



Effectiveness of Hand Hygiene to Reduce the Transmission of Respiratory Infectious Diseases in the Community

Living Evidence Synthesis #17.2 (Version 2, Date: August 9,
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1 Executive Summary

1.1 Purpose

This living evidence synthesis (LES) will review the evidence of the effectiveness of hand hygiene (hand washing with soap and water, or the use of alcohol-based hand sanitizer [ABHS]) to reduce RID transmission in community settings.

1.2 Research questions

1. What is the effectiveness of hand hygiene in reducing transmission of RIDs (i.e., COVID-19, RSV, influenza, measles, iGAS, pneumococcus, meningococcus, *Hemophilus influenzae*, *Bordetella pertussis*) in non-healthcare community-based settings?
 - a. What is the effectiveness of hand hygiene in reducing RID associated hospitalizations and death?
 - b. What is the effectiveness of hand hygiene in removing/eliminating viruses from RIDs from hands?

1.3 Approach

A systematic review following the Cochrane Handbook¹ was completed and was reported in accordance with the PRISMA reporting standards². A PRESS-reviewed³ search strategy was used to search published literature databases from database inception until January 23, 2024 (Ovid MEDLINE, Web of Science, CINAHL, CENTRAL, CDSR). A grey literature search was also completed.

Eligibility criteria:

Population of interest: Any population in a community setting (e.g. schools, households, university students).

Intervention or exposure: Hand hygiene either directly measured or reported as hand hygiene or indirectly measured through use of soap, antibacterial sanitizer and water within the context of an intervention or exposure specifically targeting hand hygiene

Comparator: No hand hygiene or another method of hand hygiene

Primary outcome: Transmission of RIDs (SARS-CoV-2, Respiratory syncytial virus (RSV), influenza, measles, invasive Group A streptococcus (iGAS), pneumococcus, meningococcus, *hemophilus influenzae*, and/or *bordetella pertussis*) confirmed with an objective diagnostic test. Studies must have reported the specific relationship between hand hygiene and any outcome of interest (e.g. a study that reported the relationship between a bundle of interventions, including hand hygiene, and the outcomes of interest was not included)

Secondary outcomes: RID-associated hospitalization or death, RID pathogens measured on hands.

Study designs: Randomized controlled trials (RCTs), non-randomized experimental studies, observational studies and modeling studies.

Other criteria: Reported in English or French

Study selection and data extraction: After calibration, abstract and full text review were conducted by two independent reviewers in duplicate. Data were extracted by single reviewers and checked for accuracy by a second reviewer. All disagreements were resolved through discussion and consensus.

Critical appraisal: Risk of bias (ROB) was assessed using the ROB-2 tool for RCTs, and ROBINS-I for observational studies. Modeling studies were not critically appraised.

1.4 Summary of Findings

Fifty-one studies across 52 publications (9 RCTs, 30 observational and 12 modeling studies) met the inclusion criteria. Included studies assessed COVID-19 (n=34) and Influenza (n=17). The risk of bias judgement for all RCTs and observational studies ranged from moderate to critical. Hand hygiene interventions in the RCTs were often multicomponent (i.e., hand hygiene education, home visits, and provision of soap or ABHS). Hand hygiene was observed by the study assessors in most of the RCTs (n=7), and three of the observational studies. The remaining studies (RCTs n=2, observational n=27) relied on self-reported adherence to hand hygiene.

1.4.1 Findings about the primary outcome: respiratory infectious disease associated infection or transmission.

Studies compared interventions to increase hand hygiene to standard practices, and to educational interventions; assessed hand hygiene practices, compared different hand hygiene products, and different frequencies and timing of hand hygiene practices.

With the available evidence, it is uncertain if hand hygiene alone is sufficient to reduce RID-associated infection or transmission in community settings.

- When an **intervention to increase hand hygiene** (hand hygiene education, home visits, daily monitoring, provision of ABHS) **is compared to standard practices**, it is unclear if hand hygiene reduces the risk of RID-associated infection or transmission or if hand hygiene makes no difference.
 - Three RCTs (two of concern, and one with a high risk of bias) reported a reduced risk of infection or transmission.
 - Two RCTs (one of concern, one high risk of bias) found no difference in infection risk.

- When an **intervention to increase hand hygiene** (hand hygiene education and provision of soap/ABHS) **is compared to a lifestyle educational intervention**, no difference in risk of transmission was reported (four RCTs, one of concern, three high risk of bias).
- It is unclear if **the practice of hand hygiene**¹ reduce the risk of RID-associated infection or transmission, or if it makes no difference.
 - Eight observational studies (five serious, three critical risk of bias) reported a reduced risk of infection or transmission.
 - Four observational studies (one moderate, one serious, one critical risk of bias) found no difference in infection or transmission risk.
 - Two observational studies (one serious risk, one critical risk of bias) reported an increased risk of infection or transmission.
- It is unclear if the **frequency of hand hygiene**² reduces the risk of transmission or if it makes no difference.
 - Eleven observational studies (one moderate risk, seven serious risk, three critical risk of bias) reported that frequent hand hygiene (e.g., hand hygiene >5 times per day) was associated with a reduced risk of infection or transmission.
 - Five observational studies (one moderate risk, four serious risk of bias) found no difference in risk.
 - One observational study (serious risk of bias) reported an increase in the risk of infection.
- It is unclear if the **timing of hand hygiene**³ reduces the risk of transmission or if it makes no difference.
 - Four observational studies (one moderate risk, two serious risk, one critical risk of bias) reported that hand hygiene after sneezing or coughing, before and after meals, and after arriving home may reduce the risk of infection or transmission.
 - Three observational studies (two serious risk, one critical risk of bias) reported that no difference in risk was observed if hand hygiene was performed before eating, or after possible exposure.
 - Two observational studies (one moderate risk, one serious risk of bias) reported an increase in the odds of infection for hand hygiene before eating or after touching frequently touched surfaces.

¹ Four observational studies reported more than one outcome

² Two observational studies reported more than one outcome

³ One observational study reported two outcomes

1.4.2 Findings about the secondary outcome: respiratory infectious disease associated hospitalization or death.

- **The practice of hand hygiene** may reduce the risk of mortality (one observational study, critical risk of bias).
- It is unclear if the **frequency of hand hygiene** reduces the risk of RID-associated hospitalization and mortality, or if it makes no difference.
 - One observational study (moderate risk of bias) reported a reduced risk of RID-associated hospitalization and mortality.
 - One observational study reported no difference in the risk of mortality (serious risk of bias).

1.4.3 Findings about the secondary outcome: viruses from respiratory infectious disease on hands.

- Different **hand hygiene products** (soap powder, 0.05% or 0.25% active chlorine, or hypochlorite) may be comparably effective in eliminating viruses from RIDs from hands (one observational study, critical risk of bias).

The findings from 12 modeling studies are consistent with the findings from the RCTs and observational studies; it is unclear if hand hygiene alone reduces the risk of RID transmission or if it makes no difference.

1.5 Conclusion

With the evidence captured in this review, it is uncertain if hand hygiene alone is sufficient to reduce infection or transmission of RIDs in the community. This conclusion echoes the findings of other recently published systematic reviews evaluating the effect of hand hygiene on confirmed RID in community settings⁴⁻⁷. The inconclusive overall finding on the effectiveness of hand hygiene may reflect the differences in methodology between primary studies, low quality reporting within included primary studies and the complexity in studying community-based public health measures (e.g., assessing adherence or the correct hand hygiene technique). Given the context of droplet and aerosol transmission of RID, the effect of hand hygiene **alone** may be uncertain yet the practice of hand hygiene in combination with other interventions (e.g., respiratory etiquette, masks, vaccination) has been demonstrated to be effective. Given the limitations of the available evidence, the effectiveness of hand hygiene in combination with other interventions^{8,9} and its effectiveness to prevent a wide range of non-

respiratory diseases in various settings¹⁰¹¹, it is important to continue to practice hand hygiene correctly and frequently to reduce the overall transmission risk of infectious diseases in the community.

2 Context for synthesizing evidence about public health and social measures

This living evidence synthesis (LES) 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 transmission of respiratory infectious diseases (SARS-CoV-2, Respiratory syncytial virus [RSV], influenza, measles, invasive Group A streptococcus [iGAS], pneumococcus, meningococcus, *Hemophilus influenzae*, and/or *Bordetella pertussis*); and 2) expanded searches to include these outcomes and to search further back in time from database inception. 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.

Box 1. Context for synthesizing evidence about public health and social measures (PHSM)

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-world settings.
 - As a result, a lack of evidence from RCTs does not necessarily mean the available evidence in this series of LESs is weak.
- Instruments for appraising 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, hand hygiene and cleaning and disinfecting measures) 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 (ROB) 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 section
- 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)
- 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.

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3 Abbreviations

ABHS	Alcohol-based hand sanitizer
AIV	Avian Influenza Virus
aOR	Adjusted odds ratio
CI	Confidence interval
HH	Hand hygiene
HW	Hand washing
iGAS	Invasive Group A Streptococcus
IQR	Interquartile range
IR	Incidence rate
IRR	Incidence risk ratio
LES	Living evidence synthesis
MI	Mean incidence
MP	Mean prevalence
NPI	Non-pharmaceutical intervention
OR	Odds ratio
PCR	Polymerase chain reaction
PHSMs	Public health and social measures
qtPCR	Quantitative polymerase chain reaction
RCT	Randomized control trial
RD	Risk difference
RID	Respiratory infectious disease
ROB	Risk of bias
RR	Risk ratio
RSV	Respiratory syncytial virus
Rts	Time-varying reproduction number
SAR	Secondary attack ratio
SD	Standard deviation
SE	Standard error
SITP	Susceptible-infectious transmission probability

4 Methods

The design and eligibility criteria for this systematic review were based on a *priori* written unregistered protocol. There were no deviations from the protocol. The protocol and systematic review followed the recommendations of the Cochrane Handbook for Systematic Reviews of Interventions ¹ and was reported in accordance with the PRISMA reporting guidelines ². The PRISMA checklist is presented in Appendix A.

4.1 Literature Search Methods

An experienced medical information specialist developed and tested the search strategies through an iterative process in consultation with the review team. Another senior information specialist peer reviewed the MEDLINE strategy prior to execution using the PRESS checklist ³.

The Ovid MEDLINE[®] ALL and Embase databases were searched with the multifile option and deduplication tool available on the Ovid platform. The Cochrane Library on Wiley, CINAHL on EBSCO, and the Core Collection of the Web of Science databases were also searched. The final searches were performed on January 23, 2024. Specific details of the search strategies are included in Appendix B.

The strategies utilized a combination of controlled vocabulary (e.g., “COVID-19”, “Respiratory Tract Infections”, “Hand Hygiene”) and keywords (e.g., “RSV”, “influenza”, “handwash”). The vocabulary and syntax across the databases were adjusted where possible, and non-human animal-only records and opinion pieces were removed (see Appendix B). Research design filters were applied to all strategies except for the Cochrane Library search. There were no date or language restrictions. The records were downloaded and deduplicated using EndNote version 20 (Clarivate Analytics) before uploading them to Covidence.

COVID-related meta sites (COVID-END, L-OVE), clinical trials registries (ClinicalTrials.gov, ICTRP Search Portal), and Google Scholar were searched to identify grey literature. Additional grey literature searches were conducted through the Canadian Agency for Drug and Technologies in Health (CADTH) Grey Matters database. Bibliographic searches of relevant systematic reviews were conducted to identify studies that were not captured in the original searches.

4.2 Study Selection

A calibration exercise was conducted by four independent reviewers on samples of 100 retrieved abstracts. After >95% agreement was reached among reviewers, single reviewers screened the remaining abstracts. Abstracts proceeded to full-text review if they met the following inclusion criteria: community-based studies that assessed hand hygiene (hand washing or alcohol-based hand sanitizer [ABHS]) either directly measured or reported as hand hygiene, or indirectly measured through the use of soap, antibacterial sanitizer and water to reduce the risk of transmission or infection with respiratory infectious diseases (RIDs) included in Table 1; and reported on outcomes including rates of transmission and/or confirmed infection, eliminating RID-associated pathogens from hands, RID-associated hospitalization and/or death. Abstracts were excluded if they failed to meet the inclusion criteria above, if they were published in languages other than English or French, or if they didn't have an eligible study design (as listed in Table 1).

Table 1. Eligibility Criteria

Population	All population groups
Intervention or exposure	Hand hygiene either directly measured or reported as hand hygiene, or indirectly measured through use of soap, water, or antibacterial sanitizer within the context of an intervention or exposure specifically targeting hand hygiene
Comparator	No hand hygiene, enhanced hand hygiene, another type of hand hygiene
Outcomes	<ul style="list-style-type: none"> ○ Transmission of RIDs (SARS-CoV-2, Respiratory syncytial virus (RSV), influenza, measles, invasive Group A streptococcus (iGAS), pneumococcus, meningococcus, <i>hemophilus influenzae</i>, and/or <i>bordetella pertussis</i>) confirmed with an objective diagnostic test (e.g., rapid COVID test, laboratory confirmed PCR test) ○ Presence of virus/bacteria from RIDs on hand surfaces measured through RT, qtPCR or cultured swab samples ○ RID-associated hospitalization and/or death ○ Relationship between outcome and exposure must be reported in isolation of other public health measures such as respiratory etiquette, masking, etc.
Study design	RCTs, non-randomized studies, observational, modeling studies.
Setting	Community-based
Language	English and French
Publication date	Data base inception to January 23, 2024

A similar calibration exercise was conducted by all four reviewers on sequential samples of ten of the retrieved full text studies. After >85% agreement was reached among reviewers, full text review was conducted by two independent reviewers in duplicate. All discrepancies between reviewers were resolved through discussion and consensus.

4.3 Data Extraction

For all included studies, year of publication, country, study design, intervention/exposure and comparator details, and outcomes were extracted by single reviewers using piloted and standardized data extraction forms. A second reviewer checked the extracted data for accuracy. Discrepancies between reviewers during data extraction were resolved through consensus.

4.4 Quality Assessment

The quality of included studies was assessed by single reviewers and checked by another reviewer. The revised Cochrane risk-of-bias tool for randomized controlled trials (ROB-2)¹² was used, while the Risk of bias in non-randomized studies of interventions (ROBINS-I) tool¹³ was used for non-randomized studies.

4.5 Data Analysis

A narrative approach to synthesis was adopted. RCTs and observational studies were synthesized in one section (Section 5), and modeling studies in a separate section (Section 6). For RCTs, synthesis was structured by comparator groups, and for observational studies by hand hygiene practices, different hand hygiene products, frequency and timing of hand hygiene and study design. Sections 7 and 8 provide a brief synthesis of population subgroups of interest, as well as sex and gender in this literature.

5 Results

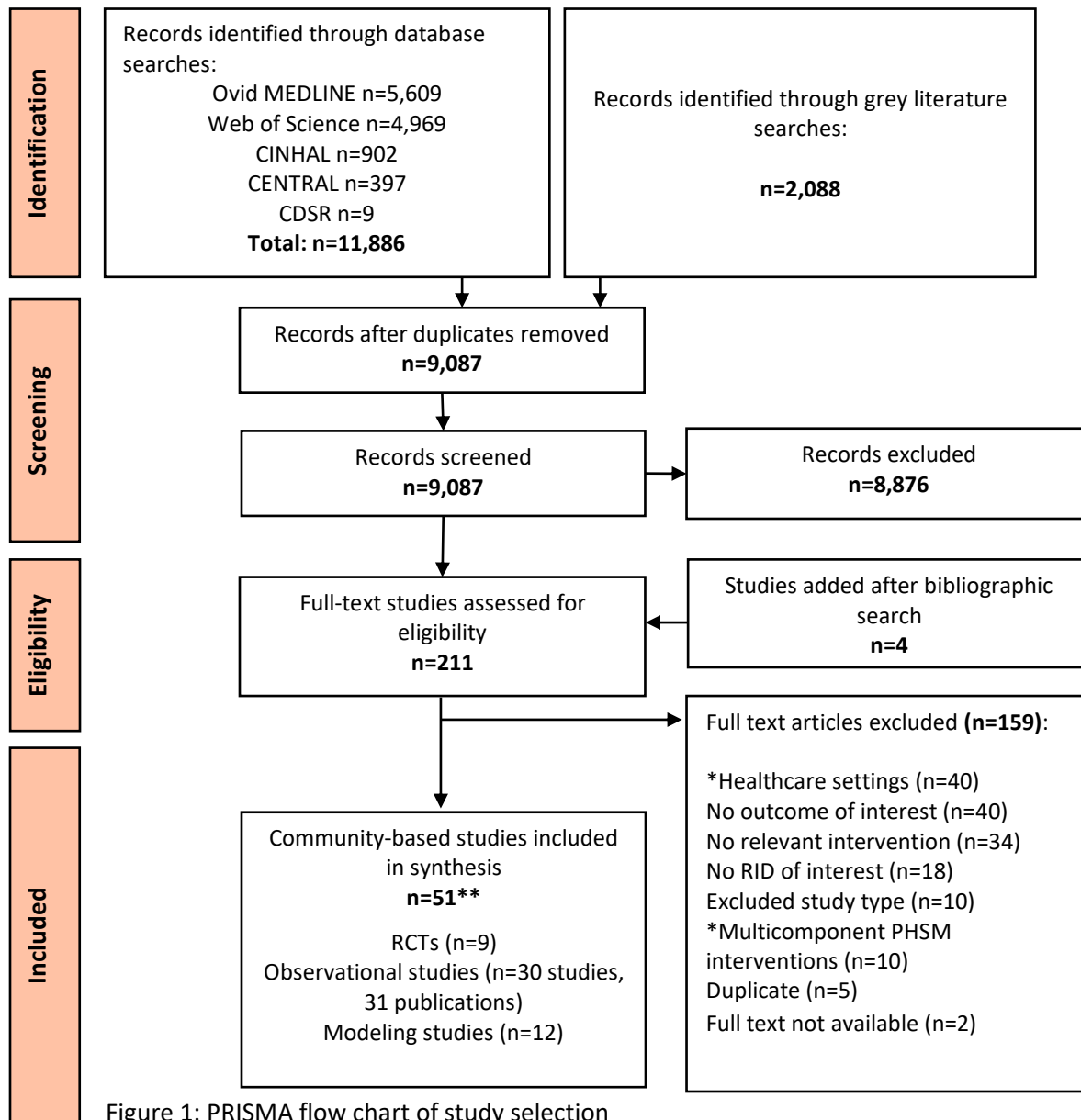


Figure 1: PRISMA flow chart of study selection

*40 excluded full text studies from healthcare settings and 10 multicomponent PHSM interventions are listed in Appendix C

**51 studies across 52 publications

The database and grey literature searches yielded 9,087 unique citations, 8,876 of which were excluded after abstract review. Two hundred and eleven studies proceeded to full text review. After excluding 159 studies at the full text review stage, 51 studies across 52 publications met the inclusion criteria, Figure 1. Reference lists of excluded studies from healthcare settings, multicomponent interventions

and the remaining studies excluded at full text review with reasons are presented in Appendix C. Fifty-one studies (52 publications) were included in the final data set, 9 RCTs¹⁴⁻²², 31 observational studies²²⁻⁵³, and 12 modeling studies⁵⁴⁻⁶⁵.

