed to compare frequencies of AIV genome detection on duck transport crates and trucks before and after decontamination. Six visits for sampling were carried out in 3 duck abattoirs. The cleaning and decontamination protocols tested were those applied by the abattoir in charge of the	• Despite the implementation of improved cleaning and decontamination procedures, a significant number of crates remained positive for AIV genome after the intervention. • A total of 86 samples out of 299 (28.8%) obtained before cleaning and decontamination were positive for AIV. After cleaning and decontamination, the AIV genome was detected in 56 samples out of 308 (18%).	Critical

RIDs	Reference	Setting and time covered	Study characteristics	Summary of key findings in relation to the outcome	RoB
			decontamination of the vehicle. Information about the cleaning and decontamination protocols was collected in a standardized questionnaire filled in during the visits at the abattoir. A trained investigator conducted all the visits. **Intervention**: cleaning and decontamination procedures on trucks and crates. Disinfectant solution: commercial solutions of QAC with glutaraldehyde **Sample**: Swab samples from trucks and crates **Population:** Trucks and crates used in abattoirs **Funding**: Public **Key outcomes**: Presence of AIV genome before and after cleaning and decontamination, visual cleanliness scores, and coliform counts on crates after cleaning and decontamination	• Residual detection of the AIV genome was found in two abattoirs. The cleaning and decontamination protocols for crates at these abattoirs, based on disinfection by spraying, appeared to be insufficient to reduce crates contamination. • No residual detection was found in one of the abattoirs. The cleaning and decontamination protocol at this abattoir was based on 2 cleaning steps with detergent and hot water (low pressure cleaning and soaking) and 1 soaking disinfection step. • In one of the abattoirs, cross-contamination was found. The authors indicate that cross-contamination may have occurred due to insufficient cleaning and decontamination of the equipment and area after treating a previous batch of contaminated crates. Authors concluded that although all the abattoirs reinforced their cleaning and decontamination protocols to mitigate the risk of AIV spread cleaning and decontamination efficacy was variable among slaughterhouses. Cleaning and disinfection efficacy seemed to depend on initial contamination load, cleaning and decontamination protocols, and the quality of protocol application. Further improvements in cleaning and decontamination protocols and reinforcement of biosecurity measures at abattoirs are needed to avoid residual contamination of the equipment and cross contamination during the decontamination process. Limitations: Quasi-experimental study with single group pretest post-test design. Although all trucks and boxes were evaluated before and after the intervention, each slaughterhouse implemented the cleaning and disinfection protocol differently. Number of virus detections are described but the analyses are not adjusted.	
Influenza AIV. **Subtype:** H9 and H5	Chowdhury, 2020 (22) Bangladesh	LBMs in Bangladesh March 2015	**Design**: Cross-sectional **Intervention**: Implementation of regular cleaning and disinfection practices in poultry shops	• Reported monthly cleaning was protective [aOR= 0.47, (95% CI, 0.28–0.8); p<0.01], but disinfecting practices of poultry holding areas was still not significantly associated	Moderate

RIDs	Reference	Setting and time covered	Study characteristics	Summary of key findings in relation to the outcome	RoB
			compared to poultry shops with irregular or no cleaning and disinfection practices. It is not specified what disinfectant or substance was used. **Sample**: 800 poultry shops. 80 LBMs were selected from 10 metropolitan areas and 10 shops were enrolled in each LBM. **Population:** Poultry shop in Bangladesh **Funding:** Public **Key outcomes**: Presence of environmental contamination with influenza A viruses and association with shop-level biosecurity practices	with influenza A virus detection in the multivariate model (p = 0.85). [Table below] Limitations: The study's cross-sectional design limits the interpretation of some results, particularly regarding the timing of biosecurity measures relative to sampling, which could affect the assessment of exposure and outcomes. The study did not explore the time from the last cleaning or disinfection to sampling, nor did it assess the viral load and viability of detected avian influenza viruses (AIVs), leaving it unclear whether the AIVs were infectious to humans. This limitation, along with potential social desirability bias in reporting biosecurity practices, might have affected the reliability of exposure and outcome measurements.	

Shop-level biosecurity practices and environmental contamination with 800 influenza A viruses in 10 metropolitan areas, Bangladesh, March 2015

Frequency	**No. (%) shops**	**No. (%) shops positive for influenza A viruses, n = 205**	**OR (95% CI)**	**p value**	**aOR (95% CI)**	**p value**
Cleaning poultry holding areas						
No cleaning in past month	26 (3)	12 (46)	Ref.	NA	Ref.	NA
Monthly	68 (9)	10 (14)	0.2 0 (0.08–0.49)	<0.01	0.47 (0.28–0.8)	<0.01
Weekly‡	238 (30)	57 (24)	0.37 (0.18–0.73)	<0.01	NA	NA
Daily	468 (59)	126 (27)	0.41 (0.27–0.62)	<0.01	1.09 (0.91–1.31)	0.31
Disinfecting poultry holding areas						
No disinfecting in past month	577 (72)	150 (26)	Ref.	NA	-	-
Monthly	38 (5)	10 (26)	1.1 (0.53–2.25)	0.79	-	-
Weekly	185 (23)	45 (24)	0.81 (0.61–1.07)	0.14	-	-

The weekly cleaning variable was removed from the multivariate model because of collinearity. Model fit: model χ^2 76.29, p<0.001, df 11; adjusted generalized R^2 0.596. Only statistically significant relationships are shown for adjusted OR (95% CI) data and corresponding p values.

LES 18.2: Effectiveness of Cleaning and Disinfecting for reducing transmission of RIDs in non-healthcare community-based settings.

RIDs	Reference	Setting and time covered	Study characteristics	Summary of key findings in relation to the outcome	RoB
Influenza AIV, **Subtype:** HPAI H5N2 virus	Garber et al, 2016 (19) United States	Rural farm settings in Iowa and Nebraska. United States Study includes all detected cases as of May 15, 2015	**Design**: Case-control study A questionnaire was developed and administered to 28 case farms and 31 control farms. Multivariable logistic regression models were fit using a forward-selection procedure. **Intervention**: Hard surface with cleaning and disinfection. It is not specified what disinfectant or substance was used. **Sample**: 28 case farms and 31 control farms. Case farms detected with HPAI H5N2 virus and control farms within a 16 km radius of each case farm **Population:** Table-egg layer and pullet farms in Iowa and Nebraska **Funding:** Public **Key outcomes**: Factors associated with farm status (infected vs. not known to be infected), including premise characteristics, vehicles and equipment, wild birds, and farm worker and visitor characteristics	• Variables associated with a decreased risk of infection included visitors changing clothing, cleaning and disinfecting a hard-surface barn entryway, and ceiling/eaves ventilation in barns. • Having a hard-surfaced barn entry pad that was cleaned and disinfected was associated with a decreased HPAI H5N2 virus infection farm status compared with not having a hard surface or no cleaning or disinfection [OR, 0.16, p = 0.01]. A higher percentage of control barns (53.6%) than case barns (28.6%) had hard-surfaced entry pads that were cleaned and disinfected.	Low
Influenza Avian influenza virus A **Subtype**: H5N1	Biswas et al., 2017 (23) Bangladesh	LBMs in Bangladesh. June 2012 to December 2012	**Design**: Cohort **Intervention**: Implementation of biosecurity measures in LBMs intervened by the FAO compared to Non-intervened LBMs without the implementation of FAO-guided biosecurity measures. **Sample**: Environmental sites commonly contaminated by avian influenza virus A (H5N1) in live-bird markets	• The risks for FAO-intervened LBMs was 0.1 (95% CI, 0.04–0.2) and for non-intervened 0.09 (95% CI, 0.05–0.15). The RR between the FAO-intervened and non-intervened LBMs was 1.1 (95% CI, 0.44–2.76), suggesting that risk in the two kinds of LBMs did not vary significantly (Z = 0.202, P = 0.413). • The OR_{MH} of the proportion of the observed LMBs positive for HPAI H5N1 was 1.40 (95% CI 1.19–1.64), also indicating that the proportion positive for HPAI H5N1 between the two kinds of LBMs did not vary significantly (v2 = 0.872, P = 0.350).	Moderate

LES 18.2: Effectiveness of Cleaning and Disinfecting for reducing transmission of RIDs in non-healthcare community-based settings.

<table>
<tr><th>RIDs</th><th>Reference</th><th>Setting and time covered</th><th>Study characteristics</th><th>Summary of key findings in relation to the outcome</th><th>RoB</th></tr>
<tr><td></td><td></td><td></td><td>Population: LBMs where FAO intervened and other registered LBMs in the Dhaka City Corporations and Chittagong City Corporation

Key outcomes: Biosecurity measures, contamination of environmental sites by HPAI H5N1</td><td><table>
<tr><td colspan="4">Multivariable analysis (initial model) of biosecurity measures in FAO-intervened and non-intervened LBMs in Bangladesh,</td></tr>
<tr><td>Variable</td><td>OR</td><td>95%CI</td><td>P value</td></tr>
<tr><td>Disinfection of poultry case after cleaning</td><td>25.9</td><td>1.2–559.0</td><td>0.038</td></tr>
<tr><td>Disposal of slaughter remnants elsewhere at market</td><td>4.8</td><td>0.1–336.9</td><td>0.469</td></tr>
<tr><td>Decontamination of poultry vehicles at marketplace</td><td>12.8</td><td>0.4–403.2</td><td>0.147</td></tr>
<tr><td>Market/floor cleaning – by market committee</td><td>26.8</td><td>0.2–3174.7</td><td>0.18</td></tr>
<tr><td>Dry cleaning (sweeping floor with broom)</td><td>1.0</td><td>0.01–131.2</td><td>0.992</td></tr>
</table>
Authors concluded that there were some empirically recognized improved biosecurity measures in operation at the FAO intervened LBMs in 2012, but the proportion positive of HPAI H5N1 in the FAO-intervened and non-intervened LBMs in Bangladesh was similar.

Limitations: The researchers who collected the biosafety information were not blinded. Exposure measurement is not an objective method. The authors estimated an RR of infection depending on whether they were intervened by the FAO or not (The RR is estimated from the incidences, which in this study is not possible to measure, so it is not an appropriate statistical method).</td><td></td></tr>
<tr><td>MRSA, VRE, Enterococcus, Staphylococcus subspecies, and influenza</td><td>LaBelle, 2020 (25)

United States</td><td>Suburban high schools and colleges in United States.

September 2017 to May 2018</td><td>Design: Quasi-experimental
Phase 1: Installation of products at the point of care in athletic training rooms
Phase 2: Initiation of educational interventions with placement of posters and checklists
Phase 3: Targeted educational materials distribution
The comparator was the condition before the intervention.

Intervention: educational interventions for surface disinfection with PURELL™ Surface Spray; GOJO Industries Inc.</td><td>• Influenza was detected on 25% of the surfaces initially with ≥195 viral particles on each contaminated site, which included front door handles (college A, 195 viral particles; high school A, 218 viral particles), drawer handles (high school A, 293 viral particles), water bottle lids (college A, 462 viral particles), and water cooler nozzles (college A, 222 viral particles).
• Influenza was not detected during the February sampling after implementation of program education.

Limitations: Quasi-experimental study, samples of surfaces are taken in gymnasiums of two high schools and two universities before and after the hand and surface disinfection protocol.</td><td>Critical</td></tr>
</table>

LES 18.2: Effectiveness of Cleaning and Disinfecting for reducing transmission of RIDs in non-healthcare community-based settings.

RIDs	Reference	Setting and time covered	Study characteristics	Summary of key findings in relation to the outcome	RoB
			Sample: Two high school and 2 collegiate athletic training rooms **Population:** High school and collegiate athletic training rooms **Funding:** Industry (GOJO Industries, Inc) **Key outcomes**: Overall bacterial load, presence of MRSA, VRE, and influenza on surfaces; reported infections in student-athletes	Elimination of staphylococci, e.g. Coli and influenza are measured. Compliance with the protocol is not verified nor are there differences in its implementation or in the population and places intervened. In addition, verification of compliance with the protocol was through checklists that coaches and athletes had to complete. Therefore, in aspects such as the implementation of the intervention and the verification of adherence and in the control of confounding factors, significant risks of bias were found, so the RoB of this study was evaluated globally as critical.	

.

Table 3: Summary of studies reporting unintended consequences associated with the use of cleaning and disinfecting products and strategies to reduce the transmission of RIDs (n=8)

Last updated March 28th 2024

RIDs	Reference	Setting and time covered	Study characteristics	Summary of key findings in relation to the outcome	RoB
SARS-CoV-2 **VOCs assessed**: None	Chauhan et al., 2024 (34) United States	The study examined ocular injuries in children under 3 years old in the US from 2017 to 2021, focusing on injuries from consumer products. Hospitals in the United States that have more than 5 beds and provide 24-hour emergency department care 2017 through 2021	**Design:** Cross-sectional. Analysis of ocular injury data for children ≤3 years of age from the US Consumer Product Safety Commission National Electronic Injury Surveillance System (NEISS). **Interventions:** Comparison of diagnoses and disposition of ocular injuries pre-pandemic (2017-2019) versus during the pandemic (2020-2021) related to consumer products. **Sample:** 23,882 reported ocular injuries from the NEISS database related to children ≤3 years of age **Population:** Children ≤3 years of age **Funding:** Not specified. **Key outcomes:** National-level estimate of ocular injuries in infants and toddlers, with a focus on the location of the injury, the diagnosis, the outcome, and a descriptive narrative of the injury.	• The proportion of injuries by month was comparable between the pre-pandemic and pandemic study periods (P= 0.249). However, after the pandemic onset, there was a trend for cleaning products accounting for the greater proportion of injuries. • A non-significant increase in cleaning product-related injuries was observed from 35.48% (95% CI, 31.39–39.79) in 2017-2019 to 41.54% (95% CI, 36.61–46.64) in 2020-2021 (P= 0.186). • However, after the onset of the pandemic, the greatest proportion of injuries was due to chemical-burn-related injuries, with a statistically significant increase from 23.34% (95% CI, 19.73–27.38) in the pre-pandemic period to 31.63% (95% CI, 26.98–36.69) in the pandemic period (P= 0.048). • Of the patients diagnosed with chemical-burn injuries, 71.75% (95% CI, 65.25–77.46) were from cleaning products. • The most represented cleaning product among chemical burn injuries was laundry detergents and bleach (53.68%). Adjusting for age, sex, race, and injury location, we found that the odds of a chemical burn were significantly more likely in the post-pandemic period [OR, 1.51 (95% CI, 1.10–2.08)]. • In examining the linear trend of chemical burn injuries by month between the pre-and post-pandemic periods, it was found that in the pre-pandemic era, July had the highest number of ocular chemical burns in relation to other diagnoses [37.71%(95% CI, 24.64–52.86)] whereas in the post-pandemic era rates of chemical burns were greater in the autumn and winter months of October [47.27 (95% CI, 28.20– 67.17)], November [43.70% (95% CI, 24.97–64.42)], and January [60.75% (95% CI, 42.49–76.43)]. Limitations: The data is taken retrospectively from a database. The characteristics of the population or sociodemographic aspects were not described precisely. The measurement of exposure and its effects was through the records used, which does not allow them to be well defined and,	Critical

RIDs	Reference	Setting and time covered	Study characteristics	Summary of key findings in relation to the outcome	RoB
			The proportion of patients diagnosed with chemical-burn-related injuries, particularly those due to cleaning products.	furthermore, they are very susceptible to bias. Therefore, the overall assessment of RoB in this study was critical.	
SARS-CoV-2 **VOCs assessed**: None	Hashemi et al., 2023 (29)	Online survey. Global, with participation from 154 countries out of 193 United Nations members. August 1, 2021, to April 30, 2022	**Design**: Cross-sectional survey. Online survey conducted globally. **Intervention**: Use of detergents, alcohol-based sanitizers, and chlorinated compounds among the general population **Sample**: 91,056 participants from 154 countries. **Population:** General global population. **Funding:** public **Key outcomes**: Health outcomes related to the use of sanitizers and disinfectants: skin effects (itching and skin irritation, dryness, scaling, and urticaria), ocular (itching and eye irritation, and redness), irritation and itching of the throat, respiratory problems (itching and nasal irritation, runny nose, cough and sneezing, and shortness of breath), and neurological effects (headache, dizziness, and vomiting).	• The most common complaints reported by participants were related to effects on the skin and respiratory system. • The highest and lowest frequencies were related to dry skin and neurological effects (headache, dizziness and vomiting). • There was a significant relationship between the use of chlorine compounds (sodium hypochlorite and chlorine) with all adverse effects ($p < 0.001$). • Itching and skin irritation was associated with the use of alcohol or alcohol-based materials (OR 1.86, $p > 0.05$) and with the use of sodium hypochlorite (OR 1. 43, $p < 0.001$). • The use of per-chlorine (OR 1.47, $p < 0.001$), alcohol-based materials (OR 1.98, $p < 0.001$); formaldehyde (OR1.40, $p < 0.001$) were associated with higher odds of skin dryness, skin peeling, and skin urticaria, respectively. • Itching and eye irritation were reported after using bleach (OR 1.83, $p < 0.001$); and sodium hypochlorite (OR 1.33, $p < 0.001$) • Eye redness was associated with the use of chlorine (OR 1.77, $p < 0.001$) and hydrogen peroxide (OR 1.49, $p < 0.001$). • Per-chloride use increased the risk of throat-related effects (OR 2.00, $p < 0.001$). The use of sodium hypochlorite is also a risk factor for itching and irritation of the throat (OR 1.66, $p < 0.001$). • The use of sodium hypochlorite (OR 1.74, $p < 0.001$) and formaldehyde (OR 1.56, $p < 0.001$) was accompanied by coughing and sneezing. Dyspnea was associated with the use of sodium hypochlorite (OR 1.78, $p < 0.001$) and per-chloride (OR 1.67, $p < 0.001$). • There was a strong association between the use of formaldehyde and the occurrence of neurological effects (OR 2.17, $p < 0.001$). The article provides a table with the relationship between the frequency of reporting of each of the reported symptoms and each of the types of sanitizers or disinfectants. Limitations: Both exposure and outcome were measured through an online survey, which provides little validity and reliability in the measurement of both	Serious

<table>
<tr><th>RIDs</th><th>Reference</th><th>Setting and time covered</th><th>Study characteristics</th><th>Summary of key findings in relation to the outcome</th><th>RoB</th></tr>
<tr><td></td><td></td><td></td><td></td><td>exposure and outcomes. Only a few confounders were also measured through the survey. While the study appears to have used appropriate statistical analysis, these factors raise concerns about the robustness of the findings.</td><td></td></tr>
<tr><td>SARS-CoV-2

VOCs assessed: None</td><td>du Plessis et al, 2022 (27)

South Africa</td><td>Calls received reporting exposure to cleaners and disinfectants. Poisons Information Helpline of the Western Cape (PIHWC), a joint telephone service provided by the Tygerberg Poisons Information Centre (TPIC) and Red Cross War Memorial's Children Hospital Poisons Information Centre (RXHPIC), both situated in Cape Town, South Africa.

March 1 to August 31 during the years 2018, 2019, and 2020.</td><td>Design: Cross-Sectional
The study design involved a retrospective review of calls received by the Poisons Information Helpline of the Western Cape (PIHWC).

Intervention: The intervention in this context was the occurrence of the COVID-19 pandemic itself, with the associated lockdown regulations and increased availability of hygiene-related chemicals, such as hand sanitizers and disinfectants. The comparators were the data from similar periods in the two preceding years, 2018 and 2019, before the pandemic and its associated interventions.

Sample: The total number of calls were 5137, 5508, and 5181 in 2018, 2019, 2020, respectively.

Population: all human-related poisoning exposure calls received by the PIHWC from March 1 to August 31 during the years 2018, 2019, and 2020.

Funding: Public

Key outcomes:</td><td>

There was a reduction in the total number of calls received during the first six months of the COVID-19 pandemic in 2020 (5137 calls) compared to the same period in 2019 (5508 calls) and 2018 (5181 calls).
Notably, there was an increase in the proportion of calls from the public in 2020 compared to 2019 (39.4% vs 33.1%).
There were no significant differences in the severity of the events reported in both periods.