5.1 RCTs and Observational Studies

5.1.1 Characteristics of included RCTs and observational studies

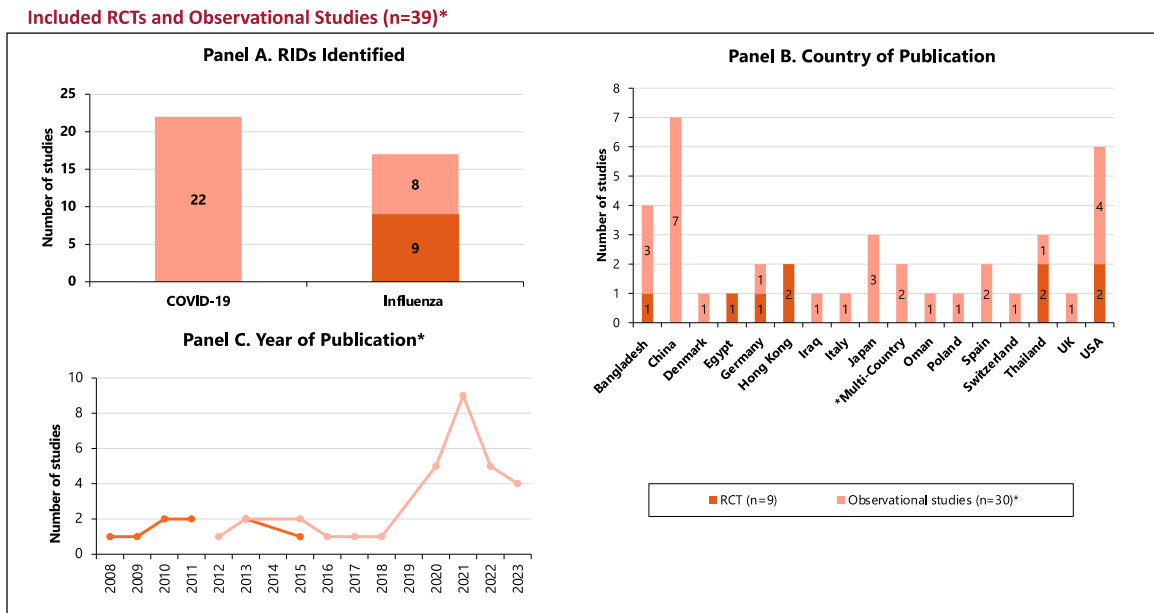


Figure 2. Characteristics of included RCTs and observational studies

Notes: *39 studies across 40 publications. Panel B: Multi-Country, one cross-sectional study⁴⁵ included participants from 14 countries: Australia, Canada, China, France, Gambia, Germany, Israel, Italy, Malaysia, Poland, Portugal, Romania, Singapore, Switzerland. One observational study³⁴ included participants from 12 unspecified West African Countries. *Panel C, study across two publications^{47,48} shown twice as published in two different years. Counted once in all other panels.

The studies assessed COVID-19 (n=22) and Influenza (n=17), Figure 2, Panel A. None of the RCTs or observational studies that met the inclusion criteria assessed measles, respiratory syncytial virus (RSV), iGAS, pneumococcus, meningococcus, *hemophilus influenzae*, or *Bordetella pertussis*. Studies were predominantly conducted in single countries, one was conducted across 14 countries⁴⁵, and one was conducted in 12 unspecified West African countries³⁴, Figure 2, Panel B. Studies were published between 2008 and 2023, with a spike in 2021, due to the COVID-19 pandemic, Figure 2, Panel C. Characteristics of all included studies are presented in Appendix D. Overall, the risk of bias in the RCTs

ranged from of concern to high, while the risk of bias in observational studies ranged from moderate to critical, Appendix E.

5.2 Randomized controlled trials comparing hand hygiene to standard practices

Box 2. Summary of findings: Hand hygiene vs. standard practices

- Five RCTs compared hand hygiene to standard practices.
- Three RCTs (two of concern, and one with a high risk of bias) reported a reduced risk of infection or transmission, and two RCTs (one of concern, one high risk) found no difference in risk between intervention and comparator groups.

Table 2. RCTs Comparing Hand Hygiene to Standard Practices

Author Year Country	Study characteristics	Results Direction of Effect*	Summary of Key Findings	Risk of bias
Azman 2013 USA	<p>Design: Cluster RCT</p> <p>RID Assessed: Influenza A and B</p> <p>Intervention: Students received training on hand hygiene practices, provision of ABHS in classrooms</p> <p>Comparator: Standard practices</p> <p>Sample: 3360 students (five schools intervention, five schools control); outcome restricted to households where the school child was the first to present (n=83 intervention, 45 control)</p> <p>Outcomes: Transmission</p>	<p>Intervention vs. control, SITP (95% CI): influenza B, restricted to households where the school child was the first to present: 0.14, (0.07-0.21) vs. 0.25 (0.11-0.37), p=0.04</p> <p>Decrease</p>	<p>No difference in infection rates between intervention and control households overall; transmission significantly lower in intervention households only for Influenza B when restricted to households where the school child was the first to present in the household</p>	High risk
Hübner 2010 Germany	<p>Design: RCT</p> <p>RID Assessed: Influenza</p> <p>Intervention: Participants advised to use supplied ABHS at least five times per day in the workplace, self-reported HH behaviours</p> <p>Comparator: Usual HH</p> <p>Sample: 129 employees from city municipality (64 intervention, 65 controls); outcome restricted to those with lab-confirmed influenza (n=3 intervention, 3 control)</p> <p>Outcomes: Infection</p>	<p>OR (95% CI): Influenza: 1.02 (0.20-5.23)</p> <p>No difference</p>	<p>No significant difference in the odds of influenza infection between intervention and comparator groups</p>	High risk
Levy 2013 Thailand	<p>Design: RCT</p> <p>RID Assessed: Influenza</p> <p>Intervention: Education, liquid soap, study nurses observed handwashing frequency of index child in the home</p>	<p>RD: (95% CI): 10.3% (1.1, 19.6), p=0.03</p> <p>Decrease</p>	<p>HW may minimize the transmission of influenza RNA in households</p>	Some concerns

	Comparator: Usual hand hygiene practices Sample: 191 households (95 intervention, 96 control) Outcomes: Transmission			
Ram 2015 Bangladesh	Design: RCT RID Assessed: Influenza Intervention: Participants educated on influenza prevention and benefits of HW, daily monitoring of use of soap and water at a central HW station Comparator: Standard practices Sample: 3,536 individuals (1,854 intervention, 1,682 control) Outcomes: Transmission	SAR ratio (95% CI): 2.40 (0.68-8.47), p=0.17; SAR: 1.24 (0.93-1.65) No difference	Intensive HW promotion had a limited impact on reducing influenza transmission	Some concerns
Talaat 2011 Egypt	Design: Cluster RCT RID Assessed: Influenza A and B Intervention: HH education, students required to wash hands at least twice a day Comparator: Observed HH activities Sample: 44,451 children from 60 elementary schools (20,882 intervention, 23,569 controls); outcome restricted to laboratory-confirmed influenza (n=125 intervention, 281 control) Outcomes: Infection	Absences caused by laboratory confirmed influenza, intervention vs. controls: -50%, p<0.0001 Decrease	Laboratory confirmed influenza decreased in intervention schools relative to control schools	Some concerns

*Green = Statistically significant decrease, Yellow = No difference.

ABHS: alcohol-based hand sanitizer; CI: confidence interval; HH: hand hygiene; HW: handwashing; MI: mean interval; OR: odds ratio; RCT: randomized control trial; RD: risk difference; RID: respiratory infectious disease; SAR: secondary attack ratio; SITP: susceptible-infectious transmission probability

Five RCTs compared interventions to increase hand hygiene to standard practices. Across the RCTs, hand hygiene interventions included a combination of education, observed frequency of hand hygiene, daily monitoring of hand washing station, and/or provision of ABHS, Table 2. All the hand hygiene interventions were compared to usual or standard practices. The risk of bias judgement in two studies were high^{22 16}, while the risk of bias judgment in the remaining three studies were of some concern, Table 2. All the studies assessed influenza. Three studies reported on infection, and two reported on transmission, Table 2. In three of the RCTs, the intervention was observed by those delivering the intervention, while the remaining two RCTs relied on self-reported adherence to the intervention^{16,22}.

The two studies that observed the intervention (risk of bias of some concern) concluded that hand hygiene significantly reduced the risk of RID-associated infection and transmission compared to controls and the third study (risk of bias of some concern) found no significant difference in transmission in the

intervention group compared to controls. In two of the studies, the hand hygiene intervention was delivered to households with a confirmed case of infection^{18,19}.

Two RCTs relied on self-reported adherence to the interventions. The first study (high risk of bias) concluded that overall, there was no difference in infection rates between intervention and control households, however transmission was significantly lower in intervention households for influenza B where the student was the index patient²². The second study (high risk of bias) found no significant difference in infection in the intervention group compared to controls¹⁶.

5.3 Randomized controlled trials comparing hand hygiene to lifestyle education

Box 3. Summary of findings: Hand hygiene vs. lifestyle education

- Four RCTs compared hand hygiene (hand hygiene education, provision of soap and ABHS) to lifestyle education (healthy diet, influenza prevention, physical activity, and smoking cessation).
- All the RCTs (one of concern, three high risk of bias) found no significant difference in transmission between the intervention and comparator groups.

Table 3. RCTs Comparing Hand Hygiene to Lifestyle Education

Author, Year, Country	Study characteristics	Results Direction of Effect*	Summary of Key Findings	Risk of bias
Cowling 2009 Hong Kong	<p>Design: Cluster RCT</p> <p>RID Assessed: Influenza</p> <p>Intervention: All household members received education on the efficacy of HH and were provided soap for the kitchen and bathroom, individual hand sanitizer, and a demonstration of proper HW</p> <p>Comparator: Healthy diet and lifestyle education</p> <p>Sample: 407 index patients positive for influenza A or B (136 households intervention, 134 households control)</p> <p>Outcomes: Transmission</p>	<p>Intervention vs. control: OR: 0.57 (0.26, 1.22); SAR (95% CI) 10 (6-14)</p> <p>No difference</p>	<p>No significant reduction in household transmission, unless the intervention was implemented early after symptom onset</p>	High risk
Cowling 2008 Hong Kong	<p>Design: Cluster RCT</p> <p>RID Assessed: Influenza</p> <p>Intervention: All household members received education on the efficacy of HH and were provided soap for the kitchen and bathroom, individual hand sanitizer, and a demonstration of proper HW</p> <p>Comparator: Healthy diet and lifestyle education</p> <p>Sample: 198 index subjects positive for influenzas A or B (36 households intervention, 127 households control)</p> <p>Outcomes: Transmission</p>	<p>Intervention vs. control OR (95% CI): 1.07 (0.29, 4.00); SAR (95% CI), control vs. HH: 0.05 (0.03, 0.10) vs. 0.06 (0.02, 0.13), p=0.99</p> <p>No difference</p>	<p>Little effect of HH on influenza transmission</p>	High risk
Larson 2010 USA	<p>Design: RCT</p> <p>RID Assessed: Influenza</p> <p>Intervention: Participants received educational materials as well as large and small ABHS</p> <p>Comparator: Educational materials on prevention and treatment of influenza</p> <p>Sample: 509 Hispanic households (205 intervention, 211 control); outcome restricted to those who tested positive for influenza (n=78)</p>	<p>Influenza rate/1,000 person weeks: education control group: 0.52; hand sanitizer group: 0.60</p> <p>No difference</p>	<p>No significant differences in infection rates were observed between the intervention groups</p>	Some concerns

Simmerman 2011 Thailand	<p>Outcomes: Transmission</p> <p>Design: RCT</p> <p>RID Assessed: Influenza</p> <p>Intervention: Participants received HH education and a hand washing kit containing a graduated dispenser with standard liquid soap</p> <p>Comparator: Education on nutrition, physical activity, smoking cessation</p> <p>Sample: Children with influenza in 465 households (155 intervention, 155 controls)</p> <p>Outcomes: Transmission</p>	<p>aOR for secondary influenza (95% CI): HW vs. control: 1.20 (0.76, 1.88), p=0.442; SAR (95% CI): control: 0.19 (0.14, 0.24); HW: 0.23 (0.18, 0.28) No difference</p>	<p>No difference in transmission of influenza between groups</p>	<p>High risk</p>
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* Yellow = No difference

ABHS: alcohol-based hand sanitizer; aOR: adjusted odds ratio; CI: confidence interval; HH: hand hygiene; HW: handwashing; OR: odds ratio; RCT: randomized control trial; RID: respiratory infectious disease; SAR: secondary attack ratio

Four RCTs compared hand hygiene to a lifestyle educational intervention. The hand hygiene interventions included an educational component, provided soap and/or ABHS to study participants, and all the interventions were observed by those delivering the intervention, Table 3. Hand hygiene interventions were compared to a lifestyle educational intervention on influenza prevention, healthy diet, smoking cessation, or physical activity with no provision of soap or ABHS. The risk of bias judgment in three of the studies were high, while the risk of bias in one was of concern, Table 3.

All four studies assessed influenza and reported on transmission. All the studies implemented the hand hygiene interventions in households with a confirmed case of infection. All the studies found no difference between the intervention and control groups, although one study¹⁴ noted that the intervention may be more effective if it was implemented soon after symptom onset, Table 3.

5.4 Observational studies assessing the practice of hand hygiene

Box 4. Summary of findings: Observational studies assessing the practice of hand hygiene

- Ten observational studies across 11 publications assessed hand hygiene practices.
- Four of the observational studies reported more than one outcome.
 - Eight observational studies (five serious, three critical risk of bias) reported a reduced risk of infection or transmission.
 - Four observational studies (one moderate, two serious, one critical risk of bias) found no difference in infection or transmission risk.
 - Two observational studies (one serious, one critical risk of bias) reported an increased risk of infection or transmission.
- It is unclear if hand hygiene practices reduce or makes no difference to the risk of RID infection or transmission.

5.4.1 Observational before and after studies

Table 4. Before and After Study Assessing Hand Hygiene Practices

Author, Year, Country	Study characteristics	Results Direction of Effect*	Summary of Key Findings	Risk of bias
Bricchi 2023 Italy	Design: Before and after cohort RID Assessed: COVID-19 Exposure: Teachers delivered standardized HH education to students, sanitizing products provided to classrooms Sample: 16,988 students; 472 elementary schools Outcomes: Infection	IR: adherent schools vs. non-adherent schools vs. regional ratio: Lombardy region: 9.6% vs. 15.4%, vs. 14.8%, p<0.001; Apulia Region: 10.7% vs. 12.3%, vs. 12.0%, p<0.001 Decrease	HH education led to lower COVID-19 infections	Critical

* Green = Statistically significant decrease

HH: hand hygiene; IR: incidence rate; RID: respiratory infectious disease

One observational before and after study²⁹ (critical risk of bias) assessed hand hygiene education, and provision of hand sanitizing products in elementary school children. The study assessors observed the hand hygiene practices, and found that hand hygiene was associated with a significant reduction in COVID-19 infection, Table 4.

5.4.2 Observational cohort studies

Table 5. Observational Cohort Study Assessing Hand Hygiene Practices

Author, Year, Country	Study characteristics	Results Direction of Effect*	Summary of Key Findings	Risk of bias
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Uchida† 2017 Japan	Design: Cohort RID Assessed: Influenza HH practices: Survey on self-reported influenza mitigation behaviours, including handwashing Sample: 10,524 children from 29 public elementary schools (2,149 exposure, 8,375 controls) Outcomes: Infection	Handwashing: OR (95% CI): 1.447 (1.274–1.644) Increase	HW had no significant protective association and was associated with an increased likelihood of developing seasonal influenza	Serious
Uchida† 2018 Japan	Design: Cohort RID Assessed: Influenza HH practices: Survey on self-reported influenza mitigation behaviours, including handwashing Sample: 10,524 children from 29 public elementary schools (2,149 exposure, 8,375 controls) Outcomes: Transmission	Rs did not correlate significantly with HW ($p=0.105$, $p=0.594$) No difference	No protective effect for HW was observed for influenza	Serious

*Yellow = No difference, Pink= statistically significant increase**

†One study across two publications

HW: handwashing; OR: odds ratio; R: reproduction number; RID: respiratory infectious disease

One observational cohort study (serious risk of bias) was reported across two publications. The study assessed self-reported hand hygiene practices to reduce the risk of infection or transmission of influenza, Table 5. In this study, all the school children washed their hands together in a communal setting. The first publication concluded that hand washing was significantly associated with an increased likelihood of influenza infection, and the second found that hand washing was not associated with any protective effect for influenza transmission^{47,48}, Table 5.

5.4.3 Observational case-control studies

Table 6. Observational Case-control Studies Assessing Hand Hygiene Practices

Author, Year, Country	Study characteristics	Results Direction of Effect*	Summary of Key Findings	Risk of bias
Doung-ngern 2020 Thailand	Design: Case-control RID Assessed: COVID-19 HH practices: Telephone survey on self-reported COVID-19 mitigating behaviors, including	aOR (95% CI), compared to no HW: sometimes: 0.34 (0.14, 0.81); often: 0.33 (0.13, 0.87), $p=0.045$ Decrease	HW significantly associated with a lower risk of COVID-19 infection	Serious

	<p>HW</p> <p>Sample: 1,050 asymptomatic contacts of COVID-19 patients (positive cases: 211, negative controls: 839)</p> <p>Outcomes: Infection</p>		
Hara 2022 Japan	<p>Design: Case-control</p> <p>RID Assessed: COVID-19</p> <p>HH practices: Survey on self-reported HH behaviours, including HW and ABHS use</p> <p>Sample: 577 (398 cases, 179 controls: contacts who did not test positive)</p> <p>Outcomes: Infection</p>	<p>OR (95% CI): HW for more than 20s each time: 0.60 (0.41–0.88) p=0.009 Decrease</p> <p>OR (95% CI): use of ABHS: 1.06 (0.60, 1.89), p=0.836 No difference</p>	<p>No significant difference was observed for the use of ABHS. HW significantly associated with reduced odds of COVID-19 infection</p> <p>Critical</p>

*Green = Statistically significant decrease, Yellow = No difference, Pink = Statistically significant increase. ABHS: alcohol-based hand sanitizer; aOR: adjusted odds ratio; CI: confidence interval; HH: hand hygiene; HW: handwashing; IRR: incidence risk ratio; MI: mean incidence; OR: odds ratio; RCT: randomized control trial; RID: respiratory infectious disease

Two case-control assessed self-reported hand hygiene practices to reduce the risk of COVID-19 infection. The first study with a serious risk of bias assessment concluded that hand washing compared to no hand washing, or hand washing often was associated with a lower risk of COVID-19 infection³³, Table 6. The second study with a critical risk of bias assessment found that hand washing for at least 20 seconds significantly reduced odds of infection while no difference was observed for the use of ABHS³⁶, Table 6.

5.4.4 Observational cross-sectional studies

Table 7. Cross-sectional Studies Assessing Hand Hygiene Practices

Author, Year, Country	Study characteristics	Results Direction of Effect*	Summary of Key Findings	Risk of bias
Abd 2021 Iraq	<p>Design: Cross-sectional</p> <p>RID Assessed: COVID-19</p> <p>HH practices: Survey on self-reported COVID-19 mitigation behaviours, including HW</p> <p>Sample: 348 adults</p> <p>Outcomes: Infection</p>	<p>HW: 28% infected vs. 54% of healthy, p<0.001; Pearson correlation: -0.245, p<0.001 Decrease</p>	<p>Self-reported hand washing was significantly lower in those with infection compared to those without</p>	<p>Serious</p>
Ahmed 2022 Bangladesh	<p>Design: Cross-sectional</p> <p>RID Assessed: COVID-19</p> <p>HH practices: Secondary analysis of survey on self-reported HW, defined as having (1) a specific place for HW, (2) water available for HW, and (3) soap or detergent present at the place of HW</p> <p>Sample: 64,400 survey</p>	<p>Areas hardest hit by COVID-19 had approx. 50% hand washing coverage, compared to over 80% in areas least affected Decrease</p>	<p>Cases increased at a higher pace where self-reported household HW was low; the district with the highest coverage of household HW had the lowest COVID-19 cases</p>	<p>Serious</p>

	participants Outcomes: Infection			
Al Lawati 2023 Oman	Design: Cross-sectional RID Assessed: COVID-19 HH practices: Survey on self-reported COVID-19 mitigation behaviours, including handwashing Sample: 139 Pilgrims who underwent PCR testing, only 4 of which tested positive Outcomes: Infection	No difference in hand sanitizer use in those who reported testing positive compared to those who did not p=0.661 No difference	No association between self-reported hand hygiene and COVID-19 infection	Moderate
Badri 2021 USA	Design: Cross-sectional RID Assessed: COVID-19 HH practices: Survey on self-reported COVID-19 mitigation behaviours, including handwashing Sample: 314 adults (209 cases, 105 controls) Outcomes: Infection	aOR (95% CI): hand sanitizer use: 0.26 (0.13-0.53) Decrease aOR (95% CI): washed hands often: 0.55 (0.21-1.44) No difference	Self-reported AHBS use decreased odds of testing positive for COVID-19, but self-reported hand washing did not	Serious
Szczuka 2021 Multi-country **	Design: Cross-sectional RID Assessed: COVID-19 HH practices: Survey on self-reported HW behaviors Sample: 6,064 adults Outcomes: Infection, mortality	Higher HW adherence associated with lower levels of COVID infections and mortality compared to beginning of the pandemic Decrease Increase in recent (2-week) cases of COVID morbidity/mortality was associated with higher levels of HW adherence Increase	Association of self-reported HW and COVID-19 infection was not clear	Critical
Xu 2020 China	Design: Cross-sectional RID Assessed: COVID-19 HH practices: Self-reported knowledge of and adherence to handwashing, proper coughing habits, social distancing and mask wearing Sample: 8,158 adults Outcomes: Infection	Infection risk (%); RR (95% CI): did not wash their hands vs. did: 2.28% vs 0.65%; 3.53 (1.53-8.15), p=0.009 Decrease	There was a significantly increased risk of COVID-19 infection for those who reported not washing their hands	Serious

*Green = Statistically significant decrease, Yellow = No difference

aOR: adjusted odds ratio; CI: confidence interval; HH: hand hygiene; HW: handwashing; OR: odds ratio; RCT: randomized control trial; RID: respiratory infectious disease; RR: risk ratio. **Australia, Canada, China, France, Gambia, Germany, Israel, Italy, Malaysia, Poland, Portugal, Romania, Singapore, Switzerland.

Six cross-sectional studies assessed self-reported hand hygiene practices to reduce the risk of COVID-19 infection, Table 7.

Three studies (serious risk of bias) found that hand hygiene practices were significantly associated with a significant reduction in infection^{23,37,66}. One study (critical risk of bias) found that higher handwashing was associated with reduced risk of infections and mortality but increase in recent cases of COVID

infections and mortality was associated with higher levels of hand washing⁴⁵. One study (moderate risk of bias) found no difference in infection risk between groups²⁴, Table 7. The remaining study with a serious risk of bias assessment concluded that the use of ABHS reduced the odds of testing positive for COVID-19 infection, but found no significant difference for handwashing²⁶, Table 7.

5.5 Studies comparing hand hygiene products

Box 5. Summary of findings: Studies comparing hand hygiene products

- One observational study with a critical risk of bias assessment compared different hand hygiene products.
- The study found that hand hygiene with soap powder, 0.05% or 0.25% of active chlorine is comparable in eliminating influenza viruses from hands.

Table 8. Studies Comparing Hand Hygiene Products

Author, Year, Country	Study characteristics	Results Direction of Effect*	Summary of Key Findings	Risk of bias
Ma 2020 China	<p>Design: Before and after cohort</p> <p>RID Assessed: Influenza (Avian)</p> <p>Exposure: Wiping hands with towel soaked in soap, or 0.05% or 0.25% active chlorine</p> <p>Sample: Individuals exposed to low pathogenic avian flu virus</p> <p>Outcomes: Eliminating RIDs from hands</p>	<p>Removal percentage (95% CI): soap powder: 98.36% (96.11% to 99.31%); 0.05% Active Chlorine: 96.62% (94.37% to 97.97%); 0.25% Active Chlorine from Sodium Hypochlorite: 99.98% (99.94% to 99.99%)</p> <p>Decrease</p>	<p>Hand wiping with a wet towel soaked in water containing soap powder, active chlorine, or active chlorine from sodium hypochlorite is highly effective in reducing the presence of the Avian Influenza Virus on hands</p>	Critical

*Green = Statistically significant decrease, ABHS: alcohol-based hand sanitizer; CI: confidence interval; HH: hand hygiene; HW: handwashing; IRR: incidence risk ratio; MI: mean incidence; OR: odds ratio; RCT: randomized control trial; RID: respiratory infectious disease

One before and after study compared different soaps (active chlorine, and soap powder) to eliminate RID pathogens from hands, Table 8. The study was assessed at a critical risk of bias, was observed by the study assessors. The study concluded that different hand soap products were comparably effective in eliminating influenza pathogens from hands⁴¹, Table 8.

5.6 Studies comparing the frequency of hand hygiene

Box 6. Summary of findings: Studies comparing the frequency of hand hygiene

- Fourteen observational studies compared different frequencies of hand hygiene. Two studies

reported more than one outcome.

- Eleven studies (one moderate risk, seven serious risk, three critical risk of bias) found that higher rates of hand hygiene were significantly associated with a reduced risk of infection and transmission.
- Five studies (one moderate risk, four serious risk of bias) found that higher rates of hand hygiene were not significantly associated with a reduced risk of infection or mortality compared to lower rates.
- One study (serious risk) found that frequent hand hygiene was associated with a higher risk of infection.
- It is unclear if the frequency of hand hygiene reduces or makes no difference to the infection or transmission risk.

Fourteen observational studies compared different frequencies of hand hygiene practices: one before and after study, one cohort study, eight case-controlled studies, and four cross-sectional studies.

Table 9. Studies Comparing the Frequency of Hand Hygiene

Author, Year, Country	Study characteristics	Results Direction of Effect*	Summary of Key Findings	Risk of bias
Baumkotter 2022 Germany	Design: Before and after RID Assessed: COVID-19 HH practices: Survey on self-reported mitigation behaviors at baseline, and follow up Sample: 10,250 adults Outcomes: Infection	Incidence: log-rank p=0.66; infection risk in relation to frequency of HW: prevalence ratio, 95% CI: (1.08, 0.88-1.34), p=0.46; aOR: 1.12, (0.88, 1.44) p=0.36 No difference	Self-reported HH was not a protective factor in reducing COVID-19 transmission and infection	Serious
Baretta 2023 Switzerland	Design: Cohort RID Assessed: COVID-19 Exposure: HH education, self-reported frequency of correct hand hygiene Sample: 216 adults Outcomes: Infection, mortality	Correct HH beta (SE), total cumulative cases: 0.02 (0.03), -0.03, 0.07, not significant No difference Correct HH beta (SE), recent new cases: 0.08 (0.02), 0.03, 0.13, p<0.05 Decrease Correct HH beta (SE), recent change in cases: 0.05 (0.02), 0.01, 0.09, p<0.05 Decrease Correct HH beta (SE), total cumulative deaths: 0.03 (0.03), -0.20, 0.08, not significant No difference Correct HH beta (SE), recent new deaths: 0.07 (0.03), 0.02, 0.12, p<0.05 Decrease	No significant association between changes in self-reported HH and total cumulative COVID-19 cases and deaths, and 2-week change in COVID-19 cases and deaths	Serious

		Correct HH beta (SE), recent change in deaths: 0.06 (0.02), 0.02, 0.10, p<0.05 Decrease		
Cajar 2022 Denmark	Design: Case-control RID Assessed: COVID-19 HH practices: Online survey on self-reported COVID-19 community exposure activities and mitigating behaviors, including HW and hand sanitizer use Sample: 93,121 (11,854 cases, and 81,267 matched negative and untested controls) Outcomes: Infection	IRR, negative control: hand sanitizer use: 0.79, p<0.001 Decrease IRR, untested control: hand sanitizer use: 0.98, p=0.58 No difference IRR, negative control: HW: 1.09, p=0.0087 Increase IRR, untested control: HW: 1.30, p<0.001 Increase	ABHS associated with lower rate of infection; frequent HW associated with a higher risk	Serious
Castilla 2012 Spain	Design: Case-control RID Assessed: Influenza A HH practices: Participants interviewed on infection prevention measures Sample: 962 (481 cases, and 481 matched controls) Outcomes: Infection	aOR (95% CI): HW ≤4 x/day vs: 5-10 x: 0.87 (0.54, 1.39), p=0.55; > 10 x/day: 0.98 (0.59, 1.64), p=0.936; after touching surfaces, frequently vs. occasionally: 0.70 (0.44, 1.11), p=0.132; ABHS frequently vs. occasionally: 1.36 (0.85, 2.19), p=0.20 No difference	Self-reported HW after touching contaminated surfaces was associated with a non-significantly lower risk of infection; frequency of self-reported HW and ABHS had no significant protective effect	Serious
Doshi 2015 Bangladesh	Design: Case-control RID Assessed: Influenza Exposure: Observed handwashing behaviour, 4 home visits, provision of soap, questionnaires on HW Sample: 486 children (cases 145, matched controls 341) Outcomes: Infection	Case vs. controls, OR (95% CI): HW events per household: 1.06 (0.90-1.24), p=0.49; HW events by caregiver: 1.01 (0.87-1.18), p=0.86; HW events following HW opportunities: 1.13 (0.94-1.36), p=0.21 No difference	No association between any self-reported HW measures and influenza infection	Moderate
Doung- ngern 2020 Thailand	Design: Case-control RID Assessed: COVID-19 HH practices: Survey on self-reported behaviors Sample: 1,050 asymptomatic contacts of COVID-19 patients (positive cases: 211, negative controls: 839) Outcomes: Infection	aOR (95% CI), compared to no HW: sometimes: 0.34 (0.14, 0.81); often: 0.33 (0.13, 0.87), p=0.045 Decrease	Self-reported HW significantly associated with a lower risk for COVID-19	Serious
Liu 2016 China	Design: Case-control RID Assessed: Influenza HH practices: Telephone survey on self-reported HW behaviors during key times; scoring system created to quantify HW frequency Sample: 200 (100 cases, 100 matched controls) Outcomes: Transmission	ORs decreased as hand-washing scores improved, 0.26 to 0.029, p<0.001 Decrease	Higher hand-washing scores and better self-reported hygienic habits were associated with reduced odds of influenza infection	Serious

Liu 2021 USA	<p>Design: Case-control RID Assessed: COVID-19 HH practices: Self-reported frequency of increased HW or ABHS Sample: 65 individuals (cases: 15 children, controls 50 household contacts) Outcomes: Transmission</p>	SAR % (95% CI): increase HW or ABHS: 19 (9-36), p=0.01 Decrease	Increased self-reported HW or hand sanitizer use had a significantly lower SAR compared to those who did not	Critical
Torner 2015 Spain	<p>Design: Case-control RID Assessed: Influenza A HH practices: Structured interview on NPIs, including frequency of HW and hand sanitizer use Sample: 478 individuals (239 cases, 239 matched controls) Outcomes: Infection</p>	aOR (95% CI): frequent HW more than 5 times per day: 0.62 (0.39 – 0.99), p=0.04 Decrease	Frequent self-reported HW (more than 5 times per day) was a significant protective factor for influenza	Critical
Zhang 2013 China	<p>Design: Case-control RID Assessed: Influenza A HH practices: Structured interview on medical history and mitigation behaviors Sample: 162 households with self-quarantined index patient at home (54 case households also with secondary case, 108 control households) Outcomes: Transmission</p>	OR (95% CI): HW ≥3 times/day vs. <3/day: 0.71 (0.48-0.94), p=0.05 Decrease	Self-reported HW frequency was significantly associated with reduced household transmission of pandemic H1N1	Serious
Folayan 2022 12 West African Countries**	<p>Design: Cross-sectional RID Assessed: COVID-19 HH practices: Survey of self-reported HH behaviors Sample: 5,050 adults Outcomes: Infection</p>	Difficulty washing hands often, aOR (95% CI): testing positive for COVID-19: 0.773 (0.659-0.907), p=0.002 Decrease	Participants who had difficulty washing their hands often were more likely to test positive for COVID-19 than not	Serious
Karout 2020 USA	<p>Design: Cross-sectional RID Assessed: COVID-19 HH practices: Questionnaire on social and precautionary behaviors, including HW and hand sanitizer use Sample: 410 asymptomatic Latino adults who underwent PCR testing (76 cases, 334 controls) Outcomes: Infection</p>	HW or ABHS: cases: never: 48.7%; sometimes: 31.6%; always: 19.7%; controls: never: 0%; sometimes: 78.7%; and always: 21.3%, p<0.001 Decrease	Cases were significantly less likely to self-report washing their hands or using hand sanitizer compared to controls	Critical
Sharif 2021 Bangladesh	<p>Design: Cross-sectional RID Assessed: COVID-19 HH practices: Self-reported frequency of HH practices Sample: 1,690 individuals in urban and rural areas Outcomes: Infection, hospitalization, mortality</p>	Washing and cleaning hands with soaps/ABHS: reduced risk of infection, aOR: 0.46, 95% CI: 0.27–0.97 (p =.005), hospitalization (p=0.02), ICU admission (p=0.05) and death (p=0.005) Decrease	Appropriate self-reported HW contributed to a decreased risk of infection	Moderate

Xie 2021 China	Design: Cross-sectional RID Assessed: COVID-19 HH practices: Questionnaire of self-reported HW behaviors Sample: 99 household contacts of individuals with COVID-19 Outcomes: Infection	Infection risk: HW \geq 5 times/day: 52.8% vs. 76.9%, p=0.04 Decrease	Self-reported HW \geq 5 times/day was associated with reduced infection risk	Serious
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*Green = Statistically significant decrease, Yellow = No difference. ** Countries not specified.

ABHS: alcohol-based hand sanitizer; aOR: adjusted odds ratio; CI: confidence interval; HH: hand hygiene; HW: handwashing; OR: odds ratio; RID: respiratory infectious disease; SAR: secondary attack ratio; SE: standard error

Two of the studies assessed a hand hygiene exposure (education)⁶⁷ and (home visits)³², while the remaining 12 studies assessed self-reported hand hygiene practices. Hand hygiene was observed in one study³², Table 9.

The before and after study (serious risk of bias), and found no protective effect of handwashing based on frequency (0-5 times, 5-10 times, and >10 times per day)²⁸. The cohort study (serious risk of bias), concluded that hand hygiene significantly reduced recent new COVID-19 cases and deaths, but found no association between hand hygiene rates and total cumulative COVID-19 cases or deaths²⁷, Table 9.

Five of the case-control studies assessed influenza, while the remaining three assessed COVID-19.

Five of the studies (three serious risk, two critical risk of bias) concluded that increased rates of hand hygiene practices were significantly associated with a lower risk of infection or transmission^{33,39,40,46,51}.

One case-control study³² (moderate risk of bias) observed hand hygiene during home visits and found no difference in infection risk, while the second study⁶⁸ (critical risk of bias) found that the frequency of hand hygiene made no difference to infection risk, Table 9. One case-control study (serious risk of bias) found that the use of ABHS was associated with a reduced risk of infection, while hand washing was associated with an increased risk³⁰. This study was a large online survey and included individuals in high-risk occupations (healthcare, social care, and education) who were both susceptible to infection and reported that they practiced hand hygiene more frequently, although specific rates of hand hygiene (e.g., five times a day) was not reported.

The four cross-sectional studies assessed COVID-19. All the cross-sectional studies^{34,42,49,52} (one moderate risk, two serious risk, one critical risk of bias) found that those who washed their hands or used ABHS more frequently had a significantly reduced risk of infection and transmission, Table 9.

5.7 Studies comparing the timing of hand hygiene

Box 7. Summary of findings: Studies comparing the timing of hand hygiene

- Eight observational studies assessed the timing of hand hygiene.
- Three of the studies (two serious, one critical risk of bias) found that hand hygiene after arriving home, sneezing, or coughing, or before and after meals is associated with a reduced risk of infection and transmission, and three studies (two serious risk, one critical risk of bias) found no difference in risk.
- One study (serious risk of bias) found that hand washing or use of ABHS when going outdoors and after touching frequently touched surfaces was associated with a higher area incidence rate of infection.
- One study (moderate risk of bias) reported two outcomes and found that washing hands after arriving home was associated with a reduced odds of infection but washing hands before eating increased odds of infection.
- It is unclear if the timing of hand hygiene reduces the risk of infection or transmission or makes no difference.

Eight studies assessed the timing of hand hygiene practices: six case-control studies and two cross-sectional studies, Table 10. These studies compared the timing of hand hygiene practices before or after performing various activities or after touching frequently touched surfaces to reduce the risk of infection or transmission.