<table>
<tr><th colspan="4">Substance categories of poisoning exposure calls received by the Poisons Information Helpline of the Western Cape in the first six months of the COVID-19 pandemic and similar periods during 2019.</th></tr>
<tr><th>Substance category</th><th colspan="3">Difference 2020 vs. 2019</th></tr>
<tr><th></th><th>n</th><th>%</th><th>p</th></tr>
<tr><td>Antiseptic and disinfectant</td><td>162</td><td>3.1</td><td>< 0.001</td></tr>
<tr><td>Household chemicals</td><td>12</td><td>2.1</td><td>0.004</td></tr>
<tr><td>Pharmaceuticals</td><td>−486</td><td>−3.3</td><td>< 0.001</td></tr>
<tr><td>Other</td><td>−261</td><td>−2.0</td><td>0.01</td></tr>
<tr><td>Unknown</td><td>−2</td><td>0.1</td><td>0.65</td></tr>
<tr><td colspan="4">Household chemicals including cosmetics, household products and handyman products</td></tr>
</table>

<table>
<tr><th colspan="7">Characteristics of poisoning exposure calls received by the Poisons Information Helpline of the Western Cape in the first six months of the COVID-19 pandemic and similar periods during 2019.</th></tr>
<tr><th></th><th colspan="2">2019</th><th colspan="2">2020</th><th></th></tr>
<tr><th>Poisoning severity</th><th>n</th><th>%</th><th>n</th><th>%</th><th>p</th></tr>
<tr><td>No symptoms</td><td>2511</td><td>45.6</td><td>2350</td><td>45.8</td><td>0.60</td></tr>
<tr><td>Minor</td><td>2194</td><td>39.8</td><td>2116</td><td>41.2</td><td>0.15</td></tr>
<tr><td>Moderate</td><td>575</td><td>10.4</td><td>478</td><td>9.3</td><td>0.05</td></tr>
<tr><td>Fatal</td><td>122</td><td>2.2</td><td>92</td><td>1.8</td><td>0.12</td></tr>
<tr><td>Unknown</td><td>4</td><td>0.1</td><td>3</td><td>0.1</td><td>0.76</td></tr>
</table>

Limitations: The data is taken retrospectively from a database. Although standard criteria were used to measure the condition, specifically the poisoning severity score (PSS), the validity and reliability of the exposure measurement and the measured outcomes are not explicitly stated, leaving some uncertainty.</td><td>Serious</td></tr>
</table>

<table>
<thead>
<tr><th>RIDs</th><th>Reference</th><th>Setting and time covered</th><th>Study characteristics</th><th>Summary of key findings in relation to the outcome</th><th>RoB</th></tr>
</thead>
<tbody>
<tr><td></td><td></td><td></td><td>The Poisoning Severity Score (PSS) was used to determine the severity of poisoning.</td><td>No confounding factors were identified, or strategies indicated to address them that could affect the study findings</td><td></td></tr>
<tr><td>SARS-CoV-2

VOCs assessed: None</td><td>Giordano et al., 2022 (28)

Italy</td><td>Calls received reporting exposure to cleaners and disinfectants. Pavia Poison Control Center (PPC)

The lockdown period (March–May 2020) and the same period over the previous three years (2017–2019)</td><td>Design: Cross-Sectional to compare exposure cases managed by the Poison Control Center during the lockdown period (March–May 2020) against the same period over the previous three years (2017–2019).

Intervention: Product categories involved in exposures were compared using the European Product Categorisation System (EuPCS), focusing on cleaning products, detergents, biocidal products, and cosmetics

The comparison was made between exposure cases managed by the PPC during the lockdown period (March–May 2020) and the same period over the previous three years (2017–2019).

Sample: 15,534 patients identified from the exposure cases. Specifically, 11,574 cases (74.5%) were from 2017–2019, and 3,960 cases (25.5%) were from 2020.

Population: patients who had been exposed to various substances in the first five months of 2017–2019 and 2020

Funding: public</td><td>
During the lockdown, calls from private citizens showed a highly significant increase (+ 11.5%, p < .001) and occupational exposures decreased (− 11.7%, p = .011). Among Cleaners, exposures to Bleaches slightly increased while Drain cleaning products went through a significant reduction (− 13.9%, p = .035). A highly significant increase of exposures to Disinfectants was observed (+ 7.7%, p = .007), particularly to those for surfaces (+ 6.8%, p = .039).
<table>
<tr><td colspan="5">Product categories (EuPCS) involved in patients' inadvertent exposures: observed and expected values in the lockdown period (March–May 2020)</td></tr>
<tr><th>Variables</th><th colspan="2">March–May 2020</th><th></th><th></th></tr>
<tr><th></th><th>Observed N.</th><th>Expected N.</th><th>Increase (%)</th><th>p-value (χ2)</th></tr>
<tr><td>Cleaning, care and maintenance products</td><td>840</td><td>848.3</td><td>−1.0</td><td>.582</td></tr>
<tr><td>Bleaching products for cleaning or laundry</td><td>322</td><td>308.8</td><td>+ 4.3</td><td>.132</td></tr>
<tr><td>Drain cleaning products</td><td>59</td><td>68.5</td><td>−13.9</td><td>.035</td></tr>
<tr><td>Detergents laundry and dishwashing</td><td>278</td><td>281.1</td><td>−1.1</td><td>.720</td></tr>
<tr><td>Laundry detergents</td><td>66</td><td>76.7</td><td>−14.0</td><td>.024</td></tr>
<tr><td>- LLDC</td><td>35</td><td>46.1</td><td>−24.1</td><td>.002</td></tr>
<tr><td>Dishwashing detergents</td><td>127</td><td>119.1</td><td>+6.6</td><td>.138</td></tr>
<tr><td>-Disinfectants</td><td>265</td><td>246.0</td><td>+ 7.7</td><td>.007</td></tr>
</table>
Limitations: Data is taken retrospectively from a reporting record base. The interventions, doses, frequency of exposure were not reported. It is not specified what consequences the exposure had. No confounding factors were identified, or strategies indicated to address them that could affect the study findings.
</td><td>Serious</td></tr>
</tbody>
</table>

<table>
<tr><th>RIDs</th><th>Reference</th><th>Setting and time covered</th><th>Study characteristics</th><th>Summary of key findings in relation to the outcome</th><th>RoB</th></tr>
<tr><td></td><td></td><td></td><td>Key outcomes: variation in exposure frequencies to specific product categories during the COVID-19 pandemic lockdown</td><td></td><td></td></tr>
<tr><td>SARS-CoV-2

VOCs assessed: None</td><td>Rosenman et al., 2022 (30)

United States</td><td>Calls received reporting exposure to cleaners and disinfectants. Michigan Poison Center (MiPC)

From January 1 to April 30 in both 2019 and 2020.</td><td>Design: Cross-Sectional

Intervention: Exposure to cleaners and disinfectants. The chemical compound and frequency reported are not specified.

Sample: The sample consisted of data extracted from the MiPC ToxSentry system for calls concerning exposure to cleaners or disinfectants received from January 1 to April 30 in both 2019 (1505 calls), and 2020 (1805 calls).

Population: individuals across the entire state of Michigan who contacted the MiPC due to exposure concerns.

Funding: public

Key outcomes:
Number of Calls Related to Cleaners and Disinfectants
Reporting of symptoms from exposure</td><td>
<table>
<tr><td colspan="5">Calls to the Michigan Poison Control Center about exposure to cleaners or disinfectants, January 1–April 30, 2019, and January 1–April 30, 2020a</td></tr>
<tr><td></td><td colspan="2">2019</td><td colspan="2">2020</td></tr>
<tr><td>Variable</td><td>All calls</td><td>Calls with ≥1 symptom</td><td>All calls</td><td>Calls with ≥1 symptom</td></tr>
<tr><td colspan="5">Cleaners</td></tr>
<tr><td>Ingestion</td><td>707 (79.1)</td><td>196 (65.3)</td><td>642 (69.3)</td><td>170 (50.0)</td></tr>
<tr><td>Inhalation</td><td>34 (3.8)</td><td>19 (6.3)</td><td>54 (5.8)</td><td>33 (9.7)</td></tr>
<tr><td>Dermal</td><td>93 (10.4)</td><td>41 (13.7)</td><td>160 (17.3)</td><td>73 (21.5)</td></tr>
<tr><td>Ocular</td><td>60 (6.7)</td><td>44 (14.7)</td><td>71 (7.7)</td><td>64 (18.8)</td></tr>
<tr><td colspan="5">Disinfectants</td></tr>
<tr><td>Ingestion</td><td>383 (63.0)</td><td>100 (42.7)</td><td>422 (49.4)</td><td>121 (33.0)</td></tr>
<tr><td>Inhalation</td><td>82 (13.5)</td><td>48 (20.5)</td><td>177 (20.7)</td><td>103 (28.1)</td></tr>
<tr><td>Dermal</td><td>76 (12.5)</td><td>30 (12.8)</td><td>180 (21.1)</td><td>81 (22.1)</td></tr>
<tr><td>Ocular</td><td>67 (11.0)</td><td>56 (23.9)</td><td>76 (8.9)</td><td>62 (16.9)</td></tr>
</table>

An increase of approximately 50% was found from the first 4 months of 2019 to the same period in 2020. The reporting of exposures to disinfectants doubled from approximately 5 to 10 calls per day. The proportion of calls about cleaners among all calls received showed a non-significant increase from 5.1% to 5.4% (P = 0. 18). For disinfectants, the number of calls increased by 42.8% (from 608 to 868), with a significant increase in the proportion of calls about disinfectants among all calls, from 3.5% to 5.0% (P < 0.001).
From 2019 to 2020 in all age groups combined, calls for ingestion as the exposure route decreased from 72.6% to 59.7% (P <0 .001), calls increased for inhalation (from 7.7% to 13.0%; P < 0.001) and dermal exposures (from 11.3% to 19.1%; P < 0.001), and calls for ocular exposures were unchanged (from 8.5% to 8.2%; P = 0.76).
The number of daily calls doubled for disinfectants on March 13, 2 days after the first COVID-19 case in Michigan, from 4.8 (95% CI, 4.2–5.4) per day to 9.0 (95% CI, 7.2, 10.8) per day. The number of daily calls did not increase significantly for cleaners, from 8.0 (95% CI, 6.2–9.8) per day to 7.6 (95% CI, 6.8–8.4) per day.

</td><td>Serious</td></tr>
</table>

<table>
<tr><th>RIDs</th><th>Reference</th><th>Setting and time covered</th><th>Study characteristics</th><th>Summary of key findings in relation to the outcome</th><th>RoB</th></tr>
<tr><td></td><td></td><td></td><td></td><td>Limitations: The data is taken retrospectively from a database. The validity and reliability of the exposure measurement and the measured outcomes are not explicitly stated, leaving some uncertainty. No confounding factors were identified, or strategies indicated to address them that could affect the study findings.</td><td></td></tr>
<tr><td>SARS-CoV-2

VOCs assessed: None</td><td>Soave et al., 2021 (33)

Italy</td><td>Calls received reporting exposure to cleaners and disinfectants. Fondazione Universitario Policlinico Agostino Gemelli IRCCS, Rome, Italy.

January 30, 2020 to May 18, 2020</td><td>Design: Cross-Sectional
A retrospective analysis of exposure calls related to household disinfectants during the COVID-19 pandemic. Data from January 30 to May 18, 2020, were compared to those obtained during the same period in 2019 to evaluate whether the incidence of adverse reactions to household disinfectants varied significantly between these time periods.

Intervention: The operators classified all the household chemicals according to their antimicrobial properties (e.g., bleach, ethanol, hand sanitizers) as ‘household disinfectants’.

Sample: Calls received by the poison control center

Population: Italian citizens, hospitals, and general practitioners

Funding: Public (Fondi di Ateneo, Linead D1 - Università Cattolica del Sacro Cuore, Grant n. R4124500772)</td><td>The center received 1972 exposure calls during the study period. A 5% increase in calls regarding exposure to household disinfectants was noted from 2019 to 2020 (9.8% to 15.2%, $p<0.001$).
The majority of enquiries regarded bleach-containing products, hand sanitizers, ethanol, and hydrogen peroxide.
Most calls were received from patients in their homes (n, 259; prevalence, 86%; increase, 107%) and concerned accidental exposure (n, 280; prevalence, 93%; increase, 76%), while cases of intentional exposure decreased (n, 14; prevalence, 5%; decrease, 33%).
The main route of exposure was ingestion (n, 170; prevalence, 57%; increase, 45%), but the highest increase was observed in inhalation cases (n, 82; prevalence, 27%; increase, 122%).
<table>
<tr><td colspan="6">The frequency and increase of calls regarding household disinfectants, the type of enquirer, type of exposure, and route of exposure between 2019 and 2020.</td></tr>
<tr><td></td><th colspan="2">2019 (n = 182)</th><th colspan="2">2020 (n = 300)</th><td></td></tr>
<tr><td>Product</td><th>n</th><th>frequency (%)</th><th>n</th><th>frequency (%*)</th><th>Increase (%)</th></tr>
<tr><td>Bleach-containing products</td><td>58</td><td>-32%</td><td>121</td><td>-40%</td><td>108%</td></tr>
<tr><td>Hand sanitizers</td><td>22</td><td>-12%</td><td>50</td><td>-17%</td><td>127%</td></tr>
<tr><td>Ethylic Alcohol</td><td>14</td><td>-8%</td><td>21</td><td>-7%</td><td>50%</td></tr>
<tr><td>Hydrogen peroxide</td><td>11</td><td>-6%</td><td>17</td><td>-6%</td><td>55%</td></tr>
<tr><td>Other products</td><td>77</td><td>-42%</td><td>91</td><td>-30%</td><td>18%</td></tr>
</table></td><td>Critical</td></tr>
</table>

RIDs	Reference	Setting and time covered	Study characteristics	Summary of key findings in relation to the outcome	RoB
			Key outcomes: Number of exposure calls related to household disinfectants		
SARS-CoV-2 **VOCs assessed**: None	Koskoy Vayisoglu & Oncu, 2021 (31) Turkey	Online survey. Turkey 30 August 2020 to 15 September 2020	**Design**: Cross-Sectional An online survey was conducted among adults between 18 and 80 years old, affected by the COVID-19 pandemic. The perception of risks and the characteristics of use of cleaning products were investigated. **Intervention**: products used in domestic cleaning **Sample**: 674 participants between the ages of 18 and 80 years in Turkey **Population:** Adults aged between 18 and 80 years, affected by the COVID-19 pandemic **Funding:** public **Key outcomes**: Frequency of cleaning, amount of cleaning product usage, frequency of problems related to the use of cleaning products, skin disturbances, shortness of breath, factors affecting the use of cleaning products	• During the pandemic period compared with the pre-pandemic period, it was observed that the frequency of cleaning (69.3%) and the amount of cleaning product usage (74.2%) increased significantly, and the frequency of problems related to the use of cleaning products was found as 46.9%. • The most reported problems were skin disturbances (68%) and shortness of breath (23%). It was determined that the history of contact with the COVID-19 patient, the perceived risk of COVID-19 infection and risky cleaning behaviour were predictive in determining the risk of experiencing problems related to cleaning products. The amount of bleach consumed per month among who did experience problems was higher than those who did not experience problems and was associated with the perceived risk of COVID-19 infection. • Use of natural cleaning alternatives like vinegar increased, but the improper use of bleach and mixing of different cleaning products were common practices that potentially led to health risks. • Limitations: The data is taken retrospectively from a database. The characteristics of the population were not described, nor were sociodemographic aspects. The validity and reliability of the exposure measurement and the measured outcomes are not explicitly stated, leaving some uncertainty. No confounding factors were identified, or strategies indicated to address them that could affect the study findings.	Serious
SARS-CoV-2	Raffee et al., 2021 (32) Jordan	Calls received reporting exposure to cleaners and disinfectants	**Design**: Cross-Sectional (Comparison of prevalence of two periods)	• During the COVID-19 lockdown, there was a 91% increase in calls related to toxic exposures compared to the previous year. The sources of calls shifted during the lockdown, with calls from CDD (911) increasing by 170%, calls from the general public by 68%, and calls from healthcare workers by 14%.	Serious

<table>
<tr><th>RIDs</th><th>Reference</th><th>Setting and time covered</th><th>Study characteristics</th><th>Summary of key findings in relation to the outcome</th><th>RoB</th></tr>
<tr>
<td>VOCs assessed: None</td>
<td></td>
<td>Pharmacy One Poison Center in Jordan.

COVID-19 lockdown period in Jordan from 21 March 2020 to 21 May 2020, compared with the same period from the previous year (21 March 2019 to 21 May 2019)</td>
<td>Intervention: COVID-19 lockdown on poison exposure calls.
Household cleaners: products containing ammonia, hydrochloric acid, sodium hypochlorite or alkaline cleaning products, drain and oven cleaners, etc.).
Alcohol: ethanol-based cleaning solutions, hand sanitizers or pure ethanol as spray (not for intake).

Sample: Call data sourced from Pharmacy One Poison Center

Population: Jordanian population

Funding: public

Key outcomes: Incidence and patterns of toxic exposures and poisoning</td>
<td>

The lockdown period saw a change in the severity of poison exposure cases. There was an increase in cases resolved with no or minor effects by 673% and 140%, respectively. Conversely, cases with moderate or severe effects decreased by 31% and 24%, respectively. The total number of admissions increased by 260%, with a notable rise in admissions for children aged 0 to 5 years by 329%.
There was a notable increase in ocular exposure by 550%. Household cleaner exposure increased among males, and alcohol exposure increased in females. Children aged below 5 years were the most affected group.
The ocular route of exposure recorded the sharpest increase, possibly due to accidental spraying or touching the eyes after hand or face sanitation.

<table>
<tr><td colspan="4">Incidence and patterns of toxic exposures and poisoning among Jordanian population during COVID-19 lockdown and 2019 (March–May)</td></tr>
<tr><td></td><td>2019</td><td>COVID-19 lockdown</td><td></td></tr>
<tr><td></td><td>Number of cases</td><td>Number of cases</td><td>% of Δ</td></tr>
<tr><td>Total number of cases</td><td>285</td><td>544</td><td>91</td></tr>
<tr><td colspan="4">Class of exposure</td></tr>
<tr><td>Household cleaners</td><td>32 (11%)</td><td>83 (15%)</td><td>159</td></tr>
<tr><td>Alcohol</td><td>12 (4%)</td><td>37 (7%)</td><td>208</td></tr>
</table>

Limitations: Reliance on self-reported data and the possibility of underreporting or misclassification of exposures due to the retrospective nature of the study could affect the accuracy of the findings. Additionally, limitations of the study include the inability to access data from other poison centers and reliance on caller information for management recommendations, which could introduce bias or inaccuracies into the data collected. No analysis adjustments are made for confounding variables.