Table 10. Studies Comparing the Timing of Hand Hygiene Practices

Author, Year, Country	Study characteristics	Results Direction of Effect*	Summary of Key Findings	Risk of bias
Anan 2021 Japan	Design: Cross-sectional survey RID Assessed: COVID-19 HH practices: Self-reported mitigation behaviours Sample: 27,036 full time workers Outcomes: Infection	OR (95% CI), Region highest infection rates vs. region with lowest infection rates: ABHS when going outdoors: 1.17 (1.01-1.35, p<0.001); ABHS or HW after touching frequently touched surfaces: 1.33 (1.18-1.51, p<0.001); carrying ABHS when going out: 1.32 (1.17-1.49, p<0.001)	Self-reported ABHS or HW when going outdoors, after touching high touch surfaces, and carrying ABHS were associated with higher area incidence rate of infection.	Serious

		Increase		
Castilla 2012 Spain	Design: Case-control RID Assessed: Influenza A HH practices: Participants interviewed on infection prevention measures Sample: 962 (481 cases, and 481 matched controls) Outcomes: Infection	aOR (95% CI): HW ≤4 x/day vs: 5-10 x: 0.87 (0.54, 1.39), p=0.55; > 10 x/day: 0.98 (0.59, 1.64), p=0.936; after touching surfaces, frequently vs. occasionally: 0.70 (0.44, 1.11), p=0.132; ABHS frequently vs. occasionally: 1.36 (0.85, 2.19), p=0.20 No difference	Self-reported HW after touching contaminated surfaces was associated with a non-significantly lower risk of infection; frequency of HW and ABHS had no significant protective effect	Serious
Francis 2023 UK	Design: Case-control RID Assessed: COVID-19 HH practices: Survey on self-reported use of NPIs two weeks before illness, and two weeks before study Sample: 27,758 adults (2,814 cases, 24,944 controls) Outcomes: Infection	Association between NPI and COVID-19 infection, OR (95% CI): HW when arriving home: 0.57 (0.46, 0.73) Decrease Association between NPI and COVID-19 infection, OR (95% CI): HW before eating: 1.65 (1.31, 20.6) Increase	Self-reported HW when arriving home was associated with reduced odds of infection; self-reported HW before eating was associated with increased odds of infection	Moderate
Lio 2021 China	Design: Case-control RID Assessed: COVID-19 HH practices: Survey on self-reported HW behaviours in different scenarios Sample: 1,137 patients with COVID-19 and travellers from high-risk countries undergoing quarantine (24 cases, 1,113 controls) Outcomes: Infection	OR (95% CI), HW: after outdoor activity: 0.027 (0.007–0.104), p<0.005; after sneezing or coughing: 0.286 (0.127–0.648), p<0.005; before touching the mouth and nose area: 0.156 (0.069–0.353), p<0.005 Decrease	Proper self-reported HW habits showed protective effects on COVID-19 infection	Serious
Liu 2016 China	Design: Case-control RID Assessed: Influenza HH practices: Telephone survey on self-reported HW behaviors during key times; scoring system created to quantify HW frequency Sample: 200 (100 cases, 100 matched controls) Outcomes: Transmission	ORs decreased as hand-washing scores improved, 0.26 to 0.029, p<0.001 Decrease	Higher hand-washing scores and better self-reported hygienic habits were associated with reduced odds of influenza infection	Serious
Skolmowska 2020 Poland	Design: Cross-sectional RID Assessed: Covid-19 HH practices: Self-reported HH behaviours during specific scenarios Sample: 1,222 adolescents Outcomes: Transmission	HW circumstances associated with lower COVID-19 morbidity: always washing hands before meals (p=0.0196), after meals (p=0.0041), after preparing meals (p=0.0297), before using the restroom (p=0.0068), after using the restroom (p=0.0014), after combing hair (p=0.0298), after handshaking (p=0.0373), after touching animals (p=0.0007),	Individuals residing in regions with lower COVID-19 morbidity exhibited better self-reported HH practices than those in regions with higher COVID-19 morbidity	Critical

		after contacting babies (p=0.0278), after blowing nose (p=0.0435), after touching sick people (p=0.0351), after removing watch and bracelets (p=0.0052), removing rings before or during handwashing (p=0.0318), drying hands with towel (p=0.0031) Decrease		
Speaker 2021 USA	Design: Case-control RID Assessed: COVID-19 HH practices: Survey on self-reported social HH behaviours Sample: 339 adults (113 cases, 226 matched controls) Outcomes: Infection	HW rates, cases vs. negative controls: HW/sanitizing hands after possible exposure: 67% vs. 63%, p=0.24; for at least 20 seconds: 75% vs. 74%, p=0.60 No difference	No significant difference in rates of self-reported HH after possible exposure or for at least 20 seconds between cases compared to negative controls	Critical
Zhang 2013 China	Design: Case-control RID Assessed: Influenza A HH practices: Structured interview on self-reported HH behaviours Sample: 41 passengers on a flight from New York to China (9 cases, 32 controls) Outcomes: Infection	OR (95% CI): cleaning hands before eating: 0.83 (0.06–49.00), p=0.55 No difference	Self-reported HH was not significantly associated with being a case passenger	Serious

*Green = Statistically significant decrease, Pink = Statistically significant increase; Yellow = No difference.

ABHS: alcohol-based hand sanitizer; aOR: adjusted odds ratio; CI: confidence interval; HH: hand hygiene; HW: handwashing; NPI: non-pharmaceutical intervention; OR: odds ratio; RID: respiratory infectious disease

Three of the case-control studies assessed COVID-19, and the remaining three assessed influenza. Two of the studies (serious risk of bias) found that handwashing after returning home or outdoor activities, before touching the mouth or nose, and improved hygiene habits were significantly associated with reduced odds of infection^{38,39}. One study (serious risk of bias) concluded that handwashing after touching contaminated surfaces was associated with a non-significant lower risk of infection⁶⁸, and two studies (one serious risk, one critical risk of bias) found no significant difference in infection risk^{44,53}. One study (moderate risk of bias) concluded that hand washing when arriving home was associated with a reduced odds of infection, but hand washing before eating was associated with an increased odds of infection³⁵, Table 10.

The two cross-sectional studies assessed COVID-19 and reported on infection and transmission. One study²⁵ (serious risk of bias) concluded that those who lived in regions with the highest infection rates were more likely to practice hand hygiene after going outdoors or touching frequently touched surfaces.

The second study with a critical risk of bias assessment concluded that individuals who lived in areas with lower COVID-19 morbidity had better hand washing practices compared to those who lived in areas with higher morbidity⁴³, Table 10.

6 Modeling studies

Box 8. Summary of findings: Modeling studies

- Twelve modeling studies were included in the final dataset.
- The findings from the modeling studies were varied, and comparable to the findings from the RCTs and observational studies.
- Ten of the studies assessed the practice of hand hygiene to reduce the risk of RID infection or mortality
- Eight of the studies concluded that the practice of hand hygiene significantly reduced the risk of RID-associated transmission and infection, one study found no difference in the risk of infection or mortality, and one study found that hand hygiene practices were associated with an increased risk of RID transmission.
- Two studies assessed the frequency of hand hygiene; one found that increased hand hygiene was associated with a reduced risk of RID-associated infection, while the second study found no difference in the risk of transmission.
- One study assessed the timing of hand hygiene practices and concluded that increased and appropriately timed hand hygiene practices may significantly reduce the risk of infection.

6.1 Characteristics of included modeling studies

Included Modelling Studies (n=12)

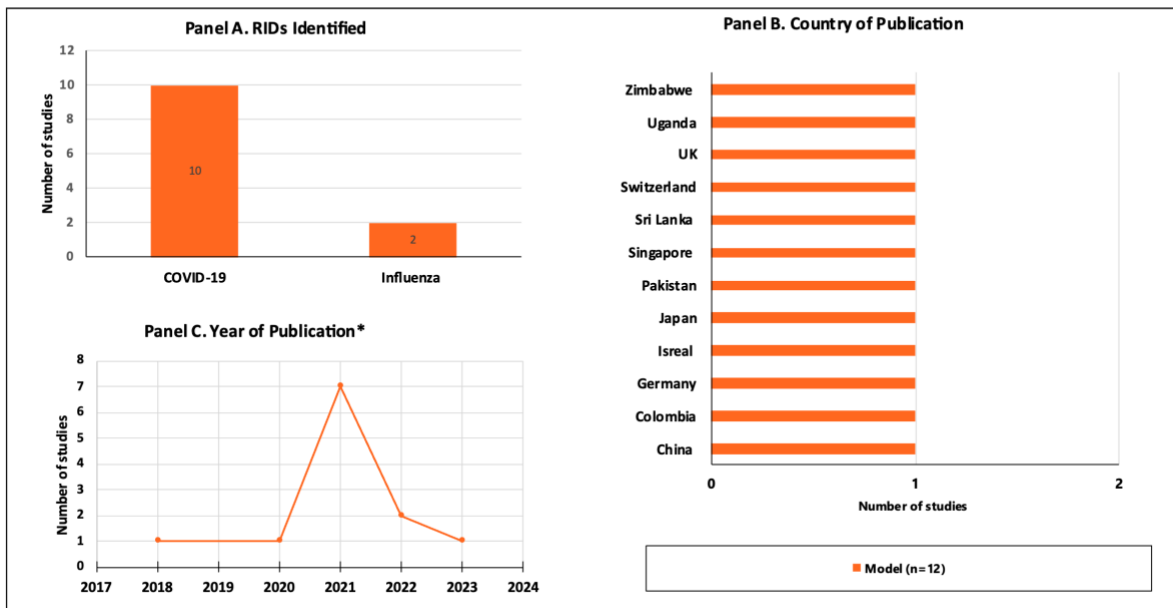


Figure 3. Characteristics of Included Modeling Studies

Ten of the modeling studies assessed COVID-19, while the remaining two assessed influenza, Figure 3, Panel A. None of the modeling studies that met our inclusion criteria assessed measles, RSV, iGAS, pneumococcus, meningococcus, *hemophilus influenzae*, and *bordetella pertussis*. One study each was conducted in China, Colombia, Germany, Israel, Japan, Pakistan, Singapore, Sri-Lanka, Switzerland, the United Kingdom, Uganda, and Zimbabwe, Figure 3, Panel B. The studies were published between 2018 and 2023, with a spike in publication observed in 2021 due to the COVID-19 pandemic, Figure 3, Panel C. Additional characteristics of the modeling studies are included in Appendix D.

Ten of the studies assessed hand hygiene practices, one study compared the frequency of hand hygiene practices, and one study compared both the timing and frequency of hand hygiene practices. Risk of bias assessments were not conducted for these studies.

6.2 Results

6.2.1 Modeling studies on hand hygiene practices

Table 11. Modeling studies on Hand Hygiene Practices

Author, Year, Country	Study characteristics	Results Direction of Effect*	Summary of Key Findings
Alvarez-Pomar 2021 Colombia	Design: Model RID Assessed: COVID-19 Objective: Comparing effect of various NPIs (i.e., social distancing, mask wearing, HW) Outcomes: Infection, mortality	No difference	With no social distancing or mask wearing, HW has no effect on flattening the curve, mortality, or confirmed cases
Brüggenjürgen 2021 Germany	Design: Model RID Assessed: COVID-19 Objective: SEIR model, impact of NPIs (i.e., test and isolate, social distancing, masking, HH) on COVID-19 transmission Outcomes: Transmission	Estimated effectiveness: 4% Decrease	Estimated effectiveness of HH was the lowest of all NPIs (keeping distance, test and isolate, masking, closure of restaurants)
Endo 2021 Japan	Design: Model RID Assessed: COVID-19 Objective: Effect of NPIs (i.e., masking, vaccination, HW) on within-school transmission Outcomes: Transmission	Median estimates (95% credible intervals): relative susceptibility to COVID-19 infection and HW: 1.54 (1.36-1.75); relative infectiousness: 1.27 (0.91-1.72) Increase	HW was associated with increased susceptibility to COVID-19
Ghoroghi 2022 UK	Design: Model RID Assessed: COVID-19 Objective: Indoor effectiveness of NPIs (i.e., masking, HH, vaccination, ventilation) Outcomes: Transmission	For 50% of individuals performing HH, 18% reduction in the mean probability of secondary infected individuals; for 70% performing HH, 27% reduction, and if 100% perform HH, there is a 38% reduction Decrease	The larger the number of individuals performing HH, the lower the mean probability of secondary infected individuals
Jayaweera 2021 Sri Lanka	Design: Model RID Assessed: COVID-19 Objective: NPIs (i.e., social distancing, lockdown and isolation, contact tracing, masking, quarantine) transmission model	Mean Rts for HH was 3.88% compared to baseline Decrease	Enhancing HH measures has a modest positive impact on reducing the effective reproduction number

	Outcomes: Transmission		
Joseph 2023 Zimbabwe	Design: Model RID Assessed: COVID-19 Objective: Modeling handwashing access Outcomes: Transmission	MP: Improved HW access: 0.39 to 0.32; with perfect HW: 0.39 to 0.15; perfect access to HW facilities: 0.025 Decrease	Increasing access to HW facilities can reduce the prevalence of respiratory illness
Nannyonga 2021 Uganda	Design: Model RID Assessed: COVID-19 Objective: Modeling effectiveness of NPIs (i.e., masking, shielding vulnerable populations, HW, physical distancing) at reducing transmission Outcomes: Transmission	Decrease	Coverage of handwashing at least 6x/day to reduce SAR to less than 1 is 70%, current coverage was around 26%
Pham 2022 Singapore	Design: Model RID Assessed: Influenza Objective: HH approaches on infection probability Outcomes: Infection	Probability of infection: no HW: 10%; every 15 min: 6%; one minute after hand contamination events: 2% Decrease	Event-prompted HW is more effective than fixed-time HW in reducing the probability of infection
Pitol 2021 Switzerland	Design: Model RID Assessed: COVID-19 Objective: Modeling effectiveness of HH to reduce virus concentration on hands Outcomes: Transmission	Decrease	Hand disinfection substantially reduces risks of transmission independent of the disease's prevalence and contact frequency
Zamir 2020 Pakistan	Design: Model RID Assessed: COVID-19 Objective: Assessing NPIs (i.e., lockdown, masking, HW, hand sanitizer) for optimal control of COVID-19 Outcomes: Transmission	Decrease	The mandatory use of sanitizer proves an essential effect in minimizing the transmission risk after 150 days compared to 250 days for HW

*Green = Statistically significant decrease, Pink= Statistically significant increase, Yellow = No difference.

HH: hand hygiene; HW: handwashing; MP: mean prevalence; NPI: non-pharmaceutical intervention; RID: respiratory infectious disease; Rts: time-varying reproduction number

Ten modeling studies assessed the effect of hand hygiene practices on risk of infection, transmission, or mortality. Nine studies assessed COVID-19 while one assessed influenza. Eight studies reported on transmission, one on infection, and one on infection and mortality. Eight of the studies concluded that hand hygiene practices decreased the risk of infection or transmission^{57-62,64 69}, one found no difference in the risk of infection or mortality⁵⁵, and one found that hand hygiene practices increased infection risk⁵⁶, Table 11.

6.2.2 Modeling studies comparing the frequency of hand hygiene

Table 12. Modeling studies comparing the frequency of hand hygiene

Author, Year, Country	Study characteristics	Results Direction of Effect*	Summary of Key Findings
Arav 2021 Israel	Design: Model RID Assessed: COVID-19 Objective: Household transmission and impact of hygiene and behavioural measures on transmission Outcomes: Transmission	OR (95% CI): washing hands once per hour vs. 3 times a day: 0.72 (0.67–0.8) Decrease	HW once per hour vs. three times a day reduces the risk of infection
Zhang 2018 China	Design: Model RID Assessed: Influenza A Objective: Transmission model assessing long-range airborne, fomite and close contact Comparator: Sample: N/A Outcomes: Transmission	No difference	Infection risk can be reduced if HW frequency is greater than six times per hour; however, HW alone is limited to reduce infection risk

*Green = Statistically significant decrease, Yellow = No difference.

CI: confidence interval; HH: hand hygiene; OR: odds ratio; RID: respiratory infectious disease

Two modeling studies compared the frequency of hand hygiene practices, and both studies reported on transmission. One study concluded that frequent hand washing (once per hour vs. three times per day) reduces infection risk⁶³, while the second study found no difference in transmission risk⁵⁴, Table 12.

6.2.3 Modeling studies comparing the timing of hand hygiene

Table 13. Modeling studies comparing the timing of hand hygiene

Author, Year, Country	Study characteristics	Results Direction of Effect*	Summary of Key Findings
Arav 2021 Israel	Design: Model RID Assessed: COVID-19 Objective: Household transmission and impact of hygiene and behavioural measures on transmission Outcomes: Transmission	Decrease	HW every 30-40 mins governed by contact events on fomites and face may reduce the risk of infection

*Green = Statistically significant decrease.

CI: confidence interval; HH: hand hygiene; OR: odds ratio; RID: respiratory infectious disease

One study compared the timing of hand hygiene practices and reported on COVID-19, Table 13. The study concluded that hand washing governed by contact events on surfaces that are likely to be contaminated with infectious pathogens may significantly reduce the risk of infection⁶³.

7 Population subgroups of interest

This review included a diverse body of literature in various community settings. Studies focused on children in schools ^{22,29} and households, ^{18,32} university students ⁵⁷, Omani pilgrims ²⁴, government employees ¹⁶, Latino adults from a religious community ⁵², airline passengers ⁵³, Hispanic households ¹⁷, and Black and Hispanic adults ²⁶. However, none of the studies that included participants from the general population stratified either adherence to hand hygiene or outcomes by a population group of interest. In the studies that included children, two studies stratified outcomes by younger compared to older age groups.

7.1 Children

One case-controlled study ⁴⁶ focused on children, and stratified outcomes by two age groups (pre-school age: 0-4yrs, and school age 5-17yrs). Only the school age group showed a significantly negative association for influenza infection for both washing hands more than five times per day and washing hands after touching contaminated surfaces.

Hand hygiene could be more effective in reducing the risk of infection in school age children, compared to younger children.

Hand hygiene practices may be more effective in reducing the risk of infection for older children, compared to younger children.

8 Sex and gender in this literature

Five studies stratified adherence to hand hygiene and outcomes by gender. Two studies^{28,45} found that higher handwashing adherence was associated with being female, compared to male but the results were not significant in one study²⁸. The third study observed that men had a statistically significantly higher odds of

infection⁴². However, the remaining two studies found no significant difference in the odds of influenza transmission¹⁵, or COVID-19 infection or mortality between males and females²⁷.

Compared to males, females might wash their hands more frequently, but there may be no difference in the odds of RID-associated infection, transmission, or mortality between males and females.

9 Limitations

The findings of this review are limited by several factors. The risk of bias judgment in all the included RCTs and observational studies ranged from moderate to critical risk of bias. Risk of bias was not assessed in the modeling studies as it was beyond the scope of this work. In the RCTs, blinding was not feasible, and both study personnel and participants were aware of the intervention. Most of the observational studies and two of the RCTs relied solely on self-reported adherence to hand hygiene. In some of the studies that observed the participants' hand hygiene practices, observation was limited to a few occasions and did not occur throughout the duration of the study or was measured through imperfect proxies (e.g., depletion of hand hygiene supplies rather than observing hand hygiene directly). Additionally, some studies did not report on hand hygiene practices in the control group. The lack of blinding in the RCTs and reliance on self-reports of hand hygiene in most studies may have introduced bias to the findings which may overestimate or underestimate the effect hand hygiene.

Most of the studies were conducted during the COVID-19 pandemic in communities where widespread non-pharmaceutical (e.g., face masks, social distancing) and pharmaceutical (vaccinations) interventions were implemented. The effect of hand hygiene may be limited by these other pandemic-related interventions which effectively reduce transmission of infection^{70,71}. Moreover, the observed effect of hand hygiene during a pandemic with intense promotion of NPIs may not be generalizable because adherence to hand hygiene may be diminished outside a pandemic context.

Although only studies with confirmed infections (e.g., rapid tests, PCR tests, laboratory confirmed infection) in participants were included in this review, a few studies adopted an ecological design where confirmed infection and/or mortality was estimated at a community or regional level.

Many of the included studies were conducted in countries with different cultural and healthcare systems compared to Canada. Cultural beliefs or practices may impact the effectiveness of hand hygiene and other behavioral NPIs, increasing or decreasing an individuals' baseline risk of contracting or spreading infection⁷². For example, in some cultures women are more likely to stay home while the men go out to work, consequently in this context men may be more susceptible to infection transmitted in work environments outside the home⁷³. These cultural and systemic differences may limit the generalizability of these findings.

The inconclusive finding of effectiveness of hand hygiene is likely specific to the context of this review question that focused on the practice of hand hygiene in isolation from any other practice (e.g. respiratory etiquette, physical distancing, masking) and only on test confirmed RID transmission in community settings. Other reviews have found that hand hygiene had a non-significant protective benefit in reducing RIDs in healthcare settings⁷⁴ and that hand hygiene can reduce other types of illnesses, such as gastro-intestinal illnesses, in the community¹⁰.

Finally, no studies that met the inclusion criteria assessed RSV, measles, iGAS, pneumococcus, meningococcus, *hemophilus influenzae*, and *Bordetella pertussis*. Furthermore, none of the studies stratified adherence to hand hygiene or outcomes to understand the impact of hand hygiene on individuals from racialized groups or ethnic minorities. This may limit the generalizability of the findings from this review across RID and populations.

10 Conclusions

Based on the available evidence, it is uncertain if hand hygiene **alone** is sufficient to reduce the risk of confirmed RID transmission in community settings. The inconclusive overall finding of this LES could be partly attributable to the challenges associated with evaluating public health and social measures in real-world settings. The finding of this LES is consistent with the findings of recently published systematic reviews that evaluated the effectiveness of hand hygiene interventions or practices to prevent test confirmed influenza or test confirmed COVID-19 in community settings⁴⁻⁷. In addition to the study-related challenges, hand hygiene to reduce the transmission of RID could be more effective when implemented in combination with other interventions (e.g., respiratory etiquette, masks, isolation, cleaning and disinfecting, vaccination), as the effect of hand hygiene alone may be limited in the context of droplet and aerosol transmission of RID. Given the limitations of the available evidence, and the effectiveness of hand hygiene to prevent a wide range of non-respiratory diseases in various settings, it remains important to continue to practice hand hygiene correctly and frequently to reduce the overall transmission risk of infectious diseases in the community.