</td>
<td></td>
</tr>
</table>

Table 4: Summary of studies reporting on effectiveness of cleaning and disinfecting in deactivating/ eliminating SARS-CoV 2 on surfaces assessed in In vitro studies. (n=14)

Last updated LES 18.1

Reference	Date released	Setting and funding	Study characteristics	Summary of key findings in relation to the outcome	RoB
Anderson et al., 2021 (37)	26 Apr 2021	Liverpool, UK; Public	**Design**: In vitro experiment **Intervention**: Disinfecting with 100µl of Virusend™[1] 30 s or 9.5min compared with Autoclaved water. **Population:** SARS-CoV-2 isolate (REMRQ0001/Human/2020/Liverpool) from a clinical sample cultured in Vero E6 cells maintained in DMEM with 4% FBS and 0.05 mg ml^{-1} gentamicin at 37 °C and 5 % CO2, using either 9.8 log_{10} or 7.9 log_{10} p.f.u. ml^{-1} of SARS-CoV-2. **Surface:** SS discs. **Key outcomes**: Log_{10} reduction in infectious SARS-CoV-2 titer achieved. **VOCs assessed**: None	• Virusend™ 100 µl reduced the virus titre by at least 4.0 log_{10} p.f.u. ml^{-1} with high titre inoculum and by at least 2.3 log_{10} p.f.u. ml^{-1} with low titre inoculum on hard surfaces after 1 or 10 minutes of contact time. • Virusend™ 100 µl reduced SARS-CoV-2 titres to below the limit of detection (3.0 log_{10} p.f.u. ml^{-1}) for both high (7.3 log_{10} p.f.u. ml^{-1} recovered for control) and low titre inoculum (5.3 log_{10} p.f.u. ml^{-1} for control) 1 minute after the intervention. • Virusend™ 100 µl reduced SARS-CoV-2 titres to below the limit of detection (3.0 log_{10} p.f.u. ml^{-1}) for both high (7.0 log_{10} p.f.u. ml^{-1} recovered for control) and low titre inoculum (5.9 log_{10} p.f.u. ml^{-1} for control) 10 minutes after the intervention.	Probably Low
Ijaz et al., 2020 (44)	August 2020	United States; Not reported	**Design**: In vitro experiment **Intervention**: Surface cleanser[2] 0.096% w/w **Population:** SARS-CoV-2 dried on a glass surface with a 5% FBS organic load **Surface:** Glass surface **Key outcomes**: Log_{10} reduction in infectious SARS-CoV-2 titer achieved. **VOCs assessed**: None	• Surface cleanser reduced the virus titre by ≥4.1 log_{10} after 5 minutes of contact time.	Probably High

Reference	Date released	Setting and funding	Study characteristics	Summary of key findings in relation to the outcome	RoB
Jahromi et al., 2020 (38)	26 Aug 2020	Public; Iran	**Design**: In vitro experiment **Intervention**: **S1:** Ethanol/WSH 70/30 **S2:** Isopropanol/WSH 70/30 **S3:** Ethanol/isopropanol/WSH 35/35/30 **S4:** Ethanol/isopropanol/WSH/glycerin 35/35/27/3 **S5:** SDBS/ethanol/WSH 3/70/27 **S6:** SDBS/ethanol/WSH/glycerin 3/70/24/3 **S7:** SLS/isopropanol/WSH 3/70/27 **S8:** Isopropanol/hand soap[3]//WSH 70/3/27 **S9:** Dish soap[4]/ethanol/WSH 3/70/27 **S10:** Ethanol/isopropanol/dish soap/WSH/glycerin 35/35/3/24/3 **S11:** Dish soap/WSH 3/97 **S12:** Hand soap/WSH 3/97 Isopropanol (>99%), glycerin (>95%), SDBS (>95%), SLS (>95%) and WSH **Population:** SARS-CoV-2 coronavirus obtained from Molecular Epidemiology Laboratory at Shiraz University of Medical Science, Iran. The coronavirus suspension was prepared by infecting monolayers of A549 cell (human lung epithelial carcinoma cells) lines. The virus titers of these suspensions ranged from 105 to 1010 $TCID_{50}$/ml. **Surface:** PVC material with PUR surface coating **Key outcomes**: Log_{10} reduction in infectious SARS-CoV-2 titer achieved. **VOCs assessed**: None	• S2 compared with S1 showed a slightly higher (~7%) reduction factor than ethanol solution, after 1 minute of contact time. • S3 compared with S1 and S2 did not exhibit RF. The virucidal efficiency of S3 was ~13% greater than the expected value (average of S1 and S2), after 1 minute of contact time. • The addition of 3% glycerin (S4) did not influence the RF significantly (6.0) compared to S3 (6.2), after 1 minute of contact time. • S5 compared to S1 increased the virucidal activity by ~21%, after 1 minute of contact time. • S6 compared to S5 increased the RF value from 6.4 to 6.6, after 1 minute of contact time. • S7 compared to S2 exhibited increased ~19% in virucidal properties, after 1 minute of contact time. • S8 compared to S7 increased RF by ~15%. Among tested fluids, recipe S8 demonstrated the greatest virucidal efficiency (RF = 7.8), after 1 minute of contact time. • S9 compared to S5 increased RF by ~16%, after 1 minute of contact time. • S10 compared to S4 increased RF by ~27% from 6 to 7.6, after 1 minute of contact time. • S11 and S12 compared to WSH slightly increased the RF value, the changes were negligible when compared with WSH, after 1 minute of contact time.	Probably Low
Jung et al., 2023 (46)	12 Aug 2022	Korea; Public	**Design**: In vitro experiment **Intervention**:	• Ethanol 50% and 70% achieved complete reduction (No viruses detected) in kraft paper, SS, and glass, after 1 minute of contact time.	Probably High

Reference	Date released	Setting and funding	Study characteristics	Summary of key findings in relation to the outcome	RoB
			Disinfecting with ethanol (Ethyl alcohol) at 50% and 70% concentrations for 1 min and 5 min compared with 0% concentration. Disinfecting with sodium hypochlorite at 500 ppm and 1000 ppm concentrations for 1 min and 5 min compared with 0% concentration. Wiping test to verify the WHO interim guidelines: A sterile cotton swab moistened with 70% EtOH, 500 or 1000 ppm NaClO was used to wipe the virus-contaminated hard surface 1–3 times, until the dry stains disappeared. **Population:** Confluent Vero E6 (ATCC CL-1586) cells inoculated with two types of SARS-CoV-2 (L type, KOR/KCDC03-NCCP43326/ 2020, accession number: MW466791.1; S type, KOR/KCDC12-NCCP43330/2020, accession number: MW466795.1) at 0.1 multiplicities of infection (MOI) in DMEM with 2% FBS, grown in DMEM (Gibco, NY, USA) with 10% FBS and 1% antibiotics antimycotics (Gibco).These cells were then cultured at 37°C with 5% CO_2 in a humidified incubator. **Surface:** Kraft paper, parchment paper, and low-density polyethylene (LDPE) were purchased from an online market. Each surface was made into a carrier with a diameter of 8 mm using a punch. SS, glass, and polypropylene (PP) were processed to a thickness of 1 mm and a diameter of 1 cm. **Key outcomes**: Log_{10} reduction in infectious SARS-CoV-2 titer achieved. **VOCs assessed**: None	• Ethanol 50% and 70% achieved complete reduction (No viruses detected) in kraft paper, SS, glass, and parchment paper after 5 minutes of contact time. • Ethanol 70% achieved complete reduction (No viruses detected) in LPDE, after 5 minutes of contact time. • Ethanol 50% reduced SARS-CoV-2 L by 2.98 ± 0.13, and SARS-CoV-2 S reduced by 2.85 ± 0.08 log $TCID_{50}$/mL, in parchment paper after 1 minute of contact time. • Ethanol 70% reduced SARS-CoV-2 L by 3.08 ± 0.06, and SARS-CoV-2 S reduced by 3.10 ± 0.03 log $TCID_{50}$/mL in parchment paper after 1 minute of contact time. • Ethanol 50% reduced SARS-CoV-2 L by 2.96 ± 0.32, and SARS-CoV-2 S were reduced by 3.50 ± 0.18 log $TCID_{50}$/mL in LPDE after 5 minutes of contact time. • Sodium hypochlorite 1000 ppm achieved complete reduction (No viruses detected) in SS, after 1 minute of contact time. • Sodium hypochlorite 1000 ppm achieved complete reduction (No viruses detected) in parchment paper, glass, SS, PP, and kraft after 5 minutes of contact time. • Sodium hypochlorite 500 ppm achieved complete reduction (No viruses detected) in PP, and kraft after 5 minutes of contact time. • Sodium hypochlorite 1000 ppm achieved >3 log in parchment paper, glass, PP after 1 minute of contact time. • Sodium hypochlorite 500 ppm achieved >3 log in glass, after 5 minutes of contact time. • Sodium hypochlorite 1000 ppm reduced SARS-CoV-2 L by 2.21 log, and SARS-CoV-2 S were by 3.06 log $TCID_{50}$/mL in LPDE after 1 minute of contact time ($p < 0.001$). • Sodium hypochlorite 1000 ppm reduced SARS-CoV-2 L band SARS-CoV-2 S to trace amounts (0.55 $TCID_{50}$/mL for S and L types) in LPDE after 5 minutes of contact time. • EtOH 70% was effective in the quantitative carrier test after 1 minute intervention. For complete reduction, surfaces were exposed for at least 5 min after intervention (SS, glass, and PP).	

Reference	Date released	Setting and funding	Study characteristics	Summary of key findings in relation to the outcome	RoB
				• NaClO 1000 ppm was effective in the quantitative carrier test after 1 minute intervention. For complete reduction, surfaces were exposed for at least 5 min after intervention 1000 ppm, whereas 500 ppm NaClO required 10 min (SS, glass, and PP).	
Welch et al., 2021 (47)	12 Aug 2020	Iowa, United States; Public	**Design**: In vitro experiment **Intervention**: Single application (by wipe) allowed to dry (<5 minutes) of: ● Bleach (10 %; 0.6 % hypochlorite) ● Isopropanol (isopropyl alcohol - IPA 70%) ● Commercial quaternary ammonium[5] ● Hydrogen peroxide 3% Compared to control wipe: Phosphate-buffered saline **Population:** SARS CoV-2 (Seattle Washington strain MN985325) provided by Dr Stanley Perlman, University of Iowa). VeroE6 were provided by Dr Stanley Perlman. Cells were maintained in media. Virus titers were determined by median tissue culture infectious dose ($TCID_{50}$) **Surface:** 3D printed material using Multi-Jet Fusion (MJF) technology and a powder-based polyamide-12 (PA12) material (HP 3D HR CB PA 12 - Hewlett-Packard, Palo Alto, CA), (used for VHA supplemental surgical face mask). **Key outcomes**: Log_{10} reduction in infectious SARS-CoV-2 titer achieved. **VOCs assessed**: None	• Single application of bleach reduced SARS-CoV-2 titer in >5.5 log in 3D printed material after 5 minutes of the intervention. No infectivity remained P < 0.001. • Single application of IPA reduced SARS-CoV-2 titer in 1.4 log in 3D printed material after 5 minutes of the intervention. No infectivity remained. • Single application of quaternary ammonium reduced SARS-CoV-2 titer in >5.5 log in 3D printed material after 5 minutes of the intervention. No infectivity remained P < 0.001. • Single application of hydrogen peroxide 3% achieved SARS-CoV-2 complete inactivation P < 0.0001.	Probably Low
Criscuolo et al., 2021 (35)	30 Dec 2020	Italy; Public	**Design**: In vitro experiment **Intervention**:	• Gaseous Ozone 0.2 ppm application reduced SARS-CoV-2 titer in >99.9% in fleece, 96.8% in gauze, 93.3% in wood, 90% in glass and 82.2% in plastic, after 2 hours of the intervention.	Probably Low

Reference	Date released	Setting and funding	Study characteristics	Summary of key findings in relation to the outcome	RoB
			Single application of gaseous ozone 0.2 ppm or 4 ppm using Ozonext Defender 10™ (Cea S.p.A., Lecco, Italy) adapted inside a system composed of a plexiglass chamber. Time exposure 30, 60, 90, and 120 min Compared to untreated controls **Population:** hCoV-19/Italy/UniSR1/2020 (GISAID accession ID: EPI_ISL_413489) isolated and propagated in Vero E6 cells. **Surface:** Six types of materials of common use: glass (13 mm round glass coverslips), plastic (cap of 0.2 mL PCR tube), gauze (sterile gauze pad), wood (sterile wood tongue depressor), fleece, and wool (both sterilized by bleaching). **Key outcomes**: Infectious titer reduction rate $1–1/10^{\log10 (N0/Nt)} \times 100$ (%). **VOCs assessed**: None	• Gaseous Ozone 4 ppm application reduced SARS-CoV-2 titer in 0 % in fleece, 68.4 % in gauze, 93.3 % in wood, 0 % in glass and 90 % in plastic, after 30 minutes of the intervention. • Gaseous Ozone 4 ppm application reduced SARS-CoV-2 titer in 96.8 % in fleece, 99.2 % in gauze, 93.3 % in wood, 93.2 % in glass and 68.4 % in plastic, after one hour of the intervention. • Gaseous Ozone 4 ppm application reduced SARS-CoV-2 titer in 99.7 % in fleece, 99.8 % in gauze, 0 % in wood, 94.4 % in glass and 90% in plastic, after two hours of the intervention.	
Caschera et al., 2021 (39)	28 Oct 2021	Canada; Industry	**Design**: In vitro experiment **Intervention**: • Quaternary ammonium (SiQAC-18 product 0.5 w/v % active in water) applied by a commercial sprayer until thoroughly wetted: For samples of the Doherty Institute, the product was applied using an air brush sprayer, distance of 20 cm, at a 45° angle, 50 mL application volume per carrier, and for the Rega Institute via an electrostatic sprayer, distance of 2 feet, 10 seconds spray time, 50 mL application volume. Discs were pretreated for Rega Institute at KU Leuven (S1) at 46 days and the Doherty Institute at the University of Melbourne (S2, S3) 47 days. Compared to untreated controls	• Pretreated SS discs with spray application of SiQAC-18 product 0.5 w/v% active in water reduced SARS-CoV-2 titer in 102.93 after 10 minutes of exposure for the GHB-03021 isolate. No infectivity remained $P < 0.0014$. • Pretreated SS discs with spray application of SiQAC-18 product 0.5 w/v% active in water reduced SARS-CoV-2 titer in 103.38 after 10 minutes of exposure for the VIC01 isolate. No infectivity remained $P < 0.0001$. • Pretreated SS discs with spray application of SiQAC-18 product 0.5 w/v% active in water degraded SARS-CoV-2 genome in with >107 less intact E gene after 10 minutes of exposure for the VIC01 isolate.	Probably Low

Reference	Date released	Setting and funding	Study characteristics	Summary of key findings in relation to the outcome	RoB
			Population: 50 mL viral suspension of SARS-CoV-2 patient isolates cultured by the Doherty Institute (Victoria, Australia) and Rega Institute. At the Doherty Institute, isolate hCoV-19/Australia/VIC01/2020 (VIC01), at the Rega Institute SARS-CoV-2 isolate hCoV19/Belgium/GHB-03021/2020 (GHB-03021). **Surface:** SS (2 cm, 2B finish) disks, donated by Pegan Industries. **Key outcomes**: viral reduction, qRT-PCR test **VOCs assessed**: None		
Hardison et al., 2022 (40)	15 dec 2022	United States; Public	**Design**: In vitro experiment **Intervention**: Single application using spray (no touch with contact time) and spray & wipe (wipe immediately post-application) methods immediately and 2 h post-contamination of: • C360™ (67619-38)[6] from The Clorox Company 2 min contact time. • Bleach™ solution (67619-32)[7] from The Clorox Company 10 min contact • Peroxide multisurface cleaner™ (1677-238) [8] from EcoLab 30 s contact • Vital Oxide™ (82972-1)[9] from Vital Solutions 5 min contact Compared to hard water. **Population:** SARS-CoV-2 (USAWA1/2020, BEI Resources, Manassas, VA) propagated in Vero E6 cells (American Type Culture Collection, Manassas, VA). **Surface:** Bus seat fabric SF (American Seating, Grand Rapids, MI), SS (0.03-cm-thick fatigue resistant 301; hardness rating of C40 on Rockwell Scale; meeting	• Single application of C360™ by spray method reduced SARS-CoV-2 titer on all materials at T0 of the intervention compared to hard water. (SS, P = 0.0002; SF, P = 0.0009; SBR, P = 0.0117; paint, P = 0.0003). • Single application of C360™ by spray method reduced SARS-CoV-2 titer on SS, SBR and paint at T2 of the intervention compared to hard water. (SS, P = 0.018; SBR, P = ≤ 0.0001; paint, P = ≥ 0.0001). No difference between hard water and C360™ was observed on SF. • No difference between C360™ and hard water by Spray & Wipe method was observed on SS, SF, SRB and paint at T0. • Single application of C360™ by Spray & Wipe method reduced SARS-CoV-2 titer on SF at T2 of the intervention compared to hard water. (SF, P = 0.0051). No difference between hard water and C360™ was observed on SS, SBR, or paint. • Single application of CDC bleach™ by spray method reduced SARS-CoV-2 titer on all materials but SF at T0 of the intervention compared to hard water. (SS, P = ≤ 0.0001; SBR, P = ≤ 0.0001; paint, P = 0.0252). • Single application of CDC bleach™ by spray method reduced SARS-CoV-2 titer on SS, and paint at T2 of the intervention compared to hard water. (SS, P = 0.0029; paint, P = 0.0075).	Probably Low

Reference	Date released	Setting and funding	Study characteristics	Summary of key findings in relation to the outcome	RoB
			ASTM A666 specifications, McMaster-Carr, Aurora, OH), and styrene–butadiene rubber SBR (0.16 cm thick, McMaster-Carr). Painted drywall tape (paint) (Lowe's Home Improvement, Columbus, Ohio) was painted (Latex Eggshell Ultra White Tintable Interior Paint, Lowe's Home Improvement, Columbus, OH). Materials were cut [3 inch × 0.75 inch (7.7 cm × 1.9 cm)] and cleaned by wiping with a cloth dampened with 70% by volume isopropanol (SBR) or by soaking in a Liqui-Nox (Alconox, White Plains, NY) solution (1:100 at pH 8.5) and rinsing with distilled water (SS). SF and paint coupons were used without cleaning. Coupons were packaged in polyethylene tubing and sterilized via Electron Beam (40kGy dose; E-BEAM Services, Inc., Lebanon, OH). **Key outcomes**: Log_{10} reduction in infectious SARS-CoV-2 titer achieved. **VOCs assessed**: None	No difference was observed between hard water and CDC bleach on SF and SRB at T2. • Single application of CDC bleach™ by Spray & Wipe method reduced SARS-CoV-2 titer on paint at T2 of the intervention compared to hard water. (P = 0.0458). No difference was observed between hard water and CDC bleach™ on SS, SF and SRB at T2. • Single application of peroxide™ by spray method reduced SARS-CoV-2 titer on SS at T0 of the intervention compared to hard water. (P = 0.0002). No difference between hard water and peroxide was observed on SF. • Single application of peroxide™ by spray method reduced SARS-CoV-2 titer on SS at T2 of the intervention compared to hard water. (P = 0.0007). No difference between hard water and peroxide was observed on SF. • No significant differences in efficacy were observed between peroxide™ and hard water for the Spray & Wipe method. • Single application of VO™ by spray method reduced SARS-CoV-2 titer on all materials at T0 of the intervention compared to hard water. (SS, P = ≤ 0.0001; SF, P = ≤ 0.0001). • Single application of VO™ by spray method reduced SARS-CoV-2 titer on SS at T2 of the intervention compared to hard water. (SS, P = 0.0022). No difference between hard water and VO was observed on SF. • Single application of VO™ by Spray & Wipe method reduced SARS-CoV-2 titer on SS at T0 of the intervention compared to hard water. (SS, P = 0.0143). No difference between hard water and VO™ was observed on SF. • Single application of VO™ by Spray & Wipe method reduced SARS-CoV-2 titer on SS at T2 of the intervention compared to hard water. (SS, P = 0.0143). No difference between hard water and VO™ was observed on SF.	
Ijaz et al., 2021 (43)	11 Mar 2021	United States; Industry	**Design**: In vitro experiment	• Single application of QAC disinfectant wipes reduced SARS-CoV-2 titer in ≥3.5,≥3.5,≥3.5 log in glass Petri dish after 1.75 minutes of the intervention.	Probably High

Reference	Date released	Setting and funding	Study characteristics	Summary of key findings in relation to the outcome	RoB
			Intervention: 2.0 mL of the test microbicide were added onto the dried viral film by direct pipetting or spray such that the dried virus film was completely covered by the test microbicide: ● QAC disinfectant wipes[10] 1.75 min contact ● Citric acid disinfectant wipes [11] 0.5 min contact ● Ethanol/ QAC disinfectant spray[12] 1.75 min contact ● QAC RTU cleaner[13] 2 min contact Compared to initial viral loads **Population:** Aliquot of 0.4 mL of SARS-CoV-2 Isolate USA-WA1/2020, obtained from CDC, through BEI Resources, Cultured in Vero E6, medium: MEM + 5% FBS plus soil load **Surface:** pre-sterilized 10-cm glass Petri dish **Key outcomes**: Log_{10} reduction in infectious SARS-CoV-2 titer achieved. **VOCs assessed**: None	• Single application of citric acid disinfectant wipes reduced SARS-CoV-2 titer in ≥3.0,≥3.0,≥3.0 log in glass Petri dish after 0.5 minutes of the intervention. • Single application of ethanol/ QAC disinfectant spray reduced SARS-CoV-2 titer in ≥4.6,≥4.7,≥4.5 Log in glass Petri dish after 1.75 minutes of the intervention. • Single application of QAC RTU cleaner reduced SARS-CoV-2 titer in ≥4.0,≥4.0,≥4.0 log in glass Petri dish after 2 minutes of the intervention.	
Ijaz et al., 2022 (41)	28 Mar 2022	United states; Industry	**Design**: In vitro experiment **Intervention**: 2.0 mL of the test microbicide were added onto the dried viral film by direct pipetting or spray such that the dried virus film was completely covered by the test microbicide: ● Quaternary ammonium[14] 5 min contact Compared to Initial viral loads **Population:** Aliquot of 0.4 mL of SARS-CoV-2 Isolate USA-WA1/2020, obtained from CDC, through BEI Resources, Cultured in Vero E6, medium: MEM + 5% FBS plus soil load **Surface:** pre-sterilized 10-cm glass Petri dish	• Single application of Quaternary ammonium reduced SARS-CoV-2 titer in ≥3.0,≥3.0,≥3.0 log in glass Petri dish after 5 minutes of the intervention.	Probably High

Reference	Date released	Setting and funding	Study characteristics	Summary of key findings in relation to the outcome	RoB
			Key outcomes: Log_{10} reduction in infectious SARS-CoV-2 titer achieved. **VOCs assessed**: None		
Rutala et al., 2022 (48)	02 Dec 2021	United States; Public and Industry	**Design**: In vitro experiment **Intervention**: The method simulates dry and wet wiping by incorporating "wear" of the test surface as well as reinoculations of the test and control surfaces over a period of at least 24 hours following product application: ● Firebird F130™ (Microban Products, Huntersville, NC) marketed as Sani-24™ by Professional Disposable International (Woodcliff Lake, NJ) 3 sprays, 15.25–20.3 cm from the surface), and allowed to dry overnight. Compared to Sterile water **Population:** ≥5-log_{10} of virus per carrier, treated with the novel disinfectant (3 sprays, 15.25–20.3 cm from the surface), and allowed to dry overnight. **Surface:** Glass surfaces (2.5 cm × 2.5 cm). The carriers were abraded using a standardized abrasion machine (Gardco Model D10V™, Paul N. Gardner Co, Pompano Beach, FL) under multiple alternating dry and wet wiping conditions **Key outcomes**: Log_{10} reduction in infectious SARS-CoV-2 titer achieved with the continuously acting disinfectant. **VOCs assessed**: None	• Application of Sani-24™ reduced SARS-CoV-2 titer in ≥4.22 log in glass surfaces after 48 hours of the intervention. (Mean Viral Recovery per Carrier: Control 5.72; • Continuously acting disinfectant ≤1.50)	Probably High
Sousa et al., 2022 (42)	02 Jun 2022	Portugal; Industry	**Design**: In vitro experiment **Intervention**: PMMA-H_2O_2 MCs[15] were dispersed into an aqueous solution of the textile binder BAYPRET NANO-PU™. The resultant suspension was then loaded	• Application of PMMA-H2O2 MCs reduced SARS-CoV-2 DNA in nonwoven fabric samples by 62.27% after 10 minutes of the intervention; by 75% after 30 minutes of the intervention and by 97.26% after one hour of the intervention.	Probably Low

Reference	Date released	Setting and funding	Study characteristics	Summary of key findings in relation to the outcome	RoB
			onto nonwoven fabric samples, covering the entire substrate area and dried for 4 h at 40 °C. Nonwoven fabric samples were prepared with PMMA-H_2O_2 MCs of three different concentrations, 12.5, 25, and 50 mg/cm. Compared to nonfabric substrates, without functionalization with PMMA or PMMA-H2O2 **Population:** 60 µL of SARS-CoV-2 samples derived from excess swab samples diagnosed through RT-qPCR as SARS-CoV-2 positive at the diagnostic laboratory from ICVS, University of Minho. Samples were diluted to contain approximately 1000–3000 viral copies per mL considering the quantification cycle (Cq) of the RT-qPCR assay in relation to the commercial standard reference. **Surface:** Nonwoven fabric samples (1 cm × 1 cm): laundry such as clothing, towels and linens. **Key outcomes**: SARS-CoV-2 RT-PCR **VOCs assessed**: None		
Tizaoui et al., 2022 (45)	15 Apr 2022	United Kingdom; Public and Industry	**Design**: In vitro experiment **Intervention**: Gaseous ozone inside a reactor made of a 3 L plastic box fitted with a fan, a gas sampling port, a manual humidifier, a temperature and humidity probe, and an ozone supply canister. The ozone canister was prepared by adsorbing ozone on silica gel and stored in a freezer at − 18 °C. Compared to air **Population:** England2 strain of SARS-CoV2 provided by Public Health England. The virus was passaged at a low multiplicity of infection of 0.01 in VeroE6 cells in DMEM. The initial virus concentration was typically between 1×10^7 and 4×10^7 PFU/mL.	• Application of ozone gas (CT = 0.5 g.min/m3) only reduced SARS-CoV-2 titer in 23% on polystyrene plastic well after 3 minutes of the intervention ($p = 0.033$, ~ 0.12 log_{10} reduction). • Application of ozone gas (CT = 1.0 g.min/m3) only reduced SARS-CoV-2 titer in 30% on polystyrene plastic well after 5 minutes of the intervention ($p = 0.022$). • Application of ozone gas (CT = 4.7 g.min/m3) reduced SARS-CoV-2 titer in 55% on polystyrene plastic well after 20 minutes of the intervention ($p = 0.015$). • Application of ozone gas (CT = ~5.0 g.min/m3) increasing relative humidity (RH) to ~70 reduced SARS-CoV-2 titer in 95% on polystyrene plastic well after 1 hour of the intervention ($p = 0.0097$). • Application of ozone gas (CT = ~15.0 g.min/m3) RH ~70 reduced SARS-CoV-2 titer in 99% on polystyrene plastic well after 1 hour of the intervention ($p = 0.01$).	Probably High

Reference	Date released	Setting and funding	Study characteristics	Summary of key findings in relation to the outcome	RoB
			Surface: Polystyrene plastic well, rigid nonporous (copper, SS, and glass) and porous (coupons of ambulance seat and ambulance floor) surfaces. Approximately 1.5 cm × 1.5 cm. **Key outcomes**: Log_{10} reduction in infectious SARS-CoV-2 titer **VOCs assessed**: None	• Application of ozone gas (CT = ~15.0 g.min/m3) at RH 81%, reduced SARS-CoV-2 titer in 99% on both glass and steel after 1 hour of the intervention ($p = < 0.05$). With copper, ambulance seat and ambulance floor, no viable virus could be recovered after treatment, even from the control sample.	
Urushidani et al., 2022 (36)	07 Apr 2022	Japan; Public and Industry	**Design**: In vitro experiment **Intervention**: Initial dry fogging for 5 seconds left to stand for 4 minutes. Dry fogging was then repeated 3 more times for 2.5 seconds each and left to stand for 4 minutes after each fogging. Dry fogging was performed 4 times, namely, 0, 4, 8, and 12 minutes after the initiation of the experiment, and the total experimental period was 16 minutes: ● Commercially available, weakly acidic (pH 6.5) hypochlorous acid solution with a free available chlorine concentration (the sum of HOCl and OCl- concentrations) of 250, and 8,700 ppm ● Commercially available hydrogen peroxide solution diluted by distilled water with hydrogen peroxide concentrations of 56,400 ppm. Compared to distilled water **Population:** Viral solutions (5 µL) containing SARS-CoV-2 (1.2×10^5 $TCID_{50}$) **Surface:** Plastic plates placed into a test chamber **Key outcomes**: Log_{10} reduction in infectious SARS-CoV-2 titer **VOCs assessed**: None	• Dry fogging of hypochlorous solution (free available chlorine concentration 250) did not reduce SARS-CoV-2 titer on plastic plates after 16 minutes of the intervention. • Dry fogging of 8,700 ppm hypochlorous solution reduced SARS-CoV-2 titer on plastic plates after 16 minutes of the intervention compared to distilled water ($P < 0.0001$). • Dry fogging of 56,400 ppm hydrogen peroxide solution reduced SARS-CoV-2 titer on plastic plates after 16 minutes of the intervention compared to distilled water ($P < 0.0001$).	Probably Low

[1]TX-10: Virusend™ was developed by Pritchard Spray Technologies, Colchester, UK
[2]0.077% w/w Alkyl dimethyl benzyl ammonium chloride (C12-16) QAC (tested at 1:1.25 of supplied)
[3]Hand soap active ingredient: sodium C12-13 parethsulfate, cocamidopropyl betaine, sodium laureth sulfate, sodium benzoate, sodium salicylate, tetrasodium EDTA, PEG-18 glyceryl oleate, citric acid

[4]Dish soap active ingredient: C10-16 alkyldimethyl amine oxide, sodium laureth sulfate, methylisothiazolinone, PEG-24 copolymer, sodium laureth sulfate, sodium dodecylbenzenesulfonate, sodium hydroxide, sodium chloride.
[5]Sani-Cloth germicidal disposable wipe AF3; n-Alkyl [68% C12, 32% C14] dimethyl ethyl benzyl ammonium chlorides – 0.14%; n-Alkyl [60% C14, 30% C12, 5% C18] dimethyl benzyl ammonium chlorides – 0.14%
[6] Neat 1%–5% Tetrasodium EDTA (CAS 13235-36-4); 0.1%–1% quaternary ammonium compounds, C12-18-alkyl[(ethyl phenyl)methyl]dimethyl (CAS 68956-79-6); 0.1%–1% quaternary ammonium compounds, C12-14-alkyl[(ethyl phenyl)methyl]dimethyl, chlorides (CAS 85409-23-0)
[7]1/3 cup bleach in 1 gallon of hard water 5%–10% Sodium hypochlorite (CAS 7681-52-9)
[8]4 oz per gallon hard water 0.39% Hydrogen peroxide (CAS 7722-84-1)
[9] Neat 0.200% Oxychlorine compounds; 0.125% n-alkyl dimethyl benzyl ammonium chloride (CAS 68391-01-5); 0.125% n-alkyl dimethyl ethyl benzyl ammonium chloride (CAS 85409-23-0)
[10] QAC Alkyl (50% C14, 40% C12, 10% C16) dimethyl benzyl ammonium chloride. (0.19% w/w)
[11] Citric acid (2.4% w/w)
[12] Ethanol (50% w/w)/ QAC Alkyl (50% C14, 40% C12, 10% C16) dimethyl benzyl ammonium saccharinate. (0.082% w/w)
[13] QAC Alkyl (67% C12, 25% C14, 7% C16, 1% C8-C10-C18) dimethyl benzyl ammonium chloride; Alkyl (50% C14, 40% C12, 10% C16) dimethyl benzyl ammonium chloride. (0.092% w/w)
[14] BTC 8358+Bardac 2080 (0.08%) 1:28 of product in 400 ppm AOAC
[15] Polymethyl methacrylate (PMMA) microcapsules developed with an active agent (hydrogen peroxide) encapsulated. PMMA with a weight average (M_w) of 550,000 g/mol (based on GPC analysis) and poly(vinyl alcohol) (PVA, 98–99%) were purchased from Alfa Aesar (Massachusetts, EUA). Hydrogen peroxide (30 wt %) in a water solution was purchased from Scharlab (Barcelona, Spain). The BAYPRET NANO-PU solution (TANATEX Chemicals) was used as the subtract binder.

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.

References

1. Respiratory Infections | CDC Yellow Book 2024 [Internet]. [citado 26 de marzo de 2024]. Disponible en: https://wwwnc.cdc.gov/travel/yellowbook/2024/posttravel-evaluation/respiratory-infections
2. CDC. Centers for Disease Control and Prevention. 2023 [citado 26 de marzo de 2024]. About Flu. Disponible en: https://www.cdc.gov/flu/about/index.html
3. For Healthcare Professionals: RSV (Respiratory Syncytial Virus) | CDC [Internet]. [citado 26 de marzo de 2024]. Disponible en: https://www.cdc.gov/rsv/clinical/index.html
4. Streptococcal Toxic Shock Syndrome: For Clinicians | CDC [Internet]. 2023 [citado 26 de marzo de 2024]. Disponible en: https://www.cdc.gov/groupastrep/diseases-hcp/Streptococcal-Toxic-Shock-Syndrome.html
5. ECDC. Guidelines for the implementation of non-pharmaceutical interventions against COVID-19 [Internet]. 2020 sep. Disponible en: https://www.ecdc.europa.eu/sites/default/files/documents/covid-19-guidelines-non-pharmaceutical-interventions-september-2020.pdf
6. EPA. List N Tool: COVID-19 Disinfectants [Internet]. [citado 21 de abril de 2023]. Disponible en: https://cfpub.epa.gov/wizards/disinfectants/
7. Dotson GS, Lotter JT, Zisook RE, Gaffney SH, Maier A, Colvin J. Setting occupational exposure limits for antimicrobial agents: A case study based on a quaternary ammonium compound-based disinfectant. Toxicol Ind Health. 1 de septiembre de 2020;36(9):619-33.
8. Wang Y, Tian H, Zhang L, Zhang M, Guo D, Wu W, et al. Reduction of secondary transmission of SARS-CoV-2 in households by face mask use, disinfection and social distancing: a cohort study in Beijing, China. BMJ Glob Health. mayo de 2020;5(5):e002794.
9. Krutikov M, Stirrup O, Fuller C, Adams N, Azmi B, Irwin-Singer A, et al. Built Environment and SARS-CoV-2 Transmission in Long-Term Care Facilities: Cross-Sectional Survey and Data Linkage. J Am Med Dir Assoc. febrero de 2024;25(2):304-313.e11.
10. Youssef D, Issa O, Kanso M, Youssef J, Abou-Abbas L, Abboud E. Practice of non-pharmaceutical interventions against COVID-19 and reduction of the risk of influenza-like illness: a cross-sectional population-based study. J Pharm Policy Pract. 30 de agosto de 2022;15(1):54.
11. Rodríguez-Barranco M, Rivas-García L, Quiles JL, Redondo-Sánchez D, Aranda-Ramírez P, Llopis-González J, et al. The spread of SARS-CoV-2 in Spain: Hygiene habits, sociodemographic

profile, mobility patterns and comorbidities. Environ Res. 1 de enero de 2021;192:110223.
12. Fasanmi OG, Ahmed SSU, Oladele-Bukola MO, El-Tahawy AS, Elbestawy AR, Fasina FO. An evaluation of biosecurity compliance levels and assessment of associated risk factors for highly pathogenic avian influenza H5N1 infection of live-bird-markets, Nigeria and Egypt. Acta Trop. diciembre de 2016;164:321-8.
13. Francis NA, Becque T, Willcox M, Hay AD, Lown M, Clarke R, et al. Non-pharmaceutical interventions and risk of COVID-19 infection: survey of U.K. public from November 2020 - May 2021. BMC Public Health. 24 de febrero de 2023;23(1):389.
14. Liu Y, Chai YH, Wu YF, Zhang YW, Wang L, Yang L, et al. Risk factors associated with indoor transmission during home quarantine of COVID-19 patients. Front Public Health. 2023;11:1170085.
15. Telford CT, Bystrom C, Fox T, Holland DP, Wiggins-Benn S, Mandani A, et al. COVID-19 Infection Prevention and Control Adherence in Long-Term Care Facilities, Atlanta, Georgia. J Am Geriatr Soc. marzo de 2021;69(3):581-6.
16. Chaudhry M, Ahmad M, Rashid HB, Sultan B, Chaudhry HR, Riaz A, et al. Prospective study of avian influenza H9 infection in commercial poultry farms of Punjab Province and Islamabad Capital Territory, Pakistan. Trop Anim Health Prod. enero de 2017;49(1):213-20.
17. D'Accolti M, Soffritti I, Bini F, Mazziga E, Cason C, Comar M, et al. Shaping the subway microbiome through probiotic-based sanitation during the COVID-19 emergency: a pre-post case-control study. Microbiome. 30 de marzo de 2023;11(1):64.
18. Chung H, Choi K, Kim S, Kim S, Lee K, Choe N. Physical and Biological Performance Evaluation of Disinfection Systems for Transportation Vehicles against AI Virus. J Microbiol Biotechnol. 28 de julio de 2021;31(7):956-66.
19. Garber L, Bjork K, Patyk K, Rawdon T, Antognoli M, Delgado A, et al. Factors Associated with Highly Pathogenic Avian Influenza H5N2 Infection on Table-Egg Layer Farms in the Midwestern United States, 2015. Avian Dis. junio de 2016;60(2):460-6.
20. Islam A, Rahman MZ, Hassan MM, Epstein JH, Klaassen M. Determinants for the presence of avian influenza virus in live bird markets in Bangladesh: Towards an easy fix of a looming one health issue. One Health. 1 de diciembre de 2023;17:100643.
21. Islam A, Islam S, Islam M, Hossain ME, Munro S, Samad MA, et al. Prevalence and risk factors for avian influenza virus (H5 and H9) contamination in peri-urban and rural live bird markets in Bangladesh. Front Public Health. 2023;11:1148994.
22. Chowdhury S, Azziz-Baumgartner E, Kile JC, Hoque MA, Rahman MZ, Hossain ME, et al. Association of Biosecurity and Hygiene Practices with Environmental Contamination with Influenza A Viruses in Live Bird Markets, Bangladesh. Emerg Infect Dis. septiembre de 2020;26(9):2087-96.
23. Biswas PK, Giasuddin M, Nath BK, Islam MZ, Debnath NC, Yamage M. Biosecurity and Circulation of Influenza A (H5N1) Virus in Live-Bird Markets in Bangladesh, 2012. Transbound Emerg Dis. junio de 2017;64(3):883-91.
24. Huneau-Salaün A, Scoizec A, Thomas R, Martenot C, Schmitz A, Pierre I, et al. Avian influenza outbreaks: evaluating the efficacy of cleaning and disinfection of vehicles and transport crates. Poult Sci. enero de 2022;101(1):101569.
25. LaBelle MW, Knapik DM, Arbogast JW, Zhou S, Bowersock L, Parker A, et al. Infection Risk Reduction Program on Pathogens in High School and Collegiate Athletic Training Rooms. Sports Health. 2020;12(1):51-7.
26. Huneau-Salaün A, Scoizec A, Thomas R, Le Bouquin S. Cleaning and disinfection of crates and trucks used for duck transport: field observations during the H5N8 avian influenza outbreaks in