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13 Appendices

13.1 Appendix A: PRISMA Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	2, 12
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	3-5
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	6-7
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	2
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	12-14
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	12
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	12, Appx. B
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	13
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	13-14
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	13
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	13, Appx. D
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	14

Section and Topic	Item #	Checklist item	Location where item is reported
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Sect. 5
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	14
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	14
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	14
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	14
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	N/A
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	N/A
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	14
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	14
RESULTS			

Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Fig. 1, 15
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Appx C
Study characteristics	17	Cite each included study and present its characteristics.	Fig 2. 16, Appx D
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Sect. 5, Appx E
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Sect 5, Appx D
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Sect. 5
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	N/A
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	N/A
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	N/A
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Appx E
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	3-5
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	41-44
	23b	Discuss any limitations of the evidence included in the review.	41-44
	23c	Discuss any limitations of the review processes used.	41-44
	23d	Discuss implications of the results for practice, policy, and future research.	41-44
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	12
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	N/A
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	N/A
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	45
Competing interests	26	Declare any competing interests of review authors.	45
Availability of	27	Report which of the following are publicly available and where they can be found: template data collection forms; data	Appx D

data, code and other materials		extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	
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From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71. doi: 10.1136/bmj.n71

13.2 Appendix B: Literature search strategies

Final Strategies – By Database

2024 Jan 23

MEDLINE

Database: Ovid MEDLINE(R) ALL <1946 to January 22, 2024>

Search Strategy:

-
- 1 COVID-19/ (252865)
 - 2 (COVID-19 or COVID19).tw,kw,kf. (357117)
 - 3 ((coronavirus* or corona virus*) and (hubei or wuhan or beijing or shanghai)).tw,kw,kf. (7184)
 - 4 (wuhan adj5 virus*).tw,kw,kf. (433)
 - 5 (2019-nCoV or 19nCoV or 2019nCoV).tw,kw,kf. (2197)
 - 6 (SARS-CoV-2 or SARS-CoV2 or SARSCoV-2 or SARSCoV2 or SARS2 or SARS-2 or severe acute respiratory syndrome coronavirus 2).tw,kw,kf. (139179)
 - 7 (2019-novel CoV or Sars-coronavirus2 or Sars-coronavirus-2 or SARS-like coronavirus* or ((novel or new or nouveau) adj2 (CoV or nCoV or covid or coronavirus* or corona virus or Pandemi*2))).tw,kw,kf. (23524)
 - 8 (novel coronavirus* or novel corona virus* or novel CoV).tw,kw,kf. (14006)
 - 9 ((coronavirus* or corona virus*) adj ("19" or "2019")).tw,kw,kf. (4029)
 - 10 ("coronavirus 2" or "corona virus 2").tw,kw,kf. (39033)
 - 11 (coronavirus* or corona virus*).ti,kw,kf. (58444)
 - 12 COVID.ti,kw,kf. (307801)
 - 13 (((alpha or beta or delta or eta or gamma or iota or kappa or lambda or omicron or zeta) adj3 variant?) and (coronavirus* or corona virus* or covid*)).tw,kw,kf. (7445)
 - 14 or/1-13 [COVID-19] (412914)
 - 15 Respiratory Syncytial Viruses/ (6365)
 - 16 Respiratory Syncytial Virus, Human/ (4185)
 - 17 Respiratory Syncytial Virus Infections/ (8961)
 - 18 (respiratorysync#tial virus* or respiratory sync#tial virus* or sync#tial respiratory virus*).tw,kw,kf. (17210)
 - 19 ((respiratorysync#tial or respiratory sync#tial or sync#tial respiratory) adj3 pneumovirus*).tw,kw,kf. (26)
 - 20 (HRSV or RSV).tw,kw,kf. (16214)
 - 21 RS virus*.tw,kw,kf. (453)
 - 22 or/15-21 [RSV INFECTIONS] (24129)
 - 23 Influenza, Human/ (58872)
 - 24 (influenza* or flu or grippe).tw,kw,kf. (150355)
 - 25 exp Influenza A virus/ (49955)
 - 26 Influenza B virus/ (4666)
 - 27 (H1N1 or PH1N1 or H3N2 or AH1N1 or "A(H1N1)" or "A/H1N1" or AH3N2 or "A(H3N2)" or "A/H3N2").tw,kw,kf. (23828)
 - 28 or/23-27 [INFLUENZA] (158269)
 - 29 Measles/ (14975)
 - 30 (measles or morbilli or rubeola*).tw,kw,kf. (26981)
 - 31 or/29-30 [MEASLES] (28899)

32 iGAS.tw,kw,kf. (409)
33 (invasi* adj3 GAS).tw,kw,kf. (599)
34 (invasi* adj3 (group A adj1 strep*)).tw,kw,kf. (715)
35 Streptococcal Infections/ and invasi*.tw,kw,kf. (2689)
36 Streptococcus pyogenes/ and invasi*.tw,kw,kf. (1622)
37 or/32-36 [iGAS] (3659)
38 exp Pneumonia/ (354560)
39 (pneumonia* or bronchopneumonia* or broncho-pneumonia* or (lung? adj2 inflam*) or lobitis or
peri-pneumoni* or peripneumoni* or pneumonitis or (pulmon* adj2 inflam*)).tw,kw,kf. (257556)
40 or/38-39 [PNEUMONIA] (526844)
41 exp Meningitis, Meningococcal/ (5743)
42 (meningococcosis or meningococcus).tw,kw,kf. (1451)
43 ((meningococc* or Neisseria meningitidis or "N. meningitidis") adj3 (disease? or infection? or
meningit*)).tw,kw,kf. (14675)
44 or/41-43 [MENINGOCOCCUS] (17355)
45 exp Haemophilus influenzae/ (14368)
46 ((h?emophilus or bacillus or bacterium or myco-bacterium or mycobacterium) adj3 (influenza* or
meningitidis)).tw,kw,kf. (20705)
47 "H. influenzae".tw,kw,kf. (7042)
48 coccobacillus pfeifferi*.tw,kw,kf. (0)
49 or/45-48 [HEMOPHILUS INFLUENZAE] (24696)
50 Bordetella pertussis/ (5673)
51 (((bordetella or bacillus or h?emophilus) adj pertussis) or bacterium tussis-convulsiva*).tw,kw,kf.
(6284)
52 "H. pertussis".tw,kw,kf. (87)
53 (abettin or "microbe de la coqueluche").tw,kw,kf. (0)
54 or/50-53 [BORDETELLA PERTUSSIS] (7887)
55 Severe Acute Respiratory Syndrome/ (5740)
56 (respiratory syndrome? adj3 (severe adj1 acute)).tw,kw,kf. (46402)
57 (SARS and (respiratory or syndrome?)).tw,kw,kf. (60054)
58 or/55-57 [SARS] (67872)
59 Respiratory Tract Infections/ (43272)
60 ((respiration or respiratory or airway? or broncho-pulmonary or bronchopulmonary or pulmonary)
adj3 infection?).tw,kw,kf. (88370)
61 or/59-60 [RESPIRATORY INFECTIONS - GENERAL] (107436)
62 14 or 22 or 28 or 31 or 37 or 40 or 44 or 49 or 54 or 58 or 61 [ALL RESPIRATORY INFECTIONS OF
INTEREST] (941654)
63 Hand Disinfection/ (6425)
64 Hand Hygiene/ (2272)
65 Hand Sanitizers/ (385)
66 ((hand or hands) adj5 (anti-sep* or antisept* or clean* or disinfect* or hygien* or rub? or rubb* or
sanit* or scrub* or soap* or steril* or wash*)).tw,kw,kf. (15678)
67 ((hand or hands) adj5 (alcohol* adj2 rub*)).tw,kw,kf. (170)
68 (handclean* or handwash*).tw,kw,kf. (3196)
69 or/63-68 [HAND HYGIENE] (19868)
70 62 and 69 [RESPIRATORY INFECTIONS - HAND HYGIENE] (4717)
71 exp Animals/ not Humans/ (5189493)
72 70 not 71 [ANIMAL-ONLY REMOVED] (4700)

73 (editorial or news or newspaper article).pt. (919466)
74 72 not 73 [OPINION PIECES REMOVED] (4636)
75 Systematic Review.pt. (250536)
76 exp Systematic Reviews as Topic/ (12491)
77 Meta Analysis.pt. (193743)
78 exp Meta-Analysis as Topic/ (28979)
79 (meta-analy* or metanaly* or metaanaly* or met analy* or integrative research or integrative review* or integrative overview* or research integration or research overview* or collaborative review*).tw,kw,kf. (301632)
80 (systematic review* or systematic overview* or evidence-based review* or evidence-based overview* or (evidence adj3 (review* or overview*)) or evidence map* or meta-review* or meta-overview* or meta-synthes* or mapping review? or rapid review* or "review of reviews" or scoping review? or umbrella review? or technology assessment* or HTA or HTAs).tw,kw,kf. (403137)
81 exp Technology Assessment, Biomedical/ (12267)
82 (cochrane or health technology assessment or evidence report or systematic reviews).jw. (23130)
83 Network Meta-Analysis/ (5674)
84 (network adj (MA or MAs)).tw,kw,kf. (20)
85 (NMA or NMAs or MTC or MTCs or MAIC or MAICs).tw,kw,kf. (9999)
86 indirect* compar*.tw,kw,kf. (2961)
87 (indirect treatment* adj1 compar*).tw,kw,kf. (511)
88 (mixed treatment* adj1 compar*).tw,kw,kf. (528)
89 (multiple treatment* adj1 compar*).tw,kw,kf. (235)
90 (multi-treatment* adj1 compar*).tw,kw,kf. (4)
91 simultaneous* compar*.tw,kw,kf. (1347)
92 mixed comparison?.tw,kw,kf. (46)
93 or/75-92 [SR FILTER] (600689)
94 74 and 93 [RESPIRATORY INFECTIONS - HAND HYGIENE - SRs] (238)
95 (controlled clinical trial or randomized controlled trial or pragmatic clinical trial or equivalence trial).pt. (699462)
96 "Clinical Trials as Topic"/ (201632)
97 exp "Controlled Clinical Trials as Topic"/ (176056)
98 (randomi#ed or randomi#ation? or randomly or RCT or placebo*).tw,kw,kf. (1262647)
99 ((singl* or doubl* or trebl* or tripl*) adj (mask* or blind* or dumm*)).tw,kw,kf. (202706)
100 trial.ti. (301263)
101 or/95-100 [RCT FILTER] (1723616)
102 74 and 101 [RCTs] (320)
103 controlled clinical trial.pt. (95538)
104 Controlled Clinical Trial/ or Controlled Clinical Trials as Topic/ (101157)
105 (control* adj2 trial).tw,kw,kf. (221694)
106 Non-Randomized Controlled Trials as Topic/ (1069)
107 (nonrandom* or non-random* or quasi-random* or quasi-experiment*).tw,kw,kf. (76763)
108 (nRCT or non-RCT).tw,kw,kf. (554)
109 Controlled Before-After Studies/ (746)
110 (control* adj3 ("before and after" or "before after")).tw,kw,kf. (5455)
111 Interrupted Time Series Analysis/ (1976)
112 time series.tw,kw,kf. (48675)
113 (pre- adj5 post-).tw,kw,kf. (136801)
114 ((pretest adj5 posttest) or (pre-test adj5 post-test)).tw,kw,kf. (12339)

- 115 Historically Controlled Study/ (231)
- 116 (control* adj2 study).tw,kw,kf. (217460)
- 117 Control Groups/ (2078)
- 118 (control* adj2 group?).tw,kw,kf. (645756)
- 119 or/103-118 [nRCT FILTER] (1293441)
- 120 74 and 119 [nRCTs] (345)
- 121 exp Cohort Studies/ (2564378)
- 122 cohort?.tw,kw,kf. (910943)
- 123 Retrospective Studies/ (1174417)
- 124 (longitudinal or prospective or retrospective).tw,kw,kf. (1763677)
- 125 ((followup or follow-up) adj (study or studies)).tw,kw,kf. (60306)
- 126 Observational study.pt. (151315)
- 127 (observation\$2 adj (study or studies)).tw,kw,kf. (175652)
- 128 ((population or population-based) adj (study or studies or analys#s)).tw,kw,kf. (28417)
- 129 ((multidimensional or multi-dimensional) adj (study or studies)).tw,kw,kf. (158)
- 130 Comparative Study.pt. (1913555)
- 131 ((comparative or comparison) adj (study or studies)).tw,kw,kf. (138384)
- 132 exp Case-Control Studies/ (1475702)
- 133 ((case-control* or case-based or case-comparison or case-compeer or case-referrent or case-referent) adj3 (study or studies)).tw,kw,kf. (146228)
- 134 Cross-Sectional Studies/ (490271)
- 135 (crosssection* or cross-section*).tw,kw,kf. (592747)
- 136 Multicenter Study.pt. (342315)
- 137 ((multicenter or multi-center or multicentre or multi-centre) adj (study or studies)).tw,kw,kf. (57980)
- 138 or/121-137 [OBSERVATIONAL FILTER] (6032628)
- 139 74 and 138 [OBSERVATIONAL STUDIES] (1657)
- 140 (model or models or mode?ling).tw,kw,kf. (3885477)
- 141 74 and 140 [MODELING STUDIES] (591)
- 142 94 or 102 or 120 or 139 or 141 [ALL STUDY DESIGNS OF INTEREST] (2362)

Embase

Database: Embase <1974 to 2024 January 22>

Search Strategy:

-
- 1 coronavirus disease 2019/ (375721)
 - 2 asymptomatic coronavirus disease 2019/ (2474)
 - 3 (COVID-19 or COVID19).tw,kw,kf. (404706)
 - 4 ((coronavirus* or corona virus*) and (hubei or wuhan or beijing or shanghai)).tw,kw,kf. (7914)
 - 5 (wuhan adj5 virus*).tw,kw,kf. (522)
 - 6 (2019-nCoV or 19nCoV or 2019nCoV).tw,kw,kf. (2473)
 - 7 (SARS-CoV-2 or SARS-CoV2 or SARSCoV-2 or SARSCoV2 or SARS2 or SARS-2 or severe acute respiratory syndrome coronavirus 2).tw,kw,kf. (160427)
 - 8 (2019-novel CoV or Sars-coronavirus2 or Sars-coronavirus-2 or SARS-like coronavirus* or ((novel or new or nouveau) adj2 (CoV or nCoV or covid or coronavirus* or corona virus or Pandemi*2))).tw,kw,kf. (26031)

9 (novel coronavirus* or novel corona virus* or novel CoV).tw,kw,kf. (14883)
 10 ((coronavirus* or corona virus*) adj ("19" or "2019")).tw,kw,kf. (4289)
 11 ("coronavirus 2" or "corona virus 2").tw,kw,kf. (39581)
 12 (coronavirus* or corona virus*).ti,kw,kf. (61228)
 13 COVID.ti,kw,kf. (337666)
 14 (((alpha or beta or delta or eta or gamma or iota or kappa or lambda or omicron or zeta) adj3
 variant?) and (coronavirus* or corona virus* or covid*)).tw,kw,kf. (8704)
 15 or/1-14 [COVID-19] (495199)
 16 Pneumovirus/ (297)
 17 exp Human respiratory syncytial virus/ (9418)
 18 exp respiratory syncytial virus infection/ (8374)
 19 (respiratorysync#tial virus* or respiratory sync#tial virus* or sync#tial respiratory virus*).tw,kw,kf.
 (21390)
 20 ((respiratorysync#tial or respiratory sync#tial or sync#tial respiratory) adj3
 pneumovirus*).tw,kw,kf. (30)
 21 (HRSV or RSV).tw,kw,kf. (21569)
 22 RS virus*.tw,kw,kf. (507)
 23 or/16-22 [RSV INFECTIONS] (33397)
 24 influenza/ (74336)
 25 (influenza* or flu or grippe).tw,kw,kf. (176353)
 26 exp influenza A/ (34555)
 27 influenza B/ (4593)
 28 (H1N1 or PH1N1 or H3N2 or AH1N1 or "A(H1N1)" or "A/H1N1" or AH3N2 or "A(H3N2)" or
 "A/H3N2").tw,kw,kf. (30161)
 29 influenza encephalitis/ (40)
 30 influenza pneumonia/ (79)
 31 exp pandemic influenza/ (16942)
 32 seasonal influenza/ (7757)
 33 or/24-32 [INFLUENZA] (203113)
 34 measles/ (21149)
 35 (measles or morbilli or rubeola*).tw,kw,kf. (27571)
 36 or/34-35 [MEASLES] (33633)
 37 iGAS.tw,kw,kf. (528)
 38 (invasi* adj3 GAS).tw,kw,kf. (772)
 39 (invasi* adj3 (group A adj1 strep*)).tw,kw,kf. (848)
 40 Streptococcus infection/ and invasi*.tw,kw,kf. (2325)
 41 Streptococcus pyogenes/ and invasi*.tw,kw,kf. (1346)
 42 or/37-41 [iGAS] (4450)
 43 exp pneumonia/ (405700)
 44 (pneumonia* or bronchopneumonia* or broncho-pneumonia* or (lung? adj2 inflam*) or lobitis or
 peri-pneumoni* or peripneumoni* or pneumonitis or (pulmon* adj2 inflam*)).tw,kw,kf. (368420)
 45 or/43-44 [PNEUMONIA] (551539)
 46 exp epidemic meningitis/ (3482)
 47 (meningococcosis or meningococcus).tw,kw,kf. (1773)
 48 ((meningococc* or Neisseria meningitidis or "N. meningitidis") adj3 (disease? or infection? or
 meningit*)).tw,kw,kf. (16354)
 49 or/46-48 [MENINGOCOCCUS] (18484)
 50 exp Haemophilus influenzae/ (32879)

51 ((h?emophilus or bacillus or bacterium or myco-bacterium or mycobacterium) adj3 (influenza* or meningitidis)).tw,kw,kf. (23947)

52 "H. influenzae".tw,kw,kf. (8571)

53 coccobacillus pfeifferi*.tw,kw,kf. (0)

54 or/50-53 [HEMOPHILUS INFLUENZAE] (39146)

55 Bordetella pertussis/ (7278)

56 (((bordetella or bacillus or h?emophilus) adj pertussis) or bacterium tussis-convulsiva*).tw,kw,kf. (6546)

57 "H. pertussis".tw,kw,kf. (15)

58 (abettin or "microbe de la coqueluche").tw,kw,kf. (1)

59 or/55-58 [BORDETELLA PERTUSSIS] (9084)

60 severe acute respiratory syndrome/ (11661)

61 (respiratory syndrome? adj3 (severe adj1 acute)).tw,kw,kf. (47616)

62 (SARS and (respiratory or syndrome?)).tw,kw,kf. (67394)

63 or/60-62 [SARS] (79742)

64 respiratory tract infection/ (69946)

65 ((respiration or respiratory or airway? or broncho-pulmonary or bronchopulmonary or pulmonary) adj3 infection?).tw,kw,kf. (126885)

66 or/64-65 [RESPIRATORY INFECTIONS - GENERAL] (158153)

67 15 or 23 or 33 or 36 or 42 or 45 or 49 or 54 or 59 or 63 or 66 [ALL RESPIRATORY INFECTIONS OF INTEREST] (1319875)

68 hand disinfection/ (916)

69 hand washing/ (20476)

70 hand sanitizer/ (2004)

71 ((hand or hands) adj5 (anti-sep* or antisept* or clean* or disinfect* or hygien* or rub? or rubb* or sanit* or scrub* or soap* or steril* or wash*)).tw,kw,kf. (21529)

72 ((hand or hands) adj5 (alcohol* adj2 rub*)).tw,kw,kf. (305)

73 (handclean* or handwash*).tw,kw,kf. (3731)

74 or/68-73 [HAND HYGIENE] (32826)

75 67 and 74 [RESPIRATORY INFECTIONS - HAND HYGIENE] (9904)

76 (exp animal/ or exp animal model/ or exp animal experiment/ or nonhuman/ or exp vertebrate/) not (exp human/ or exp human experiment/) (7355521)

77 75 not 76 [ANIMAL-ONLY REMOVED] (9750)

78 editorial.pt. (794170)

79 77 not 78 [OPINION PIECES REMOVED] (9348)

80 "systematic review"/ (450092)

81 "systematic review (topic)"/ (33815)

82 meta analysis/ (304319)

83 "meta analysis (topic)"/ (54764)

84 (meta-analy* or metanaly* or metaanaly* or met analy* or integrative research or integrative review* or integrative overview* or research integration or research overview* or collaborative review*).tw,kw,kf. (383364)

85 (systematic review* or systematic overview* or evidence-based review* or evidence-based overview* or (evidence adj3 (review* or overview*)) or evidence map* or meta-review* or meta-overview* or meta-synthes* or mapping review? or rapid review* or "review of reviews" or scoping review? or umbrella review? or technology assessment* or HTA or HTAs).tw,kw,kf. (483837)

86 exp Technology Assessment, Biomedical/ (17826)

87 (cochrane or health technology assessment or evidence report or systematic reviews).jw. (34690)

88 network meta-analysis/ (8361)
89 (network adj (MA or MAs)).tw,kw,kf. (32)
90 (NMA or NMAs or MTC or MTCs or MAIC or MAICs).tw,kw,kf. (15680)
91 indirect* compar*.tw,kw,kf. (5510)
92 (indirect treatment* adj1 compar*).tw,kw,kf. (1283)
93 (mixed treatment* adj1 compar*).tw,kw,kf. (1018)
94 (multiple treatment* adj1 compar*).tw,kw,kf. (302)
95 (multi-treatment* adj1 compar*).tw,kw,kf. (12)
96 simultaneous* compar*.tw,kw,kf. (1598)
97 mixed comparison?.tw,kw,kf. (60)
98 or/80-97 [SR FILTER] (887196)
99 79 and 98 [RESPIRATORY INFECTIONS - HAND HYGIENE - SRs] (504)
100 exp randomized controlled trial/ or controlled clinical trial/ (1000691)
101 clinical trial/ (1078729)
102 exp "controlled clinical trial (topic)"/ (277943)
103 (randomi#ed or randomi#ation? or randomly or RCT or placebo*).tw,kw,kf. (1784799)
104 ((singl* or doubl* or trebl* or tripl*) adj (mask* or blind* or dumm*)).tw,kw,kf. (287132)
105 trial.ti. (413517)
106 or/100-105 [RCT FILTER] (2796784)
107 79 and 106 [RCTs] (655)
108 controlled clinical trial/ (472123)
109 "controlled clinical trial (topic)"/ (13453)
110 (control* adj2 trial).tw,kw,kf. (297356)
111 (nonrandom* or non-random* or quasi-random* or quasi-experiment*).tw,kw,kf. (97735)
112 (nRCT or non-RCT).tw,kw,kf. (766)
113 (control* adj3 ("before and after" or "before after")).tw,kw,kf. (7096)
114 time series analysis/ (39458)
115 time series.tw,kw,kf. (54489)
116 pretest posttest control group design/ (673)
117 (pre- adj5 post-).tw,kw,kf. (244278)
118 ((pretest adj5 posttest) or (pre-test adj5 post-test)).tw,kw,kf. (16516)
119 controlled study/ (10145693)
120 (control* adj2 study).tw,kw,kf. (297307)
121 control group/ (110736)
122 (control* adj2 group?).tw,kw,kf. (929194)
123 or/108-122 [nRCT FILTER] (10867670)
124 79 and 123 [nRCTs] (2179)
125 cohort analysis/ (1108470)
126 cohort?.tw,kw,kf. (1533626)
127 retrospective study/ (1559870)
128 longitudinal study/ (205300)
129 prospective study/ (903839)
130 (longitudinal or prospective or retrospective).tw,kw,kf. (2730551)
131 follow up/ (2134249)
132 ((followup or follow-up) adj (study or studies)).tw,kw,kf. (80603)
133 observational study/ (355798)
134 (observation\$2 adj (study or studies)).tw,kw,kf. (272618)
135 population research/ (138215)

- 136 ((population or population-based) adj (study or studies or analys#s)).tw,kw,kf. (31196)
- 137 ((multidimensional or multi-dimensional) adj (study or studies)).tw,kw,kf. (188)
- 138 exp comparative study/ (1707824)
- 139 ((comparative or comparison) adj (study or studies)).tw,kw,kf. (164028)
- 140 exp case control study/ (231099)
- 141 ((case-control* or case-based or case-comparison or case-compeer or case-referrent or case-referent) adj3 (study or studies)).tw,kw,kf. (192083)
- 142 cross-sectional study/ (609907)
- 143 (crosssection* or cross-section*).tw,kw,kf. (768138)
- 144 major clinical study/ (5142828)
- 145 multicenter study/ (383546)
- 146 ((multicenter or multi-center or multicentre or multi-centre) adj (study or studies)).tw,kw,kf. (95017)
- 147 or/125-146 [OBSERVATIONAL FILTER] (10368787)
- 148 79 and 147 [OBSERVATIONAL STUDIES] (3838)
- 149 (model or models or mode?ling).tw,kw,kf. (4909732)
- 150 79 and 149 [MODELING STUDIES] (835)
- 151 99 or 107 or 124 or 148 or 150 [ALL STUDY DESIGNS OF INTEREST] (5178)

CINAHL

#	Query	Limiters/Expanders	Last Run Via	Results
S129	S85 OR S91 OR S107 OR S126 OR S128	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	902
S128	S68 AND S127	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL	190

			Plus with Full Text	
S127	TI (model or models or mode#ling) OR AB (model or models or mode#ling)	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	646,777
S126	S68 AND S125	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	612
S125	S108 OR S109 OR S110 OR S111 OR S112 OR S113 OR S114 OR S115 OR S116 OR S117 OR S118 OR S119 OR S120 OR S121 OR S122 OR S123 OR S124	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	1,716,017
S124	TI ((multicenter or "multi-center" or multicentre or "multi-centre") W0 (study or studies)) OR AB ((multicenter or "multi-center" or multicentre or "multi-centre") W0 (study or studies))	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced	15,926

			Search Database - CINAHL Plus with Full Text	
S123	(MH "Multicenter Studies")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	358,662
S122	TI (crosssection* or (cross W0 section*)) OR AB (crosssection* or (cross W0 section*))	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	223,310
S121	(MH "Cross-sectional Studies")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	259,805
S120	TI (((case W0 control*) or "case-based" or "case-comparison" or "case-compeer" or "case-referrent" or "case-referent") N3 (study or studies)) OR AB (((case W0 control*) or "case-based" or "case-	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases	40,013

	comparison" or "case-compeer" or "case-referrent" or "case-referent") N3 (study or studies))		Search Screen - Advanced Search Database - CINAHL Plus with Full Text	
S119	(MH "Case Control Studies+")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	94,005
S118	TI ((comparative or comparison) W0 (study or studies)) OR AB ((comparative or comparison) W0 (study or studies))	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	21,478
S117	(MH "Comparative Studies")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	476,518
S116	TI ((comparative or comparison) W0 (study or	Search modes - Find	Interface -	30,656

	studies or analys?s)) OR AB ((comparative or comparison) W0 (study or studies or analys?s))	all my search terms	EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	
S115	TI ((multidimensional or "multi-dimensional") W0 (study or studies or analys?s)) OR AB ((multidimensional or "multi-dimensional") W0 (study or studies or analys?s))	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	204
S114	TI ((population or "population-based") W0 (study or studies or analys?s)) OR AB ((population or "population-based") W0 (study or studies or analys?s))	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	23,962
S113	TI (observation* W0 (study or studies)) OR AB (observation* W0 (study or studies))	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with	61,339

			Full Text	
S112	TI ((followup or "follow-up") W0 (study or studies)) OR AB ((followup or "follow-up") W0 (study or studies))	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	14,669
S111	TI (longitudinal or prospective or retrospective) OR AB (longitudinal or prospective or retrospective)	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	537,935
S110	(MH "Retrospective Design")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	345,725
S109	(MH "Prospective Studies+")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search	532,755

			Database - CINAHL Plus with Full Text	
S108	TI cohort# OR AB cohort#	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	305,655
S107	S68 AND S106	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	189
S106	S92 OR S93 OR S94 OR S95 OR S96 OR S97 OR S98 OR S99 OR S100 OR S101 OR S102 OR S103 OR S104 OR S105	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	463,940
S105	TI control* N2 group# OR AB control* N2 group#	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search	153,462

			Screen - Advanced Search Database - CINAHL Plus with Full Text	
S104	(MH "Control Group")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	14,377
S103	TI control* N2 study OR AB control* N2 study	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	95,751
S102	(MH "Historically Controlled Study")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	142
S101	TI ((pretest N5 posttest) or ("pre-test" N5 "post-test")) OR AB ((pretest N5 posttest) or ("pre-test"	Search modes - Find all my search terms	Interface - EBSCOhost	9,633

	N5 "post-test")		Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	
S100	TI "pre-" N5 "post-" OR AB "pre-" N5 "post-"	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	48,836
S99	(MH "Pretest-Posttest Design+")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	56,209
S98	TI "time series" OR AB "time series"	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	8,421

S97	(MH "Interrupted Time Series Analysis")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	974
S96	TI (control* N3 ("before and after" or "before after") OR AB (control* N3 ("before and after" or "before after"))	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	2,136
S95	(MH "Controlled Before-After Studies")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	236
S94	TI (nRCT or "non-RCT") OR AB (nRCT or "non-RCT")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL	220

			Plus with Full Text	
S93	TI (nonrandom* or (non W0 random*) or (quasi W0 random*) or (quasi W0 experiment*)) OR AB (nonrandom* or (non W0 random*) or (quasi W0 random*) or (quasi W0 experiment*))	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	30,183
S92	TI control* N2 trial OR AB control* N2 trial	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	174,239
S91	S68 AND S90	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	138
S90	S86 OR S87 OR S88 OR S89	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced	495,048

			Search Database - CINAHL Plus with Full Text	
S89	TI trial	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	188,730
S88	TI ((singl* or doubl* or trebl* or tripl*) W0 (mask* or blind* or dumm*)) OR AB ((singl* or doubl* or trebl* or tripl*) W0 (mask* or blind* or dumm*))	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	60,153
S87	TI (randomi?ed or randomi?ation# or randomly or RCT or placebo*) OR AB (randomi?ed or randomi?ation# or randomly or RCT or placebo*)	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	417,599
S86	(MH "Randomized Controlled Trials") OR (MH "Equivalence Trials")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases	142,126

			Search Screen - Advanced Search Database - CINAHL Plus with Full Text	
S85	S68 AND S84	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	113
S84	S69 OR S70 OR S71 OR S72 OR S73 OR S74 OR S75 OR S76 OR S77 OR S78 OR S79 OR S80 OR S81 OR S82 OR S83	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	291,782
S83	TI mixed W0 comparison# OR AB mixed W0 comparison#	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	11
S82	TI simultaneous* W0 compar* OR AB	Search modes - Find	Interface -	198

	simultaneous* W0 compar*	all my search terms	EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	
S81	TI multi W0 treatment* N1 compar* OR AB multi W0 treatment* N1 compar*	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	2
S80	TI multiple W0 treatment* N1 compar* OR AB multiple W0 treatment* N1 compar*	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	93
S79	TI mixed W0 treatment* N1 compar* OR AB mixed W0 treatment* N1 compar*	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with	224

			Full Text	
S78	TI indirect W0 treatment* N1 compar* OR AB indirect W0 treatment* N1 compar*	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	181
S77	TI indirect* W0 compar* OR AB indirect* W0 compar*	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	1,068
S76	TI (NMA or NMAs or MTC or MTCs or MAIC or MAICs) OR AB (NMA or NMAs or MTC or MTCs or MAIC or MAICs)	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	1,675
S75	TI (network W0 (MA or MAs)) OR AB (network W0 (MA or MAs))	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search	6

			Database - CINAHL Plus with Full Text	
S74	TI ((systematic W0 review*) or (systematic W0 overview*) or ("evidence-based" W0 review*) or ("evidence-based" W0 overview*) or (evidence N3 (review* or overview*)) or (evidence W0 map*) or (meta W0 review*) or (meta W0 overview*) or (meta W0 synthes*) or (mapping W0 review#) or (rapid W0 review#) or "review of reviews" or (scoping W0 review#) or (umbrella W0 review#) or (technology W0 assessment*) or HTA or HTAs) OR AB ((systematic W0 review*) or (systematic W0 overview*) or ("evidence-based" W0 review*) or ("evidence-based" W0 overview*) or (evidence N3 (review* or overview*)) or (evidence W0 map*) or (meta W0 review*) or (meta W0 overview*) or (meta W0 synthes*) or (mapping W0 review#) or (rapid W0 review#) or "review of reviews" or (scoping W0 review#) or (umbrella W0 review#) or (technology W0 assessment*) or HTA or HTAs)	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	189,782
S73	TI ((meta W0 analy*) or metanaly* or metaanaly* or (met W0 analy*) or "integrative research" or (integrative W0 review*) or (integrative W0 overview*) or "research integration" or (research W0 overview*) or (collaborative W0 review*)) OR AB ((meta W0 analy*) or metanaly* or metaanaly* or (met W0 analy*) or "integrative research" or (integrative W0 review*) or (integrative W0 overview*) or "research integration" or (research W0 overview*) or (collaborative W0 review*))	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	121,259
S72	(MH "Meta Analysis")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	72,592

S71	PT Meta Analysis	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	56,468
S70	(MH "Systematic Review")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	130,632
S69	PT Systematic Review	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	154,872
S68	PT S66 not S67	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL	2,467

			Plus with Full Text	
S67	PT editorial	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	283,928
S66	S60 AND S65	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	2,539
S65	S61 OR S62 OR S63 OR S64	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	13,363
S64	TI (handclean* or handwash*) OR AB (handclean* or handwash*)	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced	1,607

			Search Database - CINAHL Plus with Full Text	
S63	TI ((hand or hands) N5 (alcohol* N2 rub*)) OR AB ((hand or hands) N5 (alcohol* N2 rub*))	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	386
S62	TI ((hand or hands) N5 ((anti W0 sep*) or antise* or clean* or disinfect* or hygien* or rub# or rubb* or sanit* or scrub* or soap* or steril* or wash*)) OR AB ((hand or hands) N5 ((anti W0 sep*) or antise* or clean* or disinfect* or hygien* or rub# or rubb* or sanit* or scrub* or soap* or steril* or wash*))	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	7,930
S61	(MH "Handwashing+")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	9,899
S60	S14 OR S21 OR S27 OR S30 OR S35 OR S38 OR S42 OR S47 OR S52 OR S56 OR S59	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases	252,781

			Search Screen - Advanced Search Database - CINAHL Plus with Full Text	
S59	S57 OR S58	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	22,597
S58	TI ((respiration or respiratory or airway# or "broncho-pulmonary" or bronchopulmonary or pulmonary) N3 infection#) OR AB ((respiration or respiratory or airway# or "broncho-pulmonary" or bronchopulmonary or pulmonary) N3 infection#)	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	18,165
S57	(MH "Respiratory Tract Infections")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	9,909
S56	S53 OR S54 OR S55	Search modes - Find	Interface -	9,833

		all my search terms	EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	
S55	TI (SARS and (respiratory or syndrome#)) OR AB (SARS and (respiratory or syndrome#))	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	1,452
S54	TI (respiratory W0 syndrome#) N3 (severe N1 acute) OR AB (respiratory W0 syndrome#) N3 (severe N1 acute)	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	7,960
S53	(MH "Severe Acute Respiratory Syndrome")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with	2,559

			Full Text	
S52	S48 OR S49 OR S50 OR S51	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	509
S51	TI (abettin or "microbe de la coqueluche") OR AB (abettin or "microbe de la coqueluche")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	0
S50	TI "H. pertussis" OR AB "H. pertussis"	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	1
S49	TI ((bordetella or bacillus or h#emophilus) W0 pertussis) or ("bacterium tussis" W0 convulsiva*)) OR AB ((bordetella or bacillus or h#emophilus) W0 pertussis) or ("bacterium tussis" W0 convulsiva*))	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search	381

			Database - CINAHL Plus with Full Text	
S48	(MH "Bordetella Pertussis")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	309
S47	S43 OR S44 OR S45 OR S46	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	2,386
S46	TI coccobacillus W0 pfeifferi* OR AB coccobacillus W0 pfeifferi*	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	0
S45	TI "H. influenzae" OR AB "H. influenzae"	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search	574

			Screen - Advanced Search Database - CINAHL Plus with Full Text	
S44	TI (((h#emophilus or bacillus or bacterium or "myco-bacterium" or mycobacterium) N3 (influenza* or meningitidis)) OR AB (((h#emophilus or bacillus or bacterium or "myco-bacterium" or mycobacterium) N3 (influenza* or meningitidis))	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	2,081
S43	(MH "Haemophilus Influenzae")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	988
S42	S39 OR S40 OR S41	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	2,388
S41	TI ((meningococc* or "Neisseria meningitidis" or "N. meningitidis") N3 (disease# or infection# or	Search modes - Find all my search terms	Interface - EBSCOhost	1,975

	meningit*)) OR AB ((meningococc* or "Neisseria meningitidis" or "N. meningitidis") N3 (disease# or infection# or meningit*))		Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	
S40	TI (meningococcosis or meningococcus) OR AB (meningococcosis or meningococcus)	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	160
S39	(MH "Meningitis, Meningococcal")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	777
S38	S36 OR S37	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	63,129

S37	TI (pneumonia* or bronchopneumonia* or (broncho W0 pneumonia*) or (lung# N2 inflam*) or lobitis or (peri W0 pneumoni*) or peripneumoni* or pneumonitis or (pulmon* N2 inflam*)) OR AB (pneumonia* or bronchopneumonia* or (broncho W0 pneumonia*) or (lung# N2 inflam*) or lobitis or (peri W0 pneumoni*) or peripneumoni* or pneumonitis or (pulmon* N2 inflam*))	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	47,598
S36	(MH "Pneumonia+")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	34,094
S35	S31 OR S32 OR S33 OR S34	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	5,578
S34	(MH "Streptococcal Infections") AND (TI invas* OR AB invas*))	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL	528

			Plus with Full Text	
S33	TI invasi* N3 ("group A" N1 strep*) OR AB invasi* N3 ("group A" N1 strep*)	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	193
S32	TI invasi* N3 GAS OR AB invasi* N3 GAS	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	131
S31	TI iGAS OR AB iGAS	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	4,988
S30	S28 OR S29	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced	5,842