France in 2017. Poult Sci. junio de 2020;99(6):2931-6.
27. Plessis CE du, Mohamed F, Stephen CR, Reuter H, Voigt G, Hoving DJ van, et al. A retrospective review of calls to the Poisons Information Helpline of the Western Cape during the first 6 months of the COVID-19 pandemic in South Africa. South Afr J Infect Dis [Internet]. 2022 [citado 21 de marzo de 2024];37(1). Disponible en: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8990510/
28. Giordano F, Petrolini VM, Spagnolo D, Fidente RM, Lanciotti L, Baldassarri L, et al. Significant variations of dangerous exposures during COVID-19 pandemic in Italy: a possible association with the containment measures implemented to reduce the virus transmission. BMC Public Health. 5 de marzo de 2022;22(1):441.
29. Hashemi F, Hoepner L, Hamidinejad FS, Haluza D, Afrashteh S, Abbasi A, et al. A comprehensive health effects assessment of the use of sanitizers and disinfectants during COVID-19 pandemic: a global survey. Environ Sci Pollut Res Int. junio de 2023;30(28):72368-88.
30. Rosenman KD, Reilly MJ, Wang L. Calls to a State Poison Center Concerning Cleaners and Disinfectants From the Onset of the COVID-19 Pandemic Through April 2020. Public Health Rep Wash DC 1974. 2021;136(1):27-31.
31. Koksoy Vayisoglu S, Oncu E. The use of cleaning products and its relationship with the increasing health risks during the COVID-19 pandemic. Int J Clin Pract. octubre de 2021;75(10):e14534.
32. Raffee L, Daradkeh HM, Alawneh K, Al-Fwadleh AI, Darweesh M, Hammad NH, et al. Impact of COVID-19 lockdown on the incidence and patterns of toxic exposures and poisoning in Jordan: a retrospective descriptive study. BMJ Open. 9 de diciembre de 2021;11(12):e053028.
33. Soave PM, Grassi S, Oliva A, Romanò B, Di Stasio E, Dominici L, et al. Household disinfectant exposure during the COVID-19 pandemic: a retrospective study of the data from an Italian poison control center. Eur Rev Med Pharmacol Sci. febrero de 2021;25(3):1738-42.
34. Chauhan MZ, Ali AA, Healy J, Elhusseiny AM, Phillips PH, Sallam AB, et al. The impact of the COVID-19 pandemic on ocular trauma in American infants and toddlers. J Am Assoc Pediatr Ophthalmol Strabismus. 6 de marzo de 2024;103864.
35. Criscuolo E, Diotti RA, Ferrarese R, Alippi C, Viscardi G, Signorelli C, et al. Fast inactivation of SARS-CoV-2 by UV-C and ozone exposure on different materials. Emerg Microbes Infect. 1 de enero de 2021;10(1):206-9.
36. Urushidani M, Kawayoshi A, Kotaki T, Saeki K, Mori Y, Kameoka M. Inactivation of SARS-CoV-2 and influenza A virus by dry fogging hypochlorous acid solution and hydrogen peroxide solution. PLOS ONE. 7 de abril de 2022;17(4):e0261802.
37. Anderson ER, Hughes GL, Patterson EI. Inactivation of SARS-CoV-2 on surfaces and in solution with Virusend (TX-10), a novel disinfectant. Access Microbiol. 2021;3(4):000228.
38. Jahromi R, Mogharab V, Jahromi H, Avazpour A. Synergistic effects of anionic surfactants on coronavirus (SARS-CoV-2) virucidal efficiency of sanitizing fluids to fight COVID-19. Food Chem Toxicol Int J Publ Br Ind Biol Res Assoc. noviembre de 2020;145:111702.
39. Caschera AG, McAuley J, Kim Y, Purcell D, Rymenants J, Foucher DA. Evaluation of virucidal activity of residual quaternary ammonium-treated surfaces on SARS-CoV-2. Am J Infect Control. 1 de marzo de 2022;50(3):325-9.
40. Hardison RL, Nelson SW, Limmer R, Marx J, Taylor BM, James RR, et al. Efficacy of chemical disinfectants against SARS-CoV-2 on high-touch surface materials. J Appl Microbiol. 1 de enero de 2023;134(1):lxac020.
41. Khalid Ijaz M, Nims RW, McKinney J, Gerba CP. Virucidal efficacy of laundry sanitizers

against SARS-CoV-2 and other coronaviruses and influenza viruses. Sci Rep. 28 de marzo de 2022;12(1):5247.
42. Sousa VI, Parente JF, Marques JF, Calçada C, Veiga MI, Osório NS, et al. PMMA Microcapsules for the Inactivation of SARS-CoV-2. ACS Omega. 5 de julio de 2022;7(26):22383-93.
43. Ijaz MK, Nims RW, Zhou SS, Whitehead K, Srinivasan V, Kapes T, et al. Microbicidal actives with virucidal efficacy against SARS-CoV-2 and other beta- and alpha-coronaviruses and implications for future emerging coronaviruses and other enveloped viruses. Sci Rep. 11 de marzo de 2021;11(1):5626.
44. Ijaz MK, Whitehead K, Srinivasan V, McKinney J, Rubino JR, Ripley M, et al. Microbicidal actives with virucidal efficacy against SARS-CoV-2. Am J Infect Control. agosto de 2020;48(8):972-3.
45. Tizaoui C, Stanton R, Statkute E, Rubina A, Lester-Card E, Lewis A, et al. Ozone for SARS-CoV-2 inactivation on surfaces and in liquid cell culture media. J Hazard Mater. 15 de abril de 2022;428:128251.
46. Jung S, Kim DH, Ahn HS, Go HJ, Wang Z, Yeo D, et al. Stability and inactivation of SARS-CoV-2 on food contact surfaces. Food Control. 1 de enero de 2023;143:109306.
47. Welch JL, Xiang J, Mackin SR, Perlman S, Thorne P, O'Shaughnessy P, et al. Inactivation of Severe Acute Respiratory Coronavirus Virus 2 (SARS-CoV-2) and Diverse RNA and DNA Viruses on Three-Dimensionally Printed Surgical Mask Materials. Infect Control Hosp Epidemiol. :1-8.
48. Rutala WA, Ikner LA, Donskey CJ, Weber DJ, Gerba CP. Continuously active disinfectant inactivates severe acute respiratory coronavirus virus 2 (SARS-CoV-2) and human coronavirus 229E two days after the disinfectant was applied and following wear exposures. Infect Control Hosp Epidemiol. marzo de 2023;44(3):507-9.

Appendices

Appendix 1: Detailed search strategy

Last updated 03 Feb 2024

Databases searched:

- PubMed https://pubmed.ncbi.nlm.nih.gov/
- CINAHL
- Science Direct

PubMed Search:	
#1	(("coronavirus infections"[MeSH Terms] OR "COVID-19"[MeSH Terms] OR "SARS-CoV-2"[MeSH Terms] OR "Severe Acute Respiratory Distress Syndrome"[Title/Abstract] OR "SARS"[Title/Abstract] OR "MERS"[Title/Abstract] OR "sars cov"[Title/Abstract] OR "COVID-19"[Title/Abstract] OR "coronavirus disease"[Title/Abstract] OR "novel coronavirus"[Title/Abstract] OR "novel 2019 coronavirus"[Title/Abstract] OR "nCoV"[Title/Abstract] OR "2019nCoV"[Title/Abstract] OR "19nCoV"[Title/Abstract] OR "coronavirus*"[Title/Abstract])
#2	("disinfection"[MeSH Terms] OR "disinfectants"[MeSH Terms] OR "disinfect*"[Title/Abstract] OR "biocid*"[Title/Abstract] OR "clean*"[Title/Abstract] OR "decontaminat*"[Title/Abstract] OR "fomites"[MeSH Terms] OR "household work"[MeSH Terms] OR "housekeeping, hospital"[MeSH Terms] OR "hygiene behaviour"[Title/Abstract] OR "hygiene practices"[Title/Abstract] OR "detergents"[MeSH Terms] OR "detergent*"[Title/Abstract] OR "built environment"[Title/Abstract] OR "dispersion"[Title] OR "waste"[Title] OR (("inactivat*"[Title] OR "virucidal"[Title] OR "disinfect*"[Title] OR "biocides"[Title] OR "detect*"[Title] OR "antiviral*"[Title]) AND ("surface*"[Title/Abstract] OR "material*"[Title/Abstract] OR "ll*"[Title] OR "coating*"[Title]))))
#3	("clinical trial"[Publication Type] OR "trial"[Title] OR "randomized controlled trial"[Publication Type] OR "stud*"[Title] OR "cohort"[Title/Abstract] OR "case-control"[Title/Abstract] OR "casecontrol"[Title/Abstract] OR "cross-sectional"[Title/Abstract] OR "crosssectional"[Title/Abstract] OR "comparative study"[Publication Type] OR "Controlled Clinical Trial"[Publication Type] OR "quasiexperimental"[Title/Abstract] OR "quasi-experimental"[Title] OR "comparative study"[Title/Abstract] OR "modeling"[Title/Abstract] OR "simulation"[Title/Abstract] OR "observational study"[Publication Type] OR "observational"[Title/Abstract] OR "randomized"[Title/Abstract] OR "controlled"[Title/Abstract])
#4	**2020**/01/01:**2024**/12/31[Date - Publication]
#5	#1 AND #2 AND #3 AND #4
#6	("pneumovirus infections"[MeSH Terms] OR "pneumovirus infect*"[Title/Abstract] OR "bronchiolitis, viral"[MeSH Terms] OR "Viral Bronchiolitis"[Title/Abstract] OR "respiratory syncytial viruses"[MeSH Terms] OR "respiratory syncytial virus*"[Title/Abstract] OR "Chimpanzee Coryza"[Title/Abstract] OR "Orthopneumovirus"[Title/Abstract] OR "paramyxovirid*"[Title/Abstract] OR "Orthomyxoviridae"[MeSH Terms] OR "orthomyxovir*"[Title/Abstract] OR "Influenza"[Title/Abstract] OR "myxoviruses"[Title/Abstract] OR "influenza, human"[MeSH Terms] OR "influenza in birds"[MeSH Terms] OR "Avian Flu"[Title/Abstract] OR "avian influenza"[Title/Abstract] OR "swine flu"[Title/Abstract] OR "pneumovirus infections"[MeSH Terms] OR "pneumovirus infect*"[Title/Abstract] OR "bronchiolitis, viral"[MeSH Terms] OR "Viral Bronchiolitis"[Title/Abstract] OR "respiratory syncytial viruses"[MeSH Terms] OR "respiratory syncytial virus*"[Title/Abstract] OR "Chimpanzee Coryza"[Title/Abstract] OR "Orthopneumovirus"[Title/Abstract] OR "paramyxovirid*"[Title/Abstract] OR "Orthomyxoviridae"[MeSH

	Terms] OR "orthomyxovir*"[Title/Abstract] OR "Influenza"[Title/Abstract] OR "myxoviruses"[Title/Abstract] OR "influenza, human"[MeSH Terms] OR "influenza in birds"[MeSH Terms] OR "Avian Flu"[Title/Abstract] OR "avian influenza"[Title/Abstract] OR "swine flu"[Title/Abstract] OR "Streptococcal Infections"[MeSH Terms] OR "streptococcus pyogenes"[MeSH Terms] OR "streptococcus pyogenes"[Title/Abstract] OR "Streptococcus Group A"[Title/Abstract] OR "flesh eating bacteria"[Title/Abstract])
#7	("disinfection"[MeSH Terms] OR "disinfectants"[MeSH Terms] OR "disinfect*"[Title/Abstract] OR "biocid*"[Title/Abstract] OR "clean*"[Title/Abstract] OR "decontaminat*"[Title/Abstract] OR "fomites"[MeSH Terms] OR "household work"[MeSH Terms] OR "housekeeping, hospital"[MeSH Terms] OR "detergents"[MeSH Terms] OR "detergent*"[Title/Abstract] OR (("inactivat*"[Title] OR "virucidal"[Title])
#8	("anti infective agents"[MeSH Terms] OR "inactivat*"[Title] OR "virucidal"[Title]) AND ("surface"[Title/Abstract] OR "material*"[Title/Abstract])))
#9	2016/01/01:2024/12/31[Date - Publication]
#10	#6 AND #7 AND #8 AND #9

LES 18.1

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	Suspension test[All Fields] OR In-vitro[All fields] OR "In vitro"[All fields] OR cyanovirin N [Supplementary Concept] OR In Vitro Techniques[MeSH] OR cells, cultured[MeSH]
#10	#4 or 5 or #6 or #7 or #8 or #9
#11	#3 and #10
#12	#11 NOT (Animals[Mesh] NOT (Animals[Mesh] AND Humans[Mesh]))

Additional PubMed Search:	
#1	"SARS-CoV-2"[Title] AND ("inactivat*"[Title] OR "virucidal"[Title]) AND ("anti infective agents"[MeSH Terms] OR "inactivat*"[Title] OR "virucidal"[Title]) AND ("surface"[Title/Abstract] OR "material*"[Title/Abstract])

Appendix 2: Studies excluded at the last stages of reviewing.

Excluded studies during full text assessment		
Author, year	**Reason for exclusion**	**Version of exclusion**
Abbasi,2022	Wrong Outcome	*Excluded in LES 18.2*
Abdullah,2021	Wrong Intervention	*Excluded in LES 18.2*
Abdullahi, 2020	Wrong Study Design	*Excluded in LES 18.1*
Abdullahi, 2020	Wring study design	*Excluded in LES 18.2*
Abney,2020	Wrong Study Design	*Excluded in LES 18.2*
Abney, 2021	Wrong Study Design	*Excluded in LES 18.1*
Abraham,2022	Wrong population	*Excluded in LES 18.2*
Abuzerr,2021	Wrong Outcome	*Excluded in LES 18.2*
Aghajanzadeh, 2022	Wrong Outcome	*Excluded in LES 18.1*
Ainsworth, 2021	Wrong Outcome	*Excluded in LES 18.1*
Ainsworth,2021	Wrong Intervention	*Excluded in LES 18.2*
Alahdal, 2021	Wrong Study Design	*Excluded in LES 18.2*
Al-Ansari, 2021	Wrong Intervention	*Excluded in LES 18.1*
Al-Gheethi, 2020	Wrong Study Design	*Excluded in LES 18.1*
Al-Harbi,2023	Wrong Intervention	*Excluded in LES 18.2*
Al-Khatib, 2023	Not available	*Excluded in LES 18.2*
Almeida, 2022	Wrong Setting	*Excluded in LES 18.1*
Al Momani,2019	Wrong Intervention	*Excluded in LES 18.2*
Alvis-Chirinos,2022	Wrong Intervention	*Excluded in LES 18.2*
Alwadany,2023	Wrong Intervention	*Excluded in LES 18.2*
Alwan ,2023	Wrong Intervention	*Excluded in LES 18.2*
Alondra,2023	Foreign language	*Excluded in LES 18.2*
Anan, 2021	Wrong Intervention	*Excluded in LES 18.1*
Anan,2021	Wrong Intervention	*Excluded in LES 18.2*
Anand, 2022	Wrong Study Design	*Excluded in LES 18.1*
Anderson,2016	Wrong Setting	*Excluded in LES 18.2*
Anderson, 2020	Wrong Outcome	*Excluded in LES 18.1*
Andreu, 2021	Wrong Population	*Excluded in LES 18.1*
Andrianou,2022	Wrong Outcome	*Excluded in LES 18.2*
Ansari, 2021	Wrong Study Design	*Excluded in LES 18.1*
Ardura, 2021	Wrong Outcome	*Excluded in LES 18.1*
Areekal,2022	Wrong Intervention	*Excluded in LES 18.2*
Arefi, 2020	Wrong Study Design	*Excluded in LES 18.1*
Arefi,2020	Wrong Study Design	*Excluded in LES 18.2*
Armitage,2022	Wrong Outcome	*Excluded in LES 18.2*
Armoh, 2023	Wrong Intervention	*Excluded in LES 18.2*
Asamoah,2020	Wrong Study Design	*Excluded in LES 18.2*
Asfaw,2022	Wrong Intervention	*Excluded in LES 18.2*
Aydogdu, 2021	Wrong Study Design	*Excluded in LES 18.1*

Excluded studies during full text assessment		
Author, year	**Reason for exclusion**	**Version of exclusion**
Abbasi,2022	Wrong Outcome	*Excluded in LES 18.2*
Abdullah,2021	Wrong Intervention	*Excluded in LES 18.2*
Ayenigbara,2020	Wrong Study Design	*Excluded in LES 18.2*
Azeem,2021	Wrong Study Design	*Excluded in LES 18.2*
Azelee, 2020	Wrong Study Design	*Excluded in LES 18.1*
Badri, 2021	Wrong Outcome	*Excluded in LES 18.1*
Bakkar, 2021	Wrong Setting	*Excluded in LES 18.1*
Bandou,2022	Wrong Setting	*Excluded in LES 18.2*
Bao,2023	Not available	*Excluded in LES 18.2*
Baratta,2021	Wrong Setting	*Excluded in LES 18.2*
Barbato, 2022	Wrong Population	*Excluded in LES 18.1*
Barbato,2022	Wrong Study Design	*Excluded in LES 18.2*
Barlow, 2021	Wrong Publication Type	*Excluded in LES 18.2*
Basu,2020	Wrong Intervention	*Excluded in LES 18.2*
Basu, 2021	Wrong Outcome	*Excluded in LES 18.1*
Bayarri, 2021	Wrong Outcome	*Excluded in LES 18.1*
Bayarri,2021	Wrong Study Design	*Excluded in LES 18.2*
Bazaid, 2020	Wrong Intervention	*Excluded in LES 18.1*
Bazaid,2020	Wrong Intervention	*Excluded in LES 18.2*
Bedrosian, 2021	Wrong Study Design	*Excluded in LES 18.1*
Bell, 2021	Wrong Setting	*Excluded in LES 18.1*
Bell,2021	Wrong Setting	*Excluded in LES 18.2*
Benedusi, 2022	Wrong Population	*Excluded in LES 18.1*
Berg, 2021	Wrong Setting	*Excluded in LES 18.1*
Bergman, 2021	Wrong Study Design	*Excluded in LES 18.1*
Bhattacharya, 2023	Wrong Study Design	*Excluded in LES 18.2*
Bhavanam, 2022	Wrong Setting	*Excluded in LES 18.1*
Bhutta, 2021	Wrong Study Design	*Excluded in LES 18.1*
Biddau,2022	Wrong Outcome	*Excluded in LES 18.2*
Bidra, 2020	Wrong Setting	*Excluded in LES 18.1*
Bin, 2019	Wrong Intervention	*Excluded in LES 18.2*
Biswal, 2020	Wrong Publication Type	*Excluded in LES 18.2*
Blacksell,2023	Wrong Study Design	*Excluded in LES 18.2*
Blanco,2021	Wrong Study Design	*Excluded in LES 18.2*
Block, 2020	Wrong Study Design	*Excluded in LES 18.2*
Bono, 2021	Wrong Study Design	*Excluded in LES 18.1*
Brandley, 2020	Wrong Publication Type	*Excluded in LES 18.2*
Brault, 2022	Wrong Population	*Excluded in LES 18.1*
Bregnocchi, 2022	Wrong Study Design	*Excluded in LES 18.1*
Brilli,2023	Wrong Intervention	*Excluded in LES 18.2*
Bueckert, 2020	Wrong Outcome	*Excluded in LES 18.1*
Buklaha, 2022	Wrong Study Design	*Excluded in LES 18.1*
Buonavoglia, 2022	Wrong Setting	*Excluded in LES 18.1*

Excluded studies during full text assessment		
Author, year	**Reason for exclusion**	**Version of exclusion**
Abbasi,2022	Wrong Outcome	*Excluded in LES 18.2*
Abdullah,2021	Wrong Intervention	*Excluded in LES 18.2*
Buteau, 2020	Wrong Publication Type	*Excluded in LES 18.2*
Butot,2021	Wrong intervention	*Excluded in LES 18.2*
Butot, 2021	Wrong Outcome	*Excluded in LES 18.1*
Caccavale,2023	Wrong Population	*Excluded in LES 18.2*
Cai, 2022	Wrong Study Design	*Excluded in LES 18.1*
Cai, 2023	Wrong Study Design	*Excluded in LES 18.1*
Cai, 2023	Wrong Study Design	*Excluded in LES 18.2*
Cajar, 2022	Wrong Outcome	*Excluded in LES 18.1*
Caschera, 2022	Wrong Setting	*Excluded in LES 18.2*
Castro, 2022	Wrong Population	*Excluded in LES 18.2*
Ceresa, 2021	Wrong Study Design	*Excluded in LES 18.1*
Ceylan,2020	Wrong Publication Type	*Excluded in LES 18.2*
Chabrelie,2017	Wrong Study Design	*Excluded in LES 18.2*
Chang, 2022	Wrong Outcome	*Excluded in LES 18.2*
Chauvin, 2020	Wrong Publication Type	*Excluded in LES 18.2*
Chauhan, 2023	Wrong Population	*Excluded in LES 18.2*
Chen,2018	Wrong Study Design	*Excluded in LES 18.2*
Chen, 2021	Wrong Study Design	*Excluded in LES 18.1*
Chen, 2022	Wrong Study Design	*Excluded in LES 18.1*
Chen, 2022	Wrong Population	*Excluded in LES 18.2*
Chen, 2021	Wrong Study Design	*Excluded in LES 18.2*
Chen, 2022	Wrong Study Design	*Excluded in LES 18.2*
Cheng,2022	Wrong Intervention	*Excluded in LES 18.2*
Chiappa, 2021	Wrong Outcome	*Excluded in LES 18.1*
Chiappa, 2021	Wrong Study Design	*Excluded in LES 18.2*
Chidambaram,2022	Wrong setting	*Excluded in LES 18.2*
Chirani, 2021	Wrong Study Design	*Excluded in LES 18.1*
Choi,2023	Wrong Study Design	*Excluded in LES 18.2*
Choi,2023	Wrong Intervention	*Excluded in LES 18.2*
Chojnacki, 2021	Wrong Setting	*Excluded in LES 18.1*
Cieślak, 2022	Wrong Setting	*Excluded in LES 18.2*
Cilhoroz,2021	Wrong Outcome	*Excluded in LES 18.2*
Cimolai, 2020	Wrong Study Design	*Excluded in LES 18.1*
Cimolai, 2022	Wrong Study Design	*Excluded in LES 18.1*
Ciuoderis-Aponte, 2022	Wrong Population	*Excluded in LES 18.2*
Claus, 2021	Wrong Study Design	*Excluded in LES 18.1*
Coffman,2021	Wrong Intervention	*Excluded in LES 18.2*
Collins, 2021	Wrong Population	*Excluded in LES 18.1*
Contreras,2019	Wrong Study Design	*Excluded in LES 18.2*
Cooper,2023	Wrong Study Design	*Excluded in LES 18.2*

LES 18.2: Effectiveness of Cleaning and Disinfecting for reducing transmission of RIDs in non-healthcare community-based settings.