			Search Database - CINAHL Plus with Full Text	
S29	TI (measles or morbilli or rubeola*) OR AB (measles or morbilli or rubeola*)	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	4,970
S28	(MH "Measles+")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	3,548
S27	S22 OR S23 OR S24 OR S25 OR S26	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	33,194
S26	TI (H1N1 or PH1N1 or H3N2 or AH1N1 or "A(H1N1)" or "A/H1N1" or AH3N2 or "A(H3N2)" or "A/H3N2") OR AB (H1N1 or PH1N1 or H3N2 or AH1N1 or "A(H1N1)" or "A/H1N1" or AH3N2 or	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases	5,260

	"A(H3N2)" or "A/H3N2")		Search Screen - Advanced Search Database - CINAHL Plus with Full Text	
S25	(MH "Influenza B Virus")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	489
S24	(MH "Influenza A Virus+")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	5,891
S23	TI (influenza* or flu or grippe) OR AB (influenza* or flu or grippe)	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	30,785
S22	MH "Influenza, Human+"	Search modes - Find	Interface -	9,900

		all my search terms	EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	
S21	S15 OR S16 OR S17 OR S18 OR S19 OR S20	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	4,227
S20	TI RS W0 virus* OR AB RS W0 virus*	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	6
S19	TI (HRSV or RSV) OR AB (HRSV or RSV)	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with	2,420

			Full Text	
S18	TI ((respiratorysync?tial or (respiratory W0 sync?tial) or (sync#tial W0 respiratory)) N3 pneumovirus*) OR AB ((respiratorysync?tial or (respiratory W0 sync?tial) or (sync#tial W0 respiratory)) N3 pneumovirus*)	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	1
S17	TI ((respiratorysync?tial W0 virus*) or (respiratory W0 sync?tial W0 virus*) or (sync?tial W0 respiratory W0 virus*)) OR AB ((respiratorysync?tial W0 virus*) or (respiratory W0 sync?tial W0 virus*) or (sync?tial W0 respiratory W0 virus*))	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	2,928
S16	(MH "Respiratory Syncytial Virus Infections")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	2,395
S15	(MH "Respiratory Syncytial Viruses")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search	1,282

			Database - CINAHL Plus with Full Text	
S14	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	143,457
S13	TI (((alpha or beta or delta or eta or gamma or iota or kappa or lambda or omicron or zeta) N3 variant#) and (coronavirus* or corona virus* or covid*)) OR AB (((alpha or beta or delta or eta or gamma or iota or kappa or lambda or omicron or zeta) N3 variant#) and (coronavirus* or corona virus* or covid*))	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	939
S12	TI COVID	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	97,241
S11	TI (coronavirus* or (corona W0 virus*)) OR AB (coronavirus* or (corona W0 virus*))	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search	32,192

			Screen - Advanced Search Database - CINAHL Plus with Full Text	
S10	TI ("coronavirus 2" or "corona virus 2") OR AB ("coronavirus 2" or "corona virus 2")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	5,881
S9	TI ((coronavirus* or corona virus*) W0 ("19" or "2019")) OR AB ((coronavirus* or corona virus*) W0 ("19" or "2019"))	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	877
S8	TI ("novel coronavirus*" or "novel corona virus*" or novel CoV) OR AB ("novel coronavirus*" or "novel corona virus*" or novel CoV)	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	3,159
S7	TI ("2019-novel CoV" or "Sars-coronavirus2" or "Sars-coronavirus-2" or "SARS-like coronavirus*" or	Search modes - Find all my search terms	Interface - EBSCOhost	5,541

	((novel or new or nouveau) N2 (CoV or nCoV or covid or coronavirus* or "corona virus" or Pandemi*2))) OR AB ("2019-novel CoV" or "Sars-coronavirus2" or "Sars-coronavirus-2" or "SARS-like coronavirus*" or ((novel or new or nouveau) N2 (CoV or nCoV or covid or coronavirus* or "corona virus" or Pandemi*2)))		Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	
S6	TI ("SARS-CoV-2" or "SARS-CoV2" or "SARSCoV-2" or SARSCoV2 or SARS2 or "SARS-2" or "severe acute respiratory syndrome coronavirus 2") OR AB ("SARS-CoV-2" or "SARS-CoV2" or "SARSCoV-2" or SARSCoV2 or SARS2 or "SARS-2" or "severe acute respiratory syndrome coronavirus 2")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	21,102
S5	TI ("2019-nCoV" or 19nCoV or 2019nCoV) OR AB ("2019-nCoV" or 19nCoV or 2019nCoV)	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	20,191
S4	TI wuhan N5 virus* OR AB wuhan N5 virus*	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	86

S3	TI (((coronavirus* or corona virus*) and (hubei or wuhan or beijing or shanghai))) OR AB (((coronavirus* or corona virus*) and (hubei or wuhan or beijing or shanghai)))	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	1,327
S2	TI ("COVID-19" or COVID19) OR AB ("COVID-19" or COVID19)	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	124,185
S1	(MH "COVID-19")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	45,717

Cochrane Library

Date Run: 23/01/2024 11:37:38

ID Search Hits
#1 [mh "COVID-19"] 5024
#2 "COVID-19" or COVID19 18361
#3 ((coronavirus* or (corona NEXT virus*)) and (hubei or wuhan or beijing or shanghai)):ti,ab,kw 333

#4 (wuhan NEAR/5 virus*):ti,ab,kw 12
 #5 ("2019-nCoV" or 19nCoV or 2019nCoV):ti,ab,kw 13
 #6 ("SARS-CoV-2" or "SARS-CoV2" or "SARSCoV-2" or SARSCoV2 or SARS2 or "SARS-2" or "severe acute respiratory syndrome coronavirus 2"):ti,ab,kw 7067
 #7 ("2019-novel CoV" or "Sars-coronavirus2" or "Sars-coronavirus-2" or ("SARS-like" NEXT coronavirus*) or ((novel or new or nouveau) NEAR/2 (CoV or nCoV or covid or coronavirus* or corona virus or Pandemi*2))):ti,ab,kw 1278
 #8 ((novel W0 coronavirus*) or ("novel corona" W0 virus*) or "novel CoV"):ti,ab,kw 1
 #9 ((coronavirus* or corona virus*) NEXT ("19" or "2019")):ti,ab,kw 203
 #10 ("coronavirus 2" or "corona virus 2"):ti,ab,kw 2142
 #11 coronavirus* or (corona NEXT virus*):ti,kw 11454
 #12 COVID:ti,kw 13968
 #13 (((alpha or beta or delta or eta or gamma or iota or kappa or lambda or omicron or zeta) NEAR/3 variant#) and (coronavirus* or (corona W0 virus*) or covid*)):ti,ab,kw 196
 #14 {or #1-#13} 19827
 #15 [mh ^"Respiratory Syncytial Viruses"] 133
 #16 [mh "Respiratory Syncytial Virus, Human"] 112
 #17 [mh "Respiratory Syncytial Virus Infections"] 467
 #18 ((respiratorysync* NEXT virus*) or (respiratory NEXT sync* NEXT virus*) or (sync* NEXT respiratory NEXT virus*)):ti,ab,kw 1234
 #19 (respiratorysync* or (respiratory W0 sync*) or (sync* NEXT respiratory)):ti,ab,kw 11
 #20 (HRSV or RSV):ti,ab,kw 1121
 #21 (RS NEXT virus*):ti,ab,kw 12
 #22 {or #15-#21} 1496
 #23 [mh "Influenza, Human"] 3304
 #24 (influenza* or flu or grippe):ti,ab,kw 12990
 #25 [mh "Influenza A virus"] 1028
 #26 [mh "Influenza B virus"] 321
 #27 (H1N1 or PH1N1 or H3N2 or AH1N1 or "A(H1N1)" or "A/H1N1" or AH3N2 or "A(H3N2)" or "A/H3N2"):ti,ab,kw 1665
 #28 ^{32-#27} 13008
 #29 [mh Measles] 366
 #30 (measles or morbilli or rubeola*):ti,ab,kw 1363
 #31 1368
 #32 iGAS:ti,ab,kw 27
 #33 (invasi* NEAR/3 GAS):ti,ab,kw 27
 #34 (invasi* NEAR/3 ("Group A" NEAR/1 strep*)):ti,ab,kw 1
 #35 [mh "Streptococcal Infections"] and invasi*:ti,ab,kw 144
 #36 [mh "Streptococcal pyogenes"] and invasi*:ti,ab,kw 0
 #37 198
 #38 [mh Pneumonia] 10789
 #39 (pneumonia* or bronchopneumonia* or broncho-pneumonia* or (lung NEAR/2 inflam*) or (lungs NEAR/2 inflam*) or lobitis or (peri NEXT pneumoni*) or peripneumoni* or pneumonitis or (pulmon* NEAR/2 inflam*)):ti,ab,kw 25151
 #40 ^{47-#39} 29498
 #41 [mh "Meningitis, Meningococcal"] 206
 #42 (meningococcosis or meningococcus):ti,ab,kw 294

#43 ((meningococc* or "Neisseria meningitidis" or "N. meningitidis") NEAR/3 (disease* or infection* or meningit*)):ti,ab,kw 1161

#44 {Szczuka, #41-#43} 1241

#45 [mh "Haemophilus influenzae"] 596

#46 ((h*emophilus or bacillus or bacterium or "myco-bacterium" or mycobacterium) NEAR/3 (influenza* or meningitidis)):ti,ab,kw 2063

#47 "H. influenzae":ti,ab,kw 464

#48 (cocci bacillus NEXT pfeifferi*):ti,ab,kw 0

#49 {or #45-#48} 2163

#50 [mh "Bordetella pertussis"] 135

#51 (((bordetella or bacillus or h*emophilus) NEXT pertussis) or (bacterium NEXT tussis NEXT convulsiva*)):ti,ab,kw 266

#52 "H. pertussis":ti,ab,kw 2

#53 (abettin or "microbe de la coqueluche"):ti,ab,kw 0

#54 ^{59-#53} 268

#55 [mh "Severe Acute Respiratory Syndrome"] 390

#56 (respiratory NEXT syndrome* NEAR/3 (severe NEAR/1 acute)):ti,ab,kw 2646

#57 (SARS and (respiratory or syndrome*)):ti,ab,kw 3890

#58 ^{64-#57} 4338

#59 [mh ^"Respiratory Tract Infections"] 2826

#60 ((respiration or respiratory or airway* or "broncho-pulmonary" or bronchopulmonary or pulmonary) NEAR/3 infection*):ti,ab,kw 15692

#61 15692

#62 #14 or #22 or #28 or #31 or #37 or #40 or #44 or #49 or #54 or #58 or #61 66300

#63 [mh "Hand Disinfection"] 504

#64 [mh "Hand Hygiene"] 601

#65 [mh "Hand Sanitizers"] 49

#66 ((hand or hands) NEAR/5 (anti-sep* or antisept* or clean* or disinfect* or hygien* or rub or rubs or rubb* or sanit* or scrub* or soap* or steril* or wash*)):ti,ab,kw 2203

#67 ((hand or hands) NEAR/5 (alcohol* NEAR/2 rub*)):ti,ab,kw 101

#68 (handclean* or handwash*):ti,ab,kw 629

#69 ^{10-#68} 2328

#70 #62 AND #69 407

CDSR – 9 reviews

CENTRAL – 397 trials

Editorials – 1 (*did not download*)

Web of Science

#	Search Query	Results
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- TS=("COVID-19" or COVID19) OR TS=((coronavirus* or corona virus* and (hubei or wuhan or beijing or shanghai))) OR TS=(wuhan NEAR/5 virus*) OR TS=("2019-nCoV" or 19nCoV or 2019nCoV) OR TS=("SARS-CoV-2" or "SARS-CoV2" or "SARSCoV-2" or SARSCoV2 or SARS2 or "SARS-2" or "severe acute respiratory syndrome coronavirus 2") OR TS=("2019-novel CoV" or "Sars-coronavirus2" or "Sars-coronavirus-2" or "SARS-like coronavirus*") OR TS=("novel coronavirus*" or "novel corona virus*" or novel CoV) OR TS=("coronavirus 2" or "corona virus 2") OR
- 1 TI=(coronavirus* or "corona virus" or "corona viruses" or COVID) 525552
- novel NEAR/2 (CoV or nCoV or covid or coronavirus* or "corona virus" or Pandemi*2) (Topic) OR new NEAR/2 (CoV or nCoV or covid or coronavirus* or "corona virus" or Pandemi*2) (Topic) OR nouveau NEAR/2 (CoV or nCoV or covid or coronavirus* or "corona virus" or Pandemi*2) (Topic) OR (coronavirus* NEAR/0 "19") OR (coronavirus* NEAR/0 "2019") (Topic) OR ("corona virus" NEAR/0 "19") OR ("corona virus" NEAR/0 "2019") OR ("corona viruses" NEAR/0 "19") OR ("corona viruses" NEAR/0 "2019") (Topic)
- 2 31311
- ((alpha or beta or delta or eta or gamma or iota or kappa or lambda or omicron or zeta) NEAR/3 variant*) and coronavirus* (Topic) OR ((alpha or beta or delta or eta or gamma or iota or kappa or lambda or omicron or zeta) NEAR/3 variant*) and "corona virus" (Topic) OR ((alpha or beta or delta or eta or gamma or iota or kappa or lambda or omicron or zeta) NEAR/3 variant*) and "corona viruses" (Topic) OR ((alpha or beta or delta or eta or gamma or iota or kappa or lambda or omicron or zeta) NEAR/3 variant*) and COVID (Topic)
- 3 7124
- respiratorysync* NEAR/0 virus* (Topic) OR respiratory NEAR/0 sync* NEAR/0 virus* (Topic) OR sync* NEAR/0 respiratory NEAR/0 virus* (Topic) OR respiratorysync* (Topic) OR respiratory NEAR/0 sync* (Topic) OR sync* NEAR/0 respiratory (Topic) OR HRSV or RSV (Topic) OR RS
- 4 NEAR/0 virus* (Topic) 28054
- influenza* or flu or grippe (Topic) OR H1N1 or PH1N1 or H3N2 or AH1N1 or "A(H1N1)" or "A/H1N1" or AH3N2 or "A(H3N2)" or "A/H3N2" (Topic) OR measles or morbilli or rubeola* (Topic) OR iGAS (Topic) OR invasi* NEAR/3 GAS (Topic) OR invasi* NEAR/3 ("Group A" NEAR/1 strep*) (Topic) OR pneumonia* or bronchopneumonia* or broncho-pneumonia* or (lung NEAR/2 inflam*) or (lungs NEAR/2 inflam*) or lobitis or (peri NEAR/0 pneumoni*) or peripneumoni* or pneumonitis or (pulmon* NEAR/2 inflam*) (Topic)
- 5 485293

	meningococcosis or meningococcus (Topic) OR (meningococc* or "Neisseria meningitidis" or "N. meningitidis") NEAR/3 disease* (Topic) OR (meningococc* or "Neisseria meningitidis" or "N. meningitidis") NEAR/3 infection* (Topic) OR (meningococc* or "Neisseria meningitidis" or "N. meningitidis") NEAR/3 meningit* (Topic) OR (haemophilus or hemophilus or bacillus or bacterium or "myco-bacterium" or mycobacterium) NEAR/3 influenza* (Topic) OR (haemophilus or hemophilus or bacillus or bacterium or "myco-bacterium" or mycobacterium) NEAR/3 meningit* (Topic) OR "H. influenzae" (Topic)	
6	OR coccobacillus NEAR/0 pfeifferi* (Topic)	37671
	(bordetella or bacillus or h*emophilus) NEAR/0 pertussis (Topic) OR bacterium NEAR/0 tussis NEAR/0 convulsiva* (Topic) OR "H. pertussis" (Topic) OR abettin or "microbe de la coqueluche" (Topic)	7435
	respiratory NEAR/0 syndrome* NEAR/3 (severe NEAR/1 acute) (Topic) OR SARS and (respiratory or syndrome*) (Topic) OR (respiration or respiratory or airway* or "broncho-pulmonary" or bronchopulmonary or pulmonary) NEAR/3 infection* (Topic)	151195
8		
9	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8	1057325
	hand NEAR/5 (anti-sep* or antise* or clean* or disinfect* or hygien* or rub or rubs or rubb* or sanit* or scrub* or soap* or steril* or wash*) (Topic) OR hands NEAR/5 (anti-sep* or antise* or clean* or disinfect* or hygien* or rub or rubs or rubb* or sanit* or scrub* or soap* or steril* or wash*) (Topic) OR hand NEAR/5 alcohol* NEAR/2 rub* (Topic) OR hands NEAR/5 alcohol* NEAR/2 rub* (Topic) OR handclean* or handwash* (Topic)	19961
10		
11	#10 AND #9	4969

	(meta NEAR/0 analy*) or metanaly* or metaanaly* or (met NEAR/0 analy*) or "integrative research" or (integrative NEAR/0 review*) or (integrative NEAR/0 overview*) or "research integration" or (research NEAR/0 overview*) or (collaborative NEAR/0 review*) (Topic) OR (systematic NEAR/0 review*) or (systematic NEAR/0 overview*) or ("evidence-based" NEAR/0 review*) or ("evidence-based" NEAR/0 overview*) or (evidence NEAR/3 review*) or (evidence NEAR/3 overview*) or (evidence NEAR/0 map*) or (meta NEAR/0 review*) or (meta NEAR/0 overview*) or (meta NEAR/0 synthes*) or (mapping NEAR/0 review*) or (rapid NEAR/0 review*) or "review of reviews" or (scoping NEAR/0 review*) or (umbrella NEAR/0 review*) or (technology NEAR/0 assessment*) or HTA or HTAs (Topic) OR network NEAR/0 (MA or MAs) (Topic) OR NMA or NMAs or MTC or MTCs or MAIC or MAICs (Topic) OR (indirect* NEAR/0 compar*) (Topic) OR indirect NEAR/0 treatment* NEAR/1 compar* (Topic) OR mixed NEAR/0 treatment* NEAR/1 compar* (Topic) OR multiple NEAR/0 treatment* NEAR/1 compar* (Topic) OR multi NEAR/0 treatment* NEAR/1 compar* (Topic) OR simultaneous* NEAR/0 compar* (Topic) OR mixed NEAR/0	
12	comparison* (Topic)	847691
13	#11 AND #12	307
	randomised or randomisation* or randomized or randomization* or randomly or RCT or placebo* (Topic) OR (singl* or doubl* or trebl* or tripl*) NEAR/0 blind* (Topic) OR (singl* or doubl* or trebl* or tripl*) NEAR/0 dumm* (Topic) OR (singl* or doubl* or trebl* or tripl*) NEAR/0	
14	mask* (Topic) OR trial (Title)	1968750
15	#11 AND #14	406
	control* NEAR/2 trial (Topic) OR nonrandom* or (non NEAR/0 random*) or (quasi NEAR/0 random*) or (quasi NEAR/0 experiment*) (Topic) OR nRCT or "non-RCT" (Topic) OR control* NEAR/3 ("before and after" or "before after") (Topic) OR "time series" (Topic) OR "pre-" N5 "post-" (Topic) OR (pretest NEAR/5 posttest) or ("pre-test" NEAR/5 "post-test") (Topic) OR control* NEAR/2 study (Topic) OR control* NEAR/2 group*	
16	(Topic)	1772217
17	#11 AND #16	454
	cohort OR cohorts (Topic) OR longitudinal or prospective or retrospective (Topic) OR (followup or "follow-up") NEAR/0 study (Topic) OR (followup or "follow-up") NEAR/0 studies (Topic) OR observation* NEAR/0 (study or studies) (Topic) OR (population or "population-based") NEAR/0 study (Topic) OR (population or "population-based") NEAR/0 studies (Topic) OR (population or "population-based") NEAR/0 analysis (Topic) OR	
18	(population or "population-based") NEAR/0 analyses (Topic)	2867239