Excluded studies during full text assessment		
Author, year	**Reason for exclusion**	**Version of exclusion**
Abbasi,2022	Wrong Outcome	*Excluded in LES 18.2*
Abdullah,2021	Wrong Intervention	*Excluded in LES 18.2*
Conzelmann, 2022	Wrong Intervention	*Excluded in LES 18.1*
Cordery,2022	Wrong Intervention	*Excluded in LES 18.2*
Cortes,2020	Wrong Study Design	*Excluded in LES 18.2*
Cortes, 2020	Wrong Outcome	*Excluded in LES 18.1*
Costa, 2022	Wrong Outcome	*Excluded in LES 18.1*
Cox,2016	Wrong Intervention	*Excluded in LES 18.2*
Cresswell, 2020	Wrong Study Design	*Excluded in LES 18.2*
Cui, 2021	Not available	*Excluded in LES 18.2*
Das,2020	Wrong Setting	*Excluded in LES 18.2*
Das, 2021	Wrong Outcome	*Excluded in LES 18.2*
DaSilva, 2021	Wrong Study Design	*Excluded in LES 18.2*
Dean, 2020	Wrong Publication Type	*Excluded in LES 18.2*
DeJoannon, 2021	Wrong Setting	*Excluded in LES 18.1*
Delabouglise,2020	Wrong Study Design	*Excluded in LES 18.2*
DelBrutto, 2021	Wrong Intervention	*Excluded in LES 18.1*
Del Brutto,2021	Wrong Setting	*Excluded in LES 18.2*
DeLeo, 2020	Wrong Study Design	*Excluded in LES 18.1*
Delikhoon, 2021	Wrong Outcome	*Excluded in LES 18.1*
Delpont,2021	Wrong Outcome	*Excluded in LES 18.2*
De Rose, 2020	Wrong Publication Type	*Excluded in LES 18.2*
DePasquale, 2021	Wrong Study Design	*Excluded in LES 18.2*
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*
Diamond, 2020	Wrong Publication Type	*Excluded in LES 18.2*
DiFiore, 2022	Wrong Setting	*Excluded in LES 18.1*
DiMaria, 2020	Wrong Study Design	*Excluded in LES 18.1*
Dickinson, 2022	Wrong Setting	*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*
Ding, 2023	Wrong Outcome	*Excluded in LES 18.1*
Doak, 2020	Wrong Publication Type	*Excluded in LES 18.2*
Dotson,2020	Wrong Study Design	*Excluded in LES 18.2*
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*
Duangjit, 2022	Wrong Setting	*Excluded in LES 18.1*
Durr,2016	Wrong Intervention	*Excluded in LES 18.2*
Ehsani,2023	Wrong intervention	*Excluded in LES 18.2*
Ehsani, 2023	Wrong Outcome	*Excluded in LES 18.1*

Excluded studies during full text assessment		
Author, year	**Reason for exclusion**	**Version of exclusion**
Abbasi,2022	Wrong Outcome	*Excluded in LES 18.2*
Abdullah,2021	Wrong Intervention	*Excluded in LES 18.2*
El Megharbel, 2021	Wrong Outcome	*Excluded in LES 18.1*
Elbadawy, 2021	Wrong Outcome	*Excluded in LES 18.1*
England, 2021	Wrong Intervention	*Excluded in LES 18.1*
England,2021	Wrong Outcome	*Excluded in LES 18.2*
Epelle, 2023	Wrong Study Design	*Excluded in LES 18.1*
Epelle, 2023	Wrong Study Design	*Excluded in LES 18.2*
Epelle,2023	Wrong Study Design	*Excluded in LES 18.2*
Escamilla, 2021	Wrong Study Design	*Excluded in LES 18.1*
Espinosa-Gómez, 2023	Wrong Population	*Excluded in LES 18.1*
Ezzatpanah, 2022	Wrong Study Design	*Excluded in LES 18.1*
Fachiroh, 2021	Wrong Intervention	*Excluded in LES 18.1*
Fantozzi, 2022	Wrong Population	*Excluded in LES 18.1*
Fantozzi,2022	Wrong Intervention	*Excluded in LES 18.2*
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*
Fatima,2021	Wrong Intervention	*Excluded in LES 18.2*
Ferrari, 2022	Wrong Setting	*Excluded in LES 18.1*
Filimonau,2022	Wrong Outcome	*Excluded in LES 18.2*
Filipe, 2021	Wrong Study Design	*Excluded in LES 18.1*
Fiore, 2021	Wrong Outcome	*Excluded in LES 18.1*
Fiore,2021	Wrong Population	*Excluded in LES 18.2*
Fiorini,2022	Wrong Setting	*Excluded in LES 18.2*
Foster,2020	Wrong Intervention	*Excluded in LES 18.2*
Fotsa-Mbogne, 2021	Wrong Study Design	*Excluded in LES 18.1*
Fotsa-Mbogne,2021	Wrong Intervention	*Excluded in LES 18.2*
Fournié,2016	Wrong Intervention	*Excluded in LES 18.2*
Foushee,2023	Wrong Setting	*Excluded in LES 18.2*
Frizziero, 2024	Wrong Study Design	*Excluded in LES 18.2*
Fu,2022	Wrong Outcome	*Excluded in LES 18.2*
Fuchsman,2022	Wrong Population	*Excluded in LES 18.2*
Gale,2020	Wrong Study Design	*Excluded in LES 18.2*
Gao, 2023	Wrong Population	*Excluded in LES 18.1*
Gao, 2022	Wrong Intervention	*Excluded in LES 18.2*
García-Ávila, 2020	Wrong Study Design	*Excluded in LES 18.2*
GarcíadeAbajo, 2020	Wrong Study Design	*Excluded in LES 18.1*
Gardezi, 2020	Wrong Study Design	*Excluded in LES 18.1*
Garrison,2023	Wrong Study Design	*Excluded in LES 18.2*
Ge,2022	Wrong Intervention	*Excluded in LES 18.2*
Gerlach, 2020	Wrong Publication Type	*Excluded in LES 18.2*
Gerlach, 2020	Wrong Publication Type	*Excluded in LES 18.2*

Excluded studies during full text assessment		
Author, year	**Reason for exclusion**	**Version of exclusion**
Abbasi,2022	Wrong Outcome	*Excluded in LES 18.2*
Abdullah,2021	Wrong Intervention	*Excluded in LES 18.2*
Ghai,2024	Wrong Outcome	*Excluded in LES 18.2*
Gharieb,2019	Wrong Intervention	*Excluded in LES 18.2*
Gharpure, 2020	Wrong Study Design	*Excluded in LES 18.1*
Gharpure,2020	Wrong Outcome	*Excluded in LES 18.2*
Ghoroghi, 2022	Wrong Study Design	*Excluded in LES 18.1*
Ghoroghi, 2022	Wrong Intervention	*Excluded in LES 18.2*
Ghosh,2020	Wrong Intervention	*Excluded in LES 18.2*
Ghosh, 2021	Wrong Outcome	*Excluded in LES 18.1*
Ginghin, 2021	Wrong Population	*Excluded in LES 18.1*
Gintrowicz ,2021	Wrong Study Design	*Excluded in LES 18.2*
Glass,2019	Wrong Study Design	*Excluded in LES 18.2*
Goh, 2021	Wrong Study Design	*Excluded in LES 18.2*
Gökçe, 2022	Wrong Study Design	*Excluded in LES 18.1*
Gökçe, 2024	Wrong Outcome	*Excluded in LES 18.2*
Gold, 2021	Wrong Outcome	*Excluded in LES 18.1*
Gold, 2021	Wrong Study Design	*Excluded in LES 18.2*
González,2020	Wrong Setting	*Excluded in LES 18.2*
Gopal, 2023	Wrong Study Design	*Excluded in LES 18.1*
Graça, 2022	Wrong Study Design	*Excluded in LES 18.1*
Gravatt, 2020	Not available	*Excluded in LES 18.2*
Graves,2023	Wrong Setting	*Excluded in LES 18.2*
Greenhalgh, 2021	Wrong Intervention	*Excluded in LES 18.1*
Groenewold,2019	Wrong Setting	*Excluded in LES 18.2*
Guillier,2020	Wrong Intervention	*Excluded in LES 18.2*
Giordano,2022	Wrong Outcome	*Excluded in LES 18.2*
Guo, 2023	Wrong Setting	*Excluded in LES 18.1*
Guo, 2023	Wrong Population	*Excluded in LES 18.2*
Guo, 2021	Wrong Setting	*Excluded in LES 18.2*
Gupta,2021	Wrong Study Design	*Excluded in LES 18.2*
Güner,2020	Wrong Study Design	*Excluded in LES 18.2*
Gurung, 2022	Retracted	*Excluded in LES 18.1*
Gwenzi, 2022	Wrong Study Design	*Excluded in LES 18.1*
Hageman,2020	Wrong Publication Type	*Excluded in LES 18.2*
Halperin, 2021	Wrong Study Design	*Excluded in LES 18.1*
Hamilton, 2022	Wrong Outcome	*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*
Harries,2020	Wrong Study Design	*Excluded in LES 18.2*
Hartevelt, 2022	Wrong Publication Type	*Excluded in LES 18.2*
Hassandarvish, 2020	Wrong Setting	*Excluded in LES 18.1*

Excluded studies during full text assessment		
Author, year	**Reason for exclusion**	**Version of exclusion**
Abbasi,2022	Wrong Outcome	*Excluded in LES 18.2*
Abdullah,2021	Wrong Intervention	*Excluded in LES 18.2*
Hasani, 2024	Wrong Outcome	*Excluded in LES 18.2*
Hata, 2021	Wrong Study Design	*Excluded in LES 18.1*
Hatanaka, 2021	Wrong Setting	*Excluded in LES 18.2*
Hauck, 2017	Wrong Setting	*Excluded in LES 18.2*
Henderson, 2022	Wrong Study Design	*Excluded in LES 18.1*
Henderson,2022	Wrong Intervention	*Excluded in LES 18.2*
Herbstman, 2023	Wrong Outcome	*Excluded in LES 18.2*
Hicks, 2022	Wrong Publication Type	*Excluded in LES 18.2*
Hirose, 2021	Wrong Setting	*Excluded in LES 18.1*
Hirose, 2021	Not available	*Excluded in LES 18.2*
Hoang, 2022	Wrong Study Design	*Excluded in LES 18.2*
Hora, 2020	Wrong Study Design	*Excluded in LES 18.1*
Horigan,2019	Wrong Publication Type	*Excluded in LES 18.2*
Horpiencharoen, 2019	Wrong Population	*Excluded in LES 18.2*
Hotton,2022	Wrong Intervention	*Excluded in LES 18.2*
Howard, 2020	Wrong Study Design	*Excluded in LES 18.1*
Hu, 2020	Wrong Intervention	*Excluded in LES 18.2*
Hu,2022	Not available	*Excluded in LES 18.2*
Huang,2016	Wrong Outcome	*Excluded in LES 18.2*
Huang, 2021	Wrong Setting	*Excluded in LES 18.2*
Huang, 2022	Wrong Setting	*Excluded in LES 18.2*
Huang,2023	Wrong Study Design	*Excluded in LES 18.2*
Iacono, 2024	Wrong Setting	*Excluded in LES 18.2*
Igrassia, 2020	Wrong Publication Type	*Excluded in LES 18.2*
Ijaz, 2022	Wrong Population	*Excluded in LES 18.1*
Imai,2021	Wrong Setting	*Excluded in LES 18.2*
Imai, 2021	Wrong Population	*Excluded in LES 18.1*
Islam,2020	Wrong Study Design	*Excluded in LES 18.2*
Jain,2021	Wrong Study Design	*Excluded in LES 18.2*
JameleddineChtioui, 2020	Wrong Language	*Excluded in LES 18.1*
Jana, 2023	Wrong Intervention	*Excluded in LES 18.1*
Janik, 2021	Wrong Study Design	*Excluded in LES 18.1*
Jansen,2021	Wrong Outcome	*Excluded in LES 18.2*
Jefri, 2022	Wrong Study Design	*Excluded in LES 18.1*
Jefri,2022	Wrong Study Design	*Excluded in LES 18.2*
Joseph, 2024	Wrong Outcome	*Excluded in LES 18.2*
Jung, 2023	Wrong Setting	*Excluded in LES 18.2*
Kammon,2017	Wrong Intervention	*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 Outcome	*Excluded in LES 18.1*

LES 18.2: Effectiveness of Cleaning and Disinfecting for reducing transmission of RIDs in non-healthcare community-based settings.

Excluded studies during full text assessment		
Author, year	**Reason for exclusion**	**Version of exclusion**
Abbasi,2022	Wrong Outcome	*Excluded in LES 18.2*
Abdullah,2021	Wrong Intervention	*Excluded in LES 18.2*
Kampf,2020	Wrong Study Design	*Excluded in LES 18.2*
Kampf, 2020	Wrong Publication Type	*Excluded in LES 18.2*
Kampf, 2020	Wrong Study Design	*Excluded in LES 18.2*
Kapoor, 2020	Wrong Publication Type	*Excluded in LES 18.2*
Kaushik, 2023	Wrong Study Design	*Excluded in LES 18.1*
Kaushik, 2023	Wrong Study Design	*Excluded in LES 18.2*
Kaya, 2022	Wrong Setting	*Excluded in LES 18.1*
Kaya,2022	Not available	*Excluded in LES 18.2*
Kchaou, 2020	Wrong Study Design	*Excluded in LES 18.1*
Kehoe, 2020	Wrong Publication Type	*Excluded in LES 18.2*
Kersh, 2021	Wrong Outcome	*Excluded in LES 18.1*
Kewat, 2022	Wrong Study Design	*Excluded in LES 18.1*
Khalil,2023	Wrong Setting	*Excluded in LES 18.2*
Khatib, 2020	Wrong Study Design	*Excluded in LES 18.1*
Khaw,2021	Wrong Intervention	*Excluded in LES 18.2*
Kim,2019	Wrong Outcome	*Excluded in LES 18.2*
Kim,2020	Wrong setting	*Excluded in LES 18.2*
Kirchner, 2021	Wrong Study Design	*Excluded in LES 18.2*
Kiremitler,2022	Wrong Study Design	*Excluded in LES 18.2*
Kivuti-Bitok, 2020	Wrong Study Design	*Excluded in LES 18.1*
Kivuti-Bitok,2020	Wrong Study Design	*Excluded in LES 18.2*
Klaus,2016	Wrong Publication Type	*Excluded in LES 18.2*
Kolanthai, 2022	Wrong Study Design	*Excluded in LES 18.1*
Komaikul, 2022	Wrong Setting	*Excluded in LES 18.1*
Kong,2023	Wrong Outcome	*Excluded in LES 18.2*
Kontos, 2023	Wrong Population	*Excluded in LES 18.1*
Kratzel, 2020	Wrong Setting	*Excluded in LES 18.2*
Krishnaratne,2022	Wrong Study Design	*Excluded in LES 18.2*
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*
Kumar, 2021	Wrong Outcome	*Excluded in LES 18.1*
Kumar, 2022	Wrong Study Design	*Excluded in LES 18.2*
Kunduru, 2022	Wrong Study Design	*Excluded in LES 18.1*
Kunduru,2022	Wrong Study Design	*Excluded in LES 18.2*
Kwok, 2021	Wrong Setting	*Excluded in LES 18.1*
Kwon, 2021	Wrong Study Design	*Excluded in LES 18.1*
Kwok,2021	Wrong Publication Type	*Excluded in LES 18.2*
Kwon,2021	Wrong Study Design	*Excluded in LES 18.2*
Lan,2020	Wrong Intervention	*Excluded in LES 18.2*
Lee,2020	Wrong Study Design	*Excluded in LES 18.2*

Excluded studies during full text assessment		
Author, year	**Reason for exclusion**	**Version of exclusion**
Abbasi,2022	Wrong Outcome	*Excluded in LES 18.2*
Abdullah,2021	Wrong Intervention	*Excluded in LES 18.2*
Lee, 2023	Wrong Setting	*Excluded in LES 18.2*
Lemecha,2020	Wrong Intervention	*Excluded in LES 18.2*
Lendvay, 2022	Wrong Setting	*Excluded in LES 18.1*
Lesho, 2022	Wrong Outcome	*Excluded in LES 18.1*
Li,2020	Wrong Outcome	*Excluded in LES 18.2*
Li, 2020	Wrong Study Design	*Excluded in LES 18.1*
Li,2021	Wrong Study Design	*Excluded in LES 18.2*
Li,2021	Wrong Study Design	*Excluded in LES 18.2*
Li, 2022	Wrong Outcome	*Excluded in LES 18.1*
Li, 2023	Wrong Setting	*Excluded in LES 18.2*
Liang,2020	Wrong Intervention	*Excluded in LES 18.2*
Liao, 2023	Wrong Study Design	*Excluded in LES 18.2*
Lin,2022	Wrong Publication Type	*Excluded in LES 18.2*
Lishchynskyi, 2022	Wrong Study Design	*Excluded in LES 18.1*
Lishchynskyi, 2022	Wrong Study Design	*Excluded in LES 18.2*
Liu,2016	Wrong Setting	*Excluded in LES 18.2*
Liu, 2022	Wrong Outcome	*Excluded in LES 18.1*
Liu, 2021	Wrong Study Design	*Excluded in LES 18.1*
Liu,2021	Wrong Intervention	*Excluded in LES 18.2*
Liu,2021	Wrong Outcome	*Excluded in LES 18.2*
Liu,2021	Wrong Outcome	*Excluded in LES 18.2*
Liu,2022	Wrong Intervention	*Excluded in LES 18.2*
Liu, 2021	Wrong Intervention	*Excluded in LES 18.2*
Lu, 2021	Wrong Study Design	*Excluded in LES 18.1*
Lopez,2022	Wrong Setting	*Excluded in LES 18.2*
Luo, 2020	Wrong Outcome	*Excluded in LES 18.1*
Madan,2021	Wrong Outcome	*Excluded in LES 18.2*
Mahanta, 2022	Wrong Setting	*Excluded in LES 18.2*
Mahdavi, 2021	Wrong Intervention	*Excluded in LES 18.1*
Mahdavi,2021	Wrong Intervention	*Excluded in LES 18.2*
Maher, 2022	Wrong Study Design	*Excluded in LES 18.1*
Maillard, 2020	Wrong Publication Type	*Excluded in LES 18.2*
Mallakpour, 2021	Wrong Study Design	*Excluded in LES 18.1*
Mantlo, 2020	Wrong Setting	*Excluded in LES 18.1*
Mao, 2020	Wrong Study Design	*Excluded in LES 18.2*
Maquart, 2022	Wrong Intervention	*Excluded in LES 18.1*
Marchesi,2021	Wrong Setting	*Excluded in LES 18.2*
Marchesi, 2021	Wrong Population	*Excluded in LES 18.1*
Marín-García,2020	Wrong Outcome	*Excluded in LES 18.2*
Marqués, 2021	Wrong Study Design	*Excluded in LES 18.1*
Marqués, 2021	Wrong Study Design	*Excluded in LES 18.2*

LES 18.2: Effectiveness of Cleaning and Disinfecting for reducing transmission of RIDs in non-healthcare community-based settings.

Excluded studies during full text assessment		
Author, year	**Reason for exclusion**	**Version of exclusion**
Abbasi,2022	Wrong Outcome	*Excluded in LES 18.2*
Abdullah,2021	Wrong Intervention	*Excluded in LES 18.2*
Masai,2021	Wrong Population	*Excluded in LES 18.2*
Marshall, 2020	Wrong Outcome	*Excluded in LES 18.1*
Marteinson, 2022	Wrong Outcome	*Excluded in LES 18.1*
Martins, 2022	Wrong Outcome	*Excluded in LES 18.1*
Masai, 2021	Wrong Population	*Excluded in LES 18.1*
Masotti, 2022	Wrong Study Design	*Excluded in LES 18.1*
Mathews, 2020	Wrong Publication Type	*Excluded in LES 18.2*
Matsuura, 2021	Wrong Setting	*Excluded in LES 18.1*
Matsuyama, 2023	Wrong Intervention	*Excluded in LES 18.1*
Meierhofer, 2023	Wrong Outcome	*Excluded in LES 18.1*
Meierhofer,2023	Wrong Population	*Excluded in LES 18.2*
Meister, 2024	Wrong Outcome	*Excluded in LES 18.2*
Memarzadeh, 2021	Wrong Study Design	*Excluded in LES 18.1*
Merkies,2020	Wrong Outcome	*Excluded in LES 18.2*
Migisha, 2022	Wrong Intervention	*Excluded in LES 18.2*
Millar, 2021	Wrong Population	*Excluded in LES 18.2*
Miller, 2021	Wrong Intervention	*Excluded in LES 18.2*
Miller,2022	Wrong Intervention	*Excluded in LES 18.2*
Milella, 2021	Wrong Outcome	*Excluded in LES 18.1*
Miles, 2024	Wrong Outcome	*Excluded in LES 18.2*
Min, 2024	Wrong Study Design	*Excluded in LES 18.2*
Miri, 2020	Wrong Outcome	*Excluded in LES 18.1*
Mirzay-Razaz, 2022	Wrong Outcome	*Excluded in LES 18.1*
Mishra, 2021	Wrong Study Design	*Excluded in LES 18.2*
Mohan,2021	Wrong Study Design	*Excluded in LES 18.2*
Mohtar, 2021	Wrong Population	*Excluded in LES 18.1*
Molia,2019	Wrong Study Design	*Excluded in LES 18.2*
Moreno, 2021	Wrong Study Design	*Excluded in LES 18.2*
Moritz, 2021	Wrong Intervention	*Excluded in LES 18.2*
Morisod,2023	Wrong Intervention	*Excluded in LES 18.2*
Morrison, 2021	Wrong Study Design	*Excluded in LES 18.1*
Moreau,2020	Wrong Intervention	*Excluded in LES 18.2*
Mortazavi, 2022	Wrong Population	*Excluded in LES 18.1*
Mukherjee, 2021	Wrong Study Design	*Excluded in LES 18.2*
Mukherjee, 2021	Wrong Setting	*Excluded in LES 18.1*
Mumba,2023	Wrong Intervention	*Excluded in LES 18.2*
Mummert,2017	Wrong Study Design	*Excluded in LES 18.2*
Muthugala,2020	Wrong Population	*Excluded in LES 18.2*
Mwanga, 2024	Wrong Study Design	*Excluded in LES 18.2*
Nakito, 2023	Wrong Outcome	*Excluded in LES 18.1*
Nantima,2019	Wrong Publication Type	*Excluded in LES 18.2*

Excluded studies during full text assessment		
Author, year	**Reason for exclusion**	**Version of exclusion**
Abbasi,2022	Wrong Outcome	*Excluded in LES 18.2*
Abdullah,2021	Wrong Intervention	*Excluded in LES 18.2*
Nardell, 2022	Wrong Publication Type	*Excluded in LES 18.2*
Neuberger, 2022	Wrong Study Design	*Excluded in LES 18.1*
Neves,2023	Wrong Population	*Excluded in LES 18.2*
Nguyen, 2021	Wrong Study Design	*Excluded in LES 18.1*
Nikolaidou, 2023	Wrong Outcome	*Excluded in LES 18.1*
Nkwayep,2020	Wrong Study Design	*Excluded in LES 18.2*
Noguera, 2021	Wrong Setting	*Excluded in LES 18.2*
Noorimotlagh, 2021	Wrong Outcome	*Excluded in LES 18.1*
Norvill,2022	Wrong Intervention	*Excluded in LES 18.2*
Nosik,2017	Wrong Language	*Excluded in LES 18.2*
Oberste, 2023	Wrong Intervention	*Excluded in LES 18.1*
Oberste,2023	Wrong Intervention	*Excluded in LES 18.2*
Offeddu,2016	Wrong Study Design	*Excluded in LES 18.2*
Oguma, 2021	Wrong Study Design	*Excluded in LES 18.1*
Oh,2023	Not available	*Excluded in LES 18.2*
Okajima, 2021	Wrong Setting	*Excluded in LES 18.1*
Oksanen, 2022	Wrong Outcome	*Excluded in LES 18.1*
Oliveira, 2022	Wrong Setting	*Excluded in LES 18.1*
Ouyang, 2023	Wrong Study Design	*Excluded in LES 18.2*
Owen, 2021	Wrong Population	*Excluded in LES 18.1*
Ozenen, 2020	Wrong Publication Type	*Excluded in LES 18.2*
Pamukcu, 2022	Wrong Outcome	*Excluded in LES 18.2*
Pan, 2020	Wrong Outcome	*Excluded in LES 18.1*
Pan,2023	Wrong Intervention	*Excluded in LES 18.2*
Patrizio,2023	Wrong Population	*Excluded in LES 18.2*
Patrzalek,2019	Wrong Intervention	*Excluded in LES 18.2*
Papadakis, 2023	Wrong Population	*Excluded in LES 18.2*
Paul, 2021	Wrong Study Design	*Excluded in LES 18.1*
Peddinti, 2021	Wrong Outcome	*Excluded in LES 18.1*
Pedreira, 2021	Wrong Study Design	*Excluded in LES 18.1*
Pekmezaris,2021	Wrong Intervention	*Excluded in LES 18.2*
Pelletier, 2021	Wrong Setting	*Excluded in LES 18.1*
Pereira, 2022	Wrong Setting	*Excluded in LES 18.1*
Petel, 2021	Wrong Study Design	*Excluded in LES 18.2*
Peters, 2021	Wrong Study Design	*Excluded in LES 18.1*
Petrosino, 2021	Wrong Study Design	*Excluded in LES 18.1*
Petrosino,2021	Wrong Study Design	*Excluded in LES 18.2*
Pezzotti, 2021	Wrong Intervention	*Excluded in LES 18.1*
Pezzotti, 2022	Wrong Setting	*Excluded in LES 18.1*
Phuna, 2022	Wrong Outcome	*Excluded in LES 18.1*
Phuna, 2023	Wrong Study Design	*Excluded in LES 18.2*

Excluded studies during full text assessment		
Author, year	**Reason for exclusion**	**Version of exclusion**
Abbasi,2022	Wrong Outcome	*Excluded in LES 18.2*
Abdullah,2021	Wrong Intervention	*Excluded in LES 18.2*
Porter, 2024	Wrong Study Design	*Excluded in LES 18.2*
Pourfarzi, 2021	Wrong Outcome	*Excluded in LES 18.1*
Pourfarzi,2021	Wrong Setting	*Excluded in LES 18.2*
Pourhajibagher,2022	Wrong Intervention	*Excluded in LES 18.2*
Prakash, 2022	Wrong Study Design	*Excluded in LES 18.2*
Prakash, 2022	Wrong Study Design	*Excluded in LES 18.1*
Probst, 2021	Wrong Study Design	*Excluded in LES 18.1*
Qian, 2023	Wrong Setting	*Excluded in LES 18.2*
Qiao, 2021	Wrong Intervention	*Excluded in LES 18.2*
Qin, 2022	Wrong Outcome	*Excluded in LES 18.1*
Quéromes, 2022	Wrong Setting	*Excluded in LES 18.1*
Raeiszadeh, 2020	Wrong Study Design	*Excluded in LES 18.1*
Rahimi, 2021	Wrong Study Design	*Excluded in LES 18.1*
Rahimi, 2021	Wrong Study Design	*Excluded in LES 18.2*
Rai, 2020	Wrong Study Design	*Excluded in LES 18.1*
Ramji, 2022	Wrong Setting	*Excluded in LES 18.1*
Raya Tena, 2021	Foreign Language	*Excluded in LES 18.2*
Raza, 2022	Wrong Study Design	*Excluded in LES 18.1*
Rhee,2021	Wrong Setting	*Excluded in LES 18.2*
Rhee, 2021	Wrong Setting	*Excluded in LES 18.2*
Rees, 2023	Wrong Publication Type	*Excluded in LES 18.2*
Reich, 2022	Wrong Study Design	*Excluded in LES 18.2*
Renninger, 2021	Wrong Outcome	*Excluded in LES 18.1*
Renson, 2022	Wrong Study Design	*Excluded in LES 18.1*
Renson,2022	Wrong Study Design	*Excluded in LES 18.2*
Rodriguez-Martinez, 2020	Wrong Study Design	*Excluded in LES 18.1*
Rodriguez-Martinez, 2020	Wrong Study Design	*Excluded in LES 18.2*
RomanoSpica, 2020	Wrong Outcome	*Excluded in LES 18.1*
Romeo, 2022	Wrong Outcome	*Excluded in LES 18.1*
Romeo,2022	Wrong population	*Excluded in LES 18.2*
Ronca, 2021	Wrong Intervention	*Excluded in LES 18.1*
Ronca,2021	Wrong Setting	*Excluded in LES 18.2*
Rosa,2022	Wrong Outcome	*Excluded in LES 18.2*
Rowan, 2021	Wrong Study Design	*Excluded in LES 18.2*
Rowan, 2021	Wrong Study Design	*Excluded in LES 18.1*
Ruiz-Hitzky,2020	Wrong Study Design	*Excluded in LES 18.2*
Rutala, 2023	Wrong Study Design	*Excluded in LES 18.2*
Saawarn, 2021	Wrong Study Design	*Excluded in LES 18.2*
Sagripanti, 2020	Wrong Setting	*Excluded in LES 18.2*
Saikouk,2021	Wrong population	*Excluded in LES 18.2*
SakalarÇ, 2023	Wrong Setting	*Excluded in LES 18.1*

Excluded studies during full text assessment		
Author, year	**Reason for exclusion**	**Version of exclusion**
Abbasi,2022	Wrong Outcome	*Excluded in LES 18.2*
Abdullah,2021	Wrong Intervention	*Excluded in LES 18.2*
Sakalar,2023	Wrong Setting	*Excluded in LES 18.2*
Saldaña, 2020	Wrong Study Design	*Excluded in LES 18.2*
Salem,2023	Wrong Outcome	*Excluded in LES 18.2*
Salido, 2021	Wrong Intervention	*Excluded in LES 18.1*
Salonga, 2022	Wrong Study Design	*Excluded in LES 18.1*
Sangkham, 2021	Wrong Study Design	*Excluded in LES 18.2*
SanJuan-Reyes, 2021	Wrong Study Design	*Excluded in LES 18.2*
Sarangi, 2021	Wrong Outcome	*Excluded in LES 18.1*
Sarfraz, 2022	Wrong Intervention	*Excluded in LES 18.1*
Sargent, 2020	Wrong Publication Type	*Excluded in LES 18.2*
Sarkar,2022	Wrong Intervention	*Excluded in LES 18.2*
Saxena, 2021	Wrong Study Design	*Excluded in LES 18.1*
Schanze, 2020	Wrong Setting	*Excluded in LES 18.1*
Schmitz, 2024	Wrong Study Design	*Excluded in LES 18.2*
Scholte, 2022	Wrong Setting	*Excluded in LES 18.1*
Schwartz, 2023	Wrong Intervention	*Excluded in LES 18.1*
Seethalakshmi, 2022	Wrong Study Design	*Excluded in LES 18.1*
Seif,2023	Wrong Outcome	*Excluded in LES 18.2*
Sellaoui,2021	Wrong Study Design	*Excluded in LES 18.2*
Sellera, 2021	Wrong Outcome	*Excluded in LES 18.1*
Sellera, 2021	Wrong Study Design	*Excluded in LES 18.2*
Seo,2021	Wrong Outcome	*Excluded in LES 18.2*
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*
Shen, 2023	Wrong Population	*Excluded in LES 18.1*
Shen, 2020	Wrong Publication Type	*Excluded in LES 18.2*
Sheen,2024	Wrong population	*Excluded in LES 18.2*
Shi,2020	Wrong Study Design	*Excluded in LES 18.2*
Shigute, 2020	Wrong Publication Type	*Excluded in LES 18.2*
Shimabukuro, 2020	Wrong Outcome	*Excluded in LES 18.1*
Shimasaki,2023	Wrong Publication Type	*Excluded in LES 18.2*
Shimizu, 2022	Wrong Intervention	*Excluded in LES 18.1*
Shimizu,2022	Wrong population	*Excluded in LES 18.2*
Shrestha,2021	Wrong Intervention	*Excluded in LES 18.2*
Shukla, 2021	Wrong Study Design	*Excluded in LES 18.1*
Silva, 2022	Foreign Language	*Excluded in LES 18.2*
Singh,2022	Wrong Intervention	*Excluded in LES 18.2*
Singer,2021	Wrong Study Design	*Excluded in LES 18.2*
Siniavin, 2021	Wrong Intervention	*Excluded in LES 18.1*

LES 18.2: Effectiveness of Cleaning and Disinfecting for reducing transmission of RIDs in non-healthcare community-based settings.

Excluded studies during full text assessment		
Author, year	**Reason for exclusion**	**Version of exclusion**
Abbasi,2022	Wrong Outcome	*Excluded in LES 18.2*
Abdullah,2021	Wrong Intervention	*Excluded in LES 18.2*
Smither, 2021	Wrong Intervention	*Excluded in LES 18.1*
Smither,2021	Wrong Setting	*Excluded in LES 18.2*
Sobolik, 2022	Wrong Study Design	*Excluded in LES 18.1*
Sobolik,2022	Wrong Study Design	*Excluded in LES 18.2*
Song,2022	Wrong Intervention	*Excluded in LES 18.2*
Souza, 2023	Wrong Outcome	*Excluded in LES 18.2*
Souza,2023	Wrong Outcome	*Excluded in LES 18.2*
Srivastav,2018	Wrong Outcome	*Excluded in LES 18.2*
Stein, 2023	Wrong Intervention	*Excluded in LES 18.1*
Steinhauer, 2021	Wrong Setting	*Excluded in LES 18.1*
Stratil,2021	Wrong Study Design	*Excluded in LES 18.2*
Subpiramaniyam, 2021	Wrong Study Design	*Excluded in LES 18.1*
Subpiramaniyam, 2021	Wrong Study Design	*Excluded in LES 18.2*
Su-Velez, 2020	Wrong Outcome	*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*
Suryanarayanan,2021	Wrong Study Design	*Excluded in LES 18.2*
Suzuki,2021	Wrong Setting	*Excluded in LES 18.2*
Suzuki, 2021	Wrong Setting	*Excluded in LES 18.1*
Szablewski, 2021	Wrong Intervention	*Excluded in LES 18.2*
Takayama, 2021	Wrong Setting	*Excluded in LES 18.1*
Takeda, 2021	Wrong Setting	*Excluded in LES 18.1*
Takeda, 2021	Wrong Setting	*Excluded in LES 18.1*
Takahashi,2017	Wrong Intervention	*Excluded in LES 18.2*
Tang,2021	Wrong Intervention	*Excluded in LES 18.2*
Tao, 2021	Wrong Outcome	*Excluded in LES 18.1*
Tao,2021	Wrong Outcome	*Excluded in LES 18.2*
Tarka, 2021	Wrong Outcome	*Excluded in LES 18.1*
Tasiame,2020	Wrong Intervention	*Excluded in LES 18.2*
Taylor,2021	Wrong Outcome	*Excluded in LES 18.2*
Tewari, 2022	Wrong Population	*Excluded in LES 18.1*
Tewari,2022	Wrong Setting	*Excluded in LES 18.2*
Thakar,2022	Wrong Population	*Excluded in LES 18.2*
Thaper, 2021	Wrong Study Design	*Excluded in LES 18.1*
Thomas, 2021	Wrong Study Design	*Excluded in LES 18.1*
Thomas,2021	Wrong Study Design	*Excluded in LES 18.2*
Thomas, 2022	Wrong Setting	*Excluded in LES 18.1*
Thomas,2022	Wrong Study Design	*Excluded in LES 18.2*
Thomsen, 2021	Wrong Setting	*Excluded in LES 18.2*
Thorton, 2022	Wrong Study Design	*Excluded in LES 18.2*
Tiwari, 2022	Wrong Outcome	*Excluded in LES 18.1*

Excluded studies during full text assessment		
Author, year	**Reason for exclusion**	**Version of exclusion**
Abbasi,2022	Wrong Outcome	*Excluded in LES 18.2*
Abdullah,2021	Wrong Intervention	*Excluded in LES 18.2*
Tizaoui, 2022	Wrong Setting	*Excluded in LES 18.2*
Todorov, 2021	Wrong Setting	*Excluded in LES 18.2*
Torres-Costa, 2020	Wrong Study Design	*Excluded in LES 18.1*
Trecker, 2019	Wrong Outcome	*Excluded in LES 18.2*
Trmcico, 2021	Wrong Study Design	*Excluded in LES 18.1*
Qualls,2017	Wrong Publication Type	*Excluded in LES 18.2*
Qin, 2022	Wrong Study Design	*Excluded in LES 18.2*
Urushidani,2022	Wrong Setting	*Excluded in LES 18.2*
Valsamatzi-Panagiotou, 2022	Wrong Study Design	*Excluded in LES 18.1*
Vardoulakis, 2022	Wrong Study Design	*Excluded in LES 18.2*
Vazquez-Carmona,2022	Wrong Population	*Excluded in LES 18.2*
Viana, 2021	Wrong Study Design	*Excluded in LES 18.2*
Tulalamba, 2021	Wrong Setting	*Excluded in LES 18.1*
Waleed,2022	Wrong intervention	*Excluded in LES 18.2*
Walker, 2022	Not available	*Excluded in LES 18.2*
Wang, 2020	Wrong Outcome	*Excluded in LES 18.1*
Wang, 2020	Foreign Language	*Excluded in LES 18.2*
Wang,2022	Wrong intervention	*Excluded in LES 18.2*
Wang,2022	Wrong Population	*Excluded in LES 18.2*
Ward,2020	Wrong Publication Type	*Excluded in LES 18.2*
Ward, 2021	Wrong Publication Type	*Excluded in LES 18.2*
Ward, 2023	Wrong Publication Type	*Excluded in LES 18.2*
Ward-Fore, 2020	Wrong Publication Type	*Excluded in LES 18.2*
Watanabe, 2023	Wrong Setting	*Excluded in LES 18.1*
Weber,2020	Wrong Study Design	*Excluded in LES 18.2*
Wei,2020	Wrong Setting	*Excluded in LES 18.2*
Welch, 2020	Wrong Setting	*Excluded in LES 18.1*
Widera, 2021	Wrong Setting	*Excluded in LES 18.1*
Wiktorczyk-Kapischke, 2021	Wrong Study Design	*Excluded in LES 18.1*
Wiktorczyk-Kapischke, 2021	Wrong Study Design	*Excluded in LES 18.2*
Wilasang,2016	Wrong Study Design	*Excluded in LES 18.2*
Willgert,2020	Wrong Outcome	*Excluded in LES 18.2*
Wilson,2018	Wrong Setting	*Excluded in LES 18.2*
Wilson,2019	Wrong Setting	*Excluded in LES 18.2*
Wilson,2021	Wrong Study Design	*Excluded in LES 18.2*
Wolfgruber, 2022	Wrong Setting	*Excluded in LES 18.2*
Wong, 2022	Wrong Outcome	*Excluded in LES 18.1*
Wu, 2022	Wrong Study Design	*Excluded in LES 18.1*
Xiang, 2023	Wrong Outcome	*Excluded in LES 18.2*
Xiao,2020	Wrong Study Design	*Excluded in LES 18.2*
Xiao,2021	Wrong Intervention	*Excluded in LES 18.2*

Excluded studies during full text assessment		
Author, year	**Reason for exclusion**	**Version of exclusion**
Abbasi,2022	Wrong Outcome	*Excluded in LES 18.2*
Abdullah,2021	Wrong Intervention	*Excluded in LES 18.2*
Xiao, 2022	Wrong Study Design	*Excluded in LES 18.1*
Xu, 2023	Wrong Study Design	*Excluded in LES 18.2*
Yan,2022	Wrong Intervention	*Excluded in LES 18.2*
Yang,2021	Wrong Intervention	*Excluded in LES 18.2*
Yang, 2022	Wrong Study Design	*Excluded in LES 18.1*
Yano,2020	Wrong Publication Type	*Excluded in LES 18.2*
Yap,2020	Wrong Intervention	*Excluded in LES 18.2*
Yeung, 2022	Wrong Population	*Excluded in LES 18.1*
Young,2017	Wrong Setting	*Excluded in LES 18.2*
Yu, 2022	Wrong Setting	*Excluded in LES 18.1*
Yu, 2022	Wrong Publication Type	*Excluded in LES 18.2*
Yusuf, 2021	Wrong Population	*Excluded in LES 18.2*
ZahrAllayali,2021	Wrong Intervention	*Excluded in LES 18.2*
Zhai, 2022	Wrong Intervention	*Excluded in LES 18.1*
Zhang, 2021	Wrong Intervention	*Excluded in LES 18.2*
Zhang, 2021	Wrong Outcome	*Excluded in LES 18.1*
Zhang, 2022	Wrong Study Design	*Excluded in LES 18.1*
Zhang, 2022	Wrong Study Design	*Excluded in LES 18.2*
Zhang,2022	Wrong Outcome	*Excluded in LES 18.2*
Zhao,2021	Wrong Intervention	*Excluded in LES 18.2*
Zheng, 2021	Wrong Outcome	*Excluded in LES 18.1*
Zhou,2018	Wrong Study Design	*Excluded in LES 18.2*
Zhou,2023	Wrong Study Design	*Excluded in LES 18.2*
Zhu,2021	Wrong Study Design	*Excluded in LES 18.2*
Zuniga-Montanez, 2022	Wrong Outcome	*Excluded in LES 18.1*
Studies excluded in LES 18.1, Included in LES 18.2		
Raffee, 2021	Wrong Study Design	*Excluded in LES 18.1* *Included in LES 18.2*
Soave, 2021	Wrong Outcome	*Excluded in LES 18.1* *Included in LES 18.2*
Youssef, 2022	Wrong Study Design	*Excluded in LES 18.1* *Included in LES 18.2*

Appendix 3: Data extraction form

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

LES 18.2: Effectiveness of Cleaning and Disinfecting for reducing transmission of RIDs in non-healthcare community-based settings.

Setting: include non-healthcare 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 RIDs)	RIDS transmission reduction (i.e., attack rates, reproduction number, etc.)/ Other RIDs transmission reduction/ Negative physiological health impact/ Negative emotional/psychological impact/ Deactivating/ eliminating RIDs on surfaces.
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)
Comparison	Hypothesis test used
	Result
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

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 during pandemic = serious ● Same or different country/province/state measured at a different time prior to pandemic = critical ● Not applicable = no information **Were the RIDs 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 RIDS)?** (For example, people who are less likely to adhere to PHSMs anyway may be more likely to be exposed to RIDS 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**	**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

An appropriate comparison of interventions requires that the interventions are well defined.	• 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 RIDS 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 RIDS 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 RIDS 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 RIDS 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 RIDS infection at the start of the study?**** Examples and typical judgment: ● Negative RIDS status of both groups known at study start (lab confirmed)= low ● RIDS status of intervention group known but unclear for control group OR RIDS status of both groups known by self-report only = serious ● Unclear or high likelihood pts had RIDS 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 RIDS confirmed by laboratory testing?**** Examples and typical judgment: ● All participants had PCR = low ● Most participants had PCR = moderate ● All participants had other RIDs test = serious ● Only sample or subset of population had PCR = serious ● Not reported = critical ● Only sample or subset of population had other RIDs test = serious ● Not applicable = no information **If the outcomes were derived from databases, were the databases constructed specifically for the collection of RIDS data?**** Examples and typical judgment: ● National/state/province level surveillance database or specifically for RIDS = low ● Database for non-RIDS purpose with individual level data (e.g., health records, employee records) = moderate ● Database for non-RIDS 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 RIDS 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 analytical cross-sectional studies using an JBI tool.

Critical appraisal checklist for cross-sectional studies

Questions	Possible responses
1. Were the criteria for inclusion in the sample clearly defined? The authors should provide clear inclusion and exclusion criteria that they developed prior to recruitment of the study participants. The inclusion/exclusion criteria should be specified (e.g., risk, stage of disease progression) with sufficient detail and all the necessary information critical to the study.	NA = not applicable; Y = yes; N = no; U = unclear
2. Were the study subjects and the setting described in detail? The study sample should be described in sufficient detail so that other researchers can determine if it is comparable to the population of interest to them. The authors should provide a clear description of the population from which the study participants were selected or recruited, including demographics, location, and time period.	
3. Was the exposure measured in a valid and reliable way? The study should clearly describe the method of measurement of exposure. Assessing validity requires that a 'gold standard' is available to which the measure can be compared. The validity of exposure measurement usually relates to whether a current measure is appropriate or whether a measure of past exposure is needed. Reliability refers to the processes included in an epidemiological study to check repeatability of measurements of the exposures. These usually include intra-observer reliability and inter-observer reliability.	
4. Were objective, standard criteria used for measurement of the condition? It is useful to determine if patients were included in the study based on either a specified diagnosis or definition. This is more likely to decrease the risk of bias. Characteristics are another useful approach to matching groups, and studies that did not use specified diagnostic methods or definitions should provide evidence on matching by key characteristics	
5. Were confounding factors identified? Confounding has occurred where the estimated intervention exposure effect is biased by the presence of some difference between the comparison groups (apart from the exposure investigated/of interest). Typical confounders include baseline characteristics, prognostic factors, or concomitant exposures (e.g. smoking). A confounder is a difference between the comparison groups, and it influences the direction of the study results. A high quality study at the level of cohort design will identify the potential confounders and measure them (where possible). This is difficult for studies where behavioral, attitudinal or lifestyle factors may impact on the results.	
6. Were strategies to deal with confounding factors stated? Strategies to deal with effects of confounding factors may be dealt within the study design or in data analysis. By matching or stratifying sampling of participants, effects of confounding factors can be adjusted for. When dealing with adjustment in data analysis, assess the statistics used in the study. Most will be some form of multivariate regression analysis to account for the confounding factors measured.	
7. Were the outcomes measured in a valid and reliable way? Read the methods section of the paper. If for e.g. lung cancer is assessed based on existing definitions or diagnostic criteria, then the answer to this question is likely to be yes. If lung cancer is assessed using observer reported, or self-reported scales, the risk of over- or under-reporting is increased, and objectivity is compromised. Importantly, determine if the measurement tools used were validated instruments as this has a significant impact on outcome assessment validity. Having established the objectivity of the outcome measurement (e.g. lung cancer) instrument, it's important to establish how the measurement was conducted. Were those involved in collecting data	

trained or educated in the use of the instrument/s? (e.g. radiographers). If there was more than one data collector, were they similar in terms of level of education, clinical or research experience, or level of responsibility in the piece of research being appraised?	
8. Was appropriate statistical analysis used? As with any consideration of statistical analysis, consideration should be given to whether there was a more appropriate alternate statistical method that could have been used. The methods section should be detailed enough for reviewers to identify which analytical techniques were used (in particular, regression or stratification) and how specific confounders were measured. For studies utilizing regression analysis, it is useful to identify if the study identified which variables were included and how they related to the outcome. If stratification was the analytical approach used, were the strata of analysis defined by the specified variables? Additionally, it is also important to assess the appropriateness of the analytical strategy in terms of the assumptions associated with the approach as differing methods of analysis are based on differing assumptions about the data and how it will respond.	

We appraise the methodological quality of the individual case-control studies using an JBI tool.

Critical appraisal tool for case-control studies

Questions	Possible responses
Were the groups comparable other than presence of disease in cases or absence of disease in controls? The control group should be representative of the source population that produced the cases. This is usually done by individual matching; wherein controls are selected for each case on the basis of similarity with respect to certain characteristics other than the exposure of interest. Frequency or group matching is an alternative method. Selection bias may result if the groups are not comparable.	NA = not applicable; Y = yes; N = no; U = unclear
Were cases and controls matched appropriately? As in item 1, the study should include clear definitions of the source population. Sources from which cases and controls were recruited should be carefully looked at. For example, cancer registries may be used to recruit participants in a study examining risk factors for lung cancer, which typify population-based case control studies. Study participants may be selected from the target population, the source population, or from a pool of eligible participants (such as in hospital-based case control studies).	
Were the same criteria used for identification of cases and controls? It is useful to determine if patients were included in the study based on either a specified diagnosis or definition. This is more likely to decrease the risk of bias. Characteristics are another useful approach to matching groups, and studies that did not use specified diagnostic methods or definitions should provide evidence on matching by key characteristics. A case should be defined clearly. It is also important that controls must fulfil all the eligibility criteria defined for the cases except for those relating to diagnosis of the disease.	
Was exposure measured in a standard, valid and reliable way? The study should clearly describe the method of measurement of exposure. Assessing validity requires that a 'gold standard' is available to which the measure can be compared. The validity of exposure measurement usually relates to whether a current measure is appropriate or whether a measure of past exposure is needed. Case control studies may investigate many different ‘exposures’ that may or may not be associated with the condition. In these cases, reviewers should use the main exposure of interest for their review to answer this question when using this tool at the study level. Reliability refers to the processes included in an epidemiological study to check repeatability of measurements of the exposures. These usually include intra-observer reliability and inter-observer reliability.	
Was exposure measured in the same way for cases and controls? As in item 4, the study should clearly describe the method of measurement of exposure. The exposure measures should be clearly defined and described in detail. Assessment of exposure or risk factors should have been carried out according to same procedures or protocols for both cases and controls.	
Were confounding factors identified? Confounding has occurred where the estimated intervention exposure effect is biased by the presence of some difference between the comparison groups (apart from the exposure investigated/of interest). Typical confounders include baseline characteristics, prognostic factors, or concomitant exposures (e.g. smoking). A confounder is a difference between the comparison groups, and it influences the direction of the study results. A high quality study at the level of case control design will identify the potential confounders and measure them (where possible). This is difficult for studies where behavioral, attitudinal or lifestyle factors may impact on the results.	
Were strategies to deal with confounding factors stated? Strategies to deal with effects of confounding factors may be dealt within the study design or in data analysis. By matching or stratifying sampling of participants, effects of confounding factors can be	

adjusted for. When dealing with adjustment in data analysis, assess the statistics used in the study. Most will be some form of multivariate regression analysis to account for the confounding factors measured. Look out for a description of statistical methods as regression methods such as logistic regression are usually employed to deal with confounding factors/ variables of interest.	
Were outcomes assessed in a standard, valid and reliable way for cases and controls? Read the methods section of the paper. If for e.g. lung cancer is assessed based on existing definitions or diagnostic criteria, then the answer to this question is likely to be yes. If lung cancer is assessed using observer reported, or self-reported scales, the risk of over- or under-reporting is increased, and objectivity is compromised. Importantly, determine if the measurement tools used were validated instruments as this has a significant impact on outcome assessment validity. Having established the objectivity of the outcome measurement (e.g. lung cancer) instrument, it's important to establish how the measurement was conducted. Were those involved in collecting data trained or educated in the use of the instrument/s? (e.g. radiographers). If there was more than one data collector, were they similar in terms of level of education, clinical or research experience, or level of responsibility in the piece of research being appraised?	
Was the exposure period of interest long enough to be meaningful? It is particularly important in a case control study that the exposure time was sufficient enough to show an association between the exposure and the outcome. It may be that the exposure period may be too short or too long to influence the outcome.	
Was appropriate statistical analysis used? As with any consideration of statistical analysis, consideration should be given to whether there was a more appropriate alternate statistical method that could have been used. The methods section should be detailed enough for reviewers to identify which analytical techniques were used (in particular, regression or stratification) and how specific confounders were measured. For studies utilizing regression analysis, it is useful to identify if the study identified which variables were included and how they related to the outcome. If stratification was the analytical approach used, were the strata of analysis defined by the specified variables? Additionally, it is also important to assess the appropriateness of the analytical strategy in terms of the assumptions associated with the approach as differing methods of analysis are based on differing assumptions about the data and how it will respond.	

We appraise the RoB of the In vitro studies using an adapted version of OHAT RoB Tool for Human and Animal Studies. This tool classifies the Risk of Bias as Definitely Low, Probably Low, Probably High or Definitely High. Definitely Low Risk of Bias indicates High Quality, and Definitely High Risk of Bias indicates Very Low (insufficient) Quality. OHAT RoB appraises 6 domains with 11 questions. To improve the utility of OHAT for assessing In Vitro studies reporting cleaning and disinfecting products/strategies, we have focused on study characteristics that introduce bias specifically for these interventions in the In Vitro context. Once a study has met one criterion that makes it "Definitely High" risk of bias, it will be dropped from further risk of bias assessment (exception: if limited data available for an outcome).

Study Characteristics that may introduce bias	Description
Selection bias: applies to potential differences between cells across different groups.	**Was administered dose or exposure level adequately randomized?** ● If homogeneous cell suspension, no variation or difference between groups, therefore, no need for randomization = No information ● Groups were allocated using a method with a random component, AND there is direct evidence that the study used a concurrent control group = Definitely Low ● Groups were allocated using a method with a random component, without description of the method used, AND there is direct or indirect evidence that the study used a concurrent control group, OR it is deemed that allocation without a clearly random component during the study would not appreciably bias results. = Probably Low ● Indirect evidence that groups were allocated using a method with a non-random component, OR there is indirect evidence that there was a lack of a concurrent control group, OR there is insufficient information. =Probably High ● Groups were allocated using a non-random method, OR there is direct evidence that there was a lack of a concurrent control group. = Definitely High **Was allocation to study groups adequately concealed?** ● If homogeneous cell suspension, no variation or difference between groups. = No information ● The time of assigning study groups the research personnel did not know what group were allocated to, and it is unlikely that they could have broken the blinding of allocation until after assignment was complete and irrevocable. = Definitely Low ● Indirect evidence that at the time of assigning study groups the research personnel did not know what group were allocated to and it is unlikely that they could have broken the blinding of allocation, OR it is deemed that lack of adequate allocation concealment would not appreciably bias results = Probably Low ● There is indirect evidence that at the time of assigning study groups it was possible for the research personnel to know what group were allocated to, or it is likely that they could have broken the blinding of allocation before assignment was complete and irrevocable, OR there is insufficient information provided. = Probably High ● At the time of assigning study groups, it was possible for the research personnel to know what group were allocated to, or it is likely that they could have broken the blinding of allocation before assignment was complete and irrevocable. = Definitely High
Performance Bias identical conditions include: • Same media for controls and experimental culture wells • Same solvent (i.e., used to dissolve treatment	**Were experimental conditions identical across study groups?** ● Same conditions were used in control and experimental groups. = Definitely Low ● There is indirect evidence that the same conditions were used in control and experimental groups, OR it is deemed that conditions would not appreciably bias results.= Probably Low ● There is indirect evidence that the conditions differed between control and experimental groups, OR authors did not report the conditions used. = Probably High

chemicals) for control cells. • Culture plates must be uniformly incubated and handled – Same medium and schedule for changes, washes – Same time spent out of incubator – Same incubator and plate conditions (e.g., incubator plate location effects, plate edge-effects, etc.)	• Control was untreated or treated with different conditions than experimental.= Definitely High **Were the research personnel and human subjects blinded to the study group during the study?** • Robotic systems eliminate need = No information • Research personnel were adequately blinded to study group, and it is unlikely that they could have broken the blinding during the study.= Definitely Low • There is indirect evidence that the research personnel were adequately blinded to study group, and it is unlikely that they could have broken the blinding during the study, OR it is deemed that lack of adequate blinding during the study would not appreciably bias results.= Probably Low • There is indirect evidence that the research personnel were not adequately blinded to study group, OR there is insufficient information provided about blinding to study group during the study (record "NR" as basis for answer).= Probably High • Research personnel were not adequately blinded to study group.= Definitely High
Attrition/Exclusion Bias includes evidence of well or plate loss without explanation.	**Were outcome data complete without attrition or exclusion from analysis?** • Loss of plates was adequately addressed, and reasons were documented when were removed from a study, OR missing data have been imputed using appropriate methods. = Definitely Low • There is indirect evidence that loss of plates was adequately addressed, and reasons were documented when were removed from a study, OR it is deemed that the proportion lost would not appreciably bias results.= Probably Low • There is indirect evidence that loss of plates was unacceptably large and not adequately addressed, OR there is insufficient information provided about loss of plates.= Probably High • Loss of plates was unacceptably large and not adequately addressed.=Definitely High
Detection Bias exposure characterization – purity, stability, solubility, volatility of substance	**Can we be confident in the exposure characterization?** • Exposure was independently characterized across treatment groups AND was consistently administered across treatment groups. = Definitely Low • There is indirect evidence that the exposure was independently characterized, AND there is indirect evidence that exposure was consistently administered across treatment groups.= Probably Low • There is indirect evidence that the exposure was assessed using poorly validated methods, OR there is insufficient information provided about the validity of the exposure assessment method, but no evidence for concern.= Probably High • Exposure was assessed using poorly validated methods. = Definitely High **Can we be confident in the outcome assessment?** • Automated methods used for outcome assessment. = Definitely Low • Outcome was assessed using well-established methods (the gold standard) AND assessed at the same length of time after initial exposure in all study groups, AND outcome assessors were adequately blinded to the study group, and it is unlikely that they could have broken the blinding prior to reporting outcomes. = Definitely Low • There is indirect evidence that the outcome was assessed using acceptable methods AND assessed at the same length of time after initial exposure in all study groups, OR it is deemed that the outcome assessment methods used would not appreciably bias results. For some outcomes, particularly histopathology assessment, outcome assessors are not blind to study group as they require comparison to the control to appropriately judge the outcome, but additional measures such as multiple levels of independent review by trained pathologists can minimize this potential bias. = Probably Low • There is indirect evidence that the outcome assessment method is an insensitive instrument, OR the length of time after initial exposure differed by study group. = Probably High • Outcome assessment method is an insensitive instrument, OR the length of time after initial exposure differed by study group. = Definitely High

	Were all measured outcomes reported? ● All of the study's measured outcomes outlined in the protocol, methods, abstract, and/or introduction have been reported. = Definitely Low ● There is indirect evidence that all of the study's measured outcomes outlined in the protocol, methods, abstract, and/or introduction have been reported, OR analyses that had not been planned in advance are clearly indicated as such and it is deemed that the unplanned analyses were appropriate and selective reporting would not appreciably bias results. = Probably Low ● There is indirect evidence that all of the study's measured outcomes outlined in the protocol, methods, abstract, and/or introduction have been reported, OR and there is indirect evidence that unplanned analyses were included that may appreciably bias results, OR there is insufficient information provided about selective outcome reporting. = Probably High ● All of the study's measured outcomes outlined in the protocol, methods, abstract, and/or introduction have not been reported. In addition to not reporting outcomes, this would include reporting outcomes based on composite score without individual outcome components or outcomes reported using measurements, analysis methods or subsets of the data (e.g., subscales) that were not pre-specified or reporting outcomes not pre-specified, or that unplanned analyses were included that would appreciably bias results. = Definitely High
Other biases project specific considerations (e.g., appropriate statistical methods)	**Were there no other potential threats to internal validity (e.g., statistical methods were appropriate, and researchers adhered to the study protocol)?** ● Definitely Low ● Probably Low ● Probably High ● Definitely High

Appendix 5: Glossary

AIV:	Avian Influenza Virus
AOAC:	Association of Official Analytical Chemists
DMEM:	Dulbecco's Modified Eagle Medium
FAO:	Food and Agriculture Organization
FBS:	Fetal Bovine Serum
HCW:	Healthcare Workers
IPA:	Isopropanol (Isopropyl alcohol - IPA 70%)
LBMs:	Live bird markets
Log:	Logarithm
LTC:	Long-term care
LTCF:	Long-term care facility
mL:	Milliliters
OR:	Odds Ratio
PBS:	Phosphate-buffered saline
PCHS:	Proactive Cleaning and Hygiene Solution
p.f.u:	Plaque-Forming Unit
PHSMs:	Public Health and Social Measures
PP:	Polypropylene
ppm:	parts per million
QAC:	Quaternary Ammonium Compound
RF:	virus Reduction Factor

RH: Relative Humidity

RoB: Risk of Bias

RSV: Respiratory Syncytial Virus

rRT-PCR: Real-time reverse transcriptase polymerase chain reaction

RTU: Ready to Use.

SBR: Styrene–Butadiene Rubber

SDBS: Dodecylbenzenesulfonate

SF: bus Seat Fabric

SLS: Sodium Laureth Sulfate

SS: Stainless Steel

$TCID_{50}$: 50% Tissue Culture Infectious Dose

VOC: Variant of Concern

VOI: Variant of Interest

WSH: Water of Standardized Hardness

w/w: weight-to-weight