	(multidimensional or "multi-dimensional") NEAR/0 study (Topic) OR (multidimensional or "multi-dimensional") NEAR/0 studies (Topic) OR (multidimensional or "multi-dimensional") NEAR/0 analysis (Topic) OR (multidimensional or "multi-dimensional") NEAR/0 analyses (Topic) OR (comparative or comparison) NEAR/0 study (Topic) OR (comparative or comparison) NEAR/0 studies (Topic) OR (comparative or comparison) NEAR/0 analysis (Topic) OR (comparative or comparison) NEAR/0 analyses (Topic) OR ("case control" or "case controlled" or "case-based" or "case-comparison" or "case-compeer" or "case-referrent" or "case- referent") NEAR/3 study (Topic) OR ("case control" or "case controlled" or "case-based" or "case-comparison" or "case-compeer" or "case- referrent" or "case-referent") NEAR/3 studies (Topic)	584145
19	crosssection* or (cross NEAR/0 section*) (Topic) OR (multicenter or "multi-center" or multicentre or "multi-centre") NEAR/0 study (Topic) OR (multicenter or "multi-center" or multicentre or "multi-centre") NEAR/0 studies (Topic)	986104
20		
21	#18 OR #19 OR #20	4163890
22	#11 AND #21	1510
23	TS=(model or models or modeling or modeling)	11883442
24	#23 AND #11	773
25	#24 OR #22 OR #17 OR #15 OR #13 OR #11	4969

13.3 Appendix C: Excluded studies

13.3.1 Excluded hand hygiene studies from healthcare settings

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13.3.2 Excluded multi-component interventions

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13.3.3 Excluded studies at full text review with reasons

No outcome of interest

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No relevant intervention

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13.4 Appendix D: Characteristics of included studies

Appendix Table 1. Characteristics of included studies

Study information	Intervention/Exposure/Objective	Patient characteristics	Outcomes	Key findings	Quality	
Randomized control trials						
<p>Azman et al (2013), United States</p> <p>Trial #: NCT00446628</p> <p>Funder: Johns Hopkins Sommer Scholars Program, NIH, and CDC</p> <p>Industry sponsored: no</p>	<p>Study design: secondary analysis of a cluster randomized trial</p> <p>Study setting: school</p> <p>Study duration/follow-up: six months</p>	<p>RID(s) assessed: influenza A and B</p> <p>Intervention: hand sanitizer, training on hand hygiene</p> <p>Observed vs. self-reported: not reported</p> <p>Comparator: no training</p>	<p>Population: students in elementary school</p> <p>Total N (intervention, control): 3,360</p> <p>Age: not reported</p> <p>% female: not reported</p>	<p>Intervention vs. control, SITP (95% CI): influenza B, restricted to households where the school child was the first to present: 0.14, (0.07-0.21) vs. 0.25 (0.11-0.37), p=0.04; influenza A: 0.18 (0.05-0.29) vs. 0.12 (0.04-0.19)</p>	<p>There was no difference in infection rates between intervention and control households overall; transmission was significantly lower in intervention households only for Influenza B when restricted to households where the school child was the first to present in the household</p>	<p>Serious risk of bias</p>
<p>Cowling et al (2008), Hong Kong</p> <p>Trial #: NCT00425893</p> <p>Funder: Centers for Disease Control and Prevention, the Research Fund for the Control of Infectious Disease from the Food and Health Bureau, and the Area of Excellence Scheme of the Hong Kong University</p>	<p>Study design: cluster randomized controlled trial</p> <p>Study setting: households</p> <p>Study duration/follow-up: home visit took place within 36 hours of randomization for</p>	<p>RID(s) assessed: influenza</p> <p>Intervention: hand hygiene received control + education on efficacy of hand hygiene, alcohol sanitizer and liquid hand soap</p> <p>Observed vs. self-reported: both</p> <p>Comparator: control received education on health lifestyle; facemask group received control + education on efficacy of masks and</p>	<p>Population: cases positive for influenza A or B</p> <p>Total N (intervention, control): 122 (136, control: 71, facemasks: 61)</p> <p>Age: most 2-15 years in all groups</p> <p>% female: control: 57%;</p>	<p>For confirmed influenza: OR (95% CI): 1.07 (0.29, 4.00); SAR (95% CI), control vs. HH: 0.05 (0.03, 0.10) vs. 0.06 (0.02, 0.13), p=0.99; when intervention initiated within 36 hours: 0.06 (0.03, 0.13) vs. 0.10 (0.03, 0.23), p=0.69; when intervention initiated after 36 hours: 0.05</p>	<p>Little effect of HH on influenza transmission</p>	<p>High risk of bias</p>

Study information		Intervention/Exposure/Objective	Patient characteristics	Outcomes	Key findings	Quality
Industry sponsored: no	baseline data collection; home visits scheduled at 3, 6 and 9 days	asked to wear a mask when in the house	facemask: 45%; HH: 72%	(0.02, 0.12) vs. 0.01 (0.00, 0.12), p=0.30		
Cowling et al (2009), Hong Kong Trial #: NCT00425893 Funder: Centers for Disease Control and Prevention, the Research Fund for the Control of Infectious Disease from the Food and Health Bureau, and the Area of Excellence Scheme of the Hong Kong University Industry sponsored: no	Study design: cluster randomized controlled trial Study setting: households Study duration/follow-up: home visits scheduled at 3 and 6 days after baseline	RID(s) assessed: influenza Intervention: education about proper hand hygiene; provision of hand soap for each kitchen and bathroom and individual bottles of sanitizer for each participant Observed vs. self-reported: both Comparator: control: education on importance of a healthy lifestyle; facemask: same as hand hygiene + provision of a box of 50 surgical facemasks and asked to wear facemasks as much as possible when at home	Population: cases positive for influenza A or B Total N (intervention, control): 322 (136, control: 134, facemasks: 137) Age, median (IQR): control: 10 (6-18); intervention: 12 (7-28); facemask: 10 (6-22) % female: control: 53%; intervention: 44%; facemask: 55%	Transmission risk for confirmed influenza, OR (95% CI), compared to control: 0.57 (0.26, 1.22); SAR (95% CI) for confirmed influenza: control: 10 (6-14); HH: 5 (3-9); facemask: 7 (4-11), p=0.22; within 36 hours: control: 12 (7-18); HH: 5 (1-11); facemask: 4 (1-7), p=0.040	There was no statistically significant reduction in household transmission, unless the intervention was implemented early after symptom onset	High risk of bias

Study information		Intervention/Exposure/Objective	Patient characteristics	Outcomes	Key findings	Quality
<p>Larson et al (2010), United States</p> <p>Trial #: NCT00448981</p> <p>Funder: none reported</p> <p>Industry sponsored: not reported</p>	<p>Study design: RCT</p> <p>Study setting: households</p> <p>Study duration/follow-up: 19 months</p>	<p>RID(s) assessed: influenza</p> <p>Intervention: educational materials along with hand sanitizers, intended to be carried individually by household members to work or school</p> <p>Observed vs. self-reported: observed</p> <p>Comparator: education: received educational materials on prevention and treatment of URIs and influenza; hand sanitizer + face mask</p>	<p>Population: racialized children and adults</p> <p>Total N (intervention, control): 509 (169, 340)</p> <p>Age: most were 18 or older (52.7%)</p> <p>% female: 52%</p>	<p>Influenza rate/1,000 person weeks: education: 0.52; hand sanitizer: 0.60; hand sanitizer + face mask: 0.49; household members with no reported symptoms, hand sanitizer vs. education: p<0.01</p>	<p>Significant association between hand sanitizer use and a higher likelihood of reporting no symptoms among household members; however, no significant differences in infection rates were observed between the intervention groups</p>	<p>Some concerns of bias</p>
<p>Hubner et al (2010), Germany</p> <p>Trial #: ISRCTN96340690</p> <p>Funder: none reported</p> <p>Industry sponsored: not reported</p>	<p>Study design: RCT</p> <p>Study setting: city municipality</p> <p>Study duration/follow-up: 13 months</p>	<p>RID(s) assessed: Influenza</p> <p>Intervention: hand sanitizer provided, participants advised to use at least five times per day</p> <p>Observed vs. self-reported: self-reported</p> <p>Comparator: usual HH</p>	<p>Population: employees from city municipality</p> <p>Total N (intervention, control): 129 (64, 65)</p> <p>Age: 44.6</p> <p>% female: 86%</p>	<p>Influenza: 1.02 (0.20 - 5.23)</p>	<p>Hand sanitizer use did not significantly reduce the odds of influenza infection</p>	<p>High risk of bias</p>
<p>Simmerman et al (2011), Thailand</p> <p>Trial #: not reported</p>	<p>Study design: RCT</p> <p>Study setting: households</p>	<p>RID(s) assessed: influenza</p> <p>Intervention: handwashing education and a handwashing kit that included a graduated dispenser with standard</p>	<p>Population: children</p> <p>Total N (intervention, control): 348 (119, 229)</p>	<p>aOR for secondary influenza (95% CI): HW vs. control: 1.20 (0.76, 1.88), p=0.442; SAR (95% CI): control: 0.19</p>	<p>No difference in transmission of influenza between groups</p>	<p>High risk of bias</p>

Study information		Intervention/Exposure/Objective	Patient characteristics	Outcomes	Key findings	Quality
Funder: Centers for Disease Control and Prevention Industry sponsored: no	Study duration/follow-up: seven-day follow-up	unscented liquid hand soap Observed vs. self-reported: observed Comparator: education on nutrition, physical activity, and smoking cessation	Age: median age index patients: 5.5 years; median age household contacts: 34 years (IQR: 24-42) % female: 35%	(0.14, 0.24); HW: 0.23 (0.18, 0.28); face mask + HW: 0.23 (0.17, 0.28); p=0.63		
Talaat et al (2011), Egypt Trial #: US Naval Medical Research Unit No. 3 (NAMRU3) Institutional Review Board (Protocol #NAMRU3.NAMRU3.2007-0007) Funder: none reported Industry sponsored: not reported	Study design: RCT Study setting: elementary schools Study duration/follow-up: 12 weeks	RID(s) assessed: influenza A and B Intervention: materials for students, teachers, and parents; posters near sink; students required to wash hands at least twice a day Observed vs. self-reported: observed Comparator: observed HH activities	Population: children attending government elementary schools Total N (intervention, control): 44,451 (20,882, 23,569) Age, median: 8 % female: 49%	Laboratory confirmed influenza, intervention vs. controls: -47%, p<0.0001	Laboratory confirmed influenza decreased in intervention schools relative to control schools	Some concerns of bias
Levy et al (2013), Thailand Trial #: not reported Funder: US Centers for Disease Control and Prevention Industry sponsored: no	Study design: nested RCT Study setting: households Study duration/follow-up: seven-day follow-up	RID(s) assessed: influenza Intervention: handwashing frequency Observed vs. self-reported: observed Comparator: control, handwashing + face mask	Population: children Total N (intervention, control): 191 (96, 95) Age: 1-15 % female: 44%	RD (95% CI): 10.3% (1.1, 19.6), p=0.0310; % of households with 1 or more secondary infection on day 3 home visit was similar in handwashing and control households (36.8% vs. 29.2%, p=0.26)	HW might play a role in minimizing the transmission of influenza RNA on household surfaces	Some concerns of bias
Ram et al (2015), Bangladesh Trial #: NCT00880659	Study design: RCT Study setting:	RID(s) assessed: influenza Intervention: soap and daily	Population: children, adults	SAR ratio (95% CI): 2.40 (0.68-8.47), p=0.17; ARR: 1.24 (0.93-1.65)	Intensive HW promotion had a limited impact on	Some concerns of bias

Study information		Intervention/Exposure/Objective	Patient characteristics	Outcomes	Key findings	Quality
Funder: US Centers for Disease Control and Prevention Industry sponsored: no	households, rural area Study duration/follow-up: ten-day follow up	handwashing promotion Observed vs. self-reported: observed Comparator: standard practices	Total N (intervention, control): 3,536 (1,854, 1,682) Mean age in months (SD) of index case: intervention: 121.2 (181.7); control: 92.5 (141.0) % female: 40%		reducing influenza	
Secondary analysis of RCT data						
Baretta et al (2023), Switzerland Trial #: not reported Funder: Ursula-Wirz Stiftung Industry sponsored: no	Study design: secondary analysis of a double-blind parallel randomized trial Study setting: community Study duration/follow-up: not reported	RID(s) assessed: COVID-19 Intervention: hand hygiene ("Soapp", an app-based intervention to promote hand hygiene) Observed vs. self-reported: self-reported Comparator: pre/post intervention	Population: adults Total N (intervention, control): 216 Age (mean, SD): 40, 16 % female: 74	Soapp use (correct HH): beta (SE), 95% CI: total cumulative deaths: 0.03 (0.03), -0.20, 0.08; recent new deaths: 0.07 (0.03), 0.02, 0.12, p<0.05; recent change in deaths: 0.06 (0.02), 0.02, 0.10, p<0.05	No association between HH and total cumulative COVID-19 cases and deaths, and 2-week change in COVID-19 cases and deaths	Serious risk of bias
Before and after cohorts						
Baumkotter et al (2022), Germany Trial #: not reported Funder: European Regional Development Fund and the Ministry of Science and Health	Study design: prospective cohort study Study setting: community Study	RID(s) assessed: COVID-19 Exposure: COVID-19 protective behaviour Observed vs. self-reported: self-reported	Population: adults Total N (exposure, control): 10,250 Age, median: 56.9, 43.3/68.6	Incidence: log-rank P=0.66; infection risk in relation to frequency of HW: prevalence ratio, 95% CI: unadjusted: 1.08, 0.88-1.34, p=0.46; adjusted: 1.12, 0.88, 1.44, p=0.36	HH was not a protective factor in reducing COVID-19 transmission and infection	Serious risk of bias

Study information		Intervention/Exposure/Objective	Patient characteristics	Outcomes	Key findings	Quality
of the State of Rhineland-Palatinate; ReALity Initiative of the Life Sciences of the Johannes Gutenberg University Mainz; National University Medicine Research Network on COVID-19 B-FAST Industry sponsored: no	duration/follow-up: baseline: October 2020-April 2021; follow-up: March 2021-June 2021, four months after baseline	Comparator: pre/post	% female: 50.8%			
Bricchi et al (2023), Italy Trial #: not reported Funder: Reckitt Italia Industry sponsored: no	Study design: before and after cohorts Study setting: elementary school Study duration/follow-up: baseline; follow-up at one month after receiving and using the kit	RID(s) assessed: COVID-19 Exposure: Igiene Insieme program; educational materials and sanitizing products Observed vs. self-reported: self-reported Comparator: pre/post	Population: students in elementary school Total N (exposure, control): 472 schools; 16,988 students Age: not reported % female: not reported	Incidence rate, adherent schools vs. non-adherent schools, vs. regional ratio: Lombardy region: 9.6% vs. 15.4%, vs. 14.8%, p<0.001; Apuila Region: 10.7% vs. 12.3%, vs. 12.0%, p<0.001	HH education led to lower COVID-19 infections	Critical risk of bias
Xie et al (2021), China Trial #: not reported Funder: none reported Industry sponsored: not reported	Study design: observational, retrospective family cluster cohort Study setting: community Study duration/follow-up:	RID(s) assessed: COVID-19 Exposure: handwashing Observed vs. self-reported: observed Comparator: not reported	Population: household contacts of 20 individuals (index patients) with COVID-19 Total N (exposure, control): 99 Age, median (range): 38 (0.8-86)	Infection risk: HW ≥ 5 times/day: 52.8% vs. 76.9%, p=0.04	HW ≥ 5 times/day was associated with reduced infection risk	Serious risk of bias

Study information		Intervention/Exposure/Objective	Patient characteristics	Outcomes	Key findings	Quality
	three months		% female: not reported			
Case-control studies						
Castilla et al (2012), Spain Trial #: not reported Funder: Ministerio de Ciencia e Innovacion, Instituto de Salud Carlos III, Programa de Investigacion sobre Gripe A/H1N1 and Agency for the Management of Grants for University Research Industry sponsored: no	Study design: case-control study Study setting: community Study duration/follow-up: July 2009-February 2010	RID(s) assessed: influenza A(H1N1) Exposure: influenza infection prevention measures Observed vs. self-reported: self-reported Comparator: matched controls	Population: cases of confirmed H1N1 Total N (exposure, control): 962, 481, 481 Age, mean, SD: cases: 43.2, 13.7; controls: 47.0, 15.9 % female: cases: 62.5%; controls: 62.6%	Crude OR (95% CI), adjusted OR (95% CI): HW, compared to washing 4 or less times/day: 0.91 (0.64, 1.28), p=0.574; 0.87 (0.54, 1.39), p=0.55; more than 10 times/day: 1.13 (0.79, 1.60), p=0.514; 0.98 (0.59, 1.64), p=0.936; HW after touching contaminated surfaces, frequently/always vs. never/occasionally: 0.72 (0.52, 0.99), p=0.044; 0.70 (0.44, 1.11), p=0.132; using alcohol-based hand sanitizers, frequently/always vs. never/occasionally: 1.80 (1.30, 2.50), p<0.001; 1.36 (0.85, 2.19), p=0.197	Habitual HW after touching contaminated surfaces was associated with a non-significantly lower risk of H1N1; the frequency of HW and alcohol-based sanitizers had no significant protective effect	Serious risk of bias
Zhang et al (2013), China Trial #: not reported Funder: National High	Study design: case-control Study setting: households	RID(s) assessed: influenza A (H1N1) Exposure: handwashing Observed vs. self-reported: self-	Population: case households with self-quarantined index patient and secondary case	OR (95% CI): HW ≥3 times/day vs. <3/day: 0.71 (0.48-0.94), p=0.05	HW frequency was significantly associated with household transmission of pandemic H1N1	Serious risk of bias

Study information		Intervention/Exposure/Objective	Patient characteristics	Outcomes	Key findings	Quality
Technology Research and Development Program of China Industry sponsored: no	Study duration/follow-up: two months	reported Comparator: control households also with self quarantined index patient at home	Total N (exposure, control): 162 (54, 108) Age: not reported % female: not reported			
Zhang et al (2013), China Trial #: not reported Funder: none reported Industry sponsored: not reported	Study design: case-control Study setting: flight from New York to Hong Kong to Fuzhou Study duration/follow-up: not reported	RID(s) assessed: influenza A (H1N1) Exposure: hand hygiene when using lavatory or before eating Observed vs. self-reported: self-reported Comparator: controls	Population: passengers age 5+ Total N (exposure, control): 41 (9, 32) Age, median (range): 20 (6-46) % female: 44% of cases, 53% of controls	OR (95% CI): 0.83 (0.06–49.00), p=0.55	HH was not significantly associated with being a case passenger	Serious risk of bias
Doshi et al (2015), Bangladesh Trial #: not reported Funder: CDC Industry sponsored: no	Study design: case-control Study setting: community Study duration/follow-up: data collection occurred 4-6 weeks after diagnosis; four visits made over 11 days	RID(s) assessed: influenza Exposure: handwashing behaviour Observed vs. self-reported: observed Comparator: matched controls with no respiratory illness in the 6 months prior	Population: children with lab-confirmed influenza Total N (exposure, control): 486 (145, 341) Age: most children were 24-59 months % female: case: 49%; control: 55.4%	Median (range), case vs. controls, OR (95% CI): HW events per household: 3 (0-12) vs. 2 (0-13), 1.06 (0.90-1.24), p=0.49; HW events by caregiver: 1 (0-8) vs. 1 (0-8), 1.01 (0.87-1.18), p=0.86; HW events following HW opportunities: 2 (0-9) vs. 1 (0-11), 1.13 (0.94-1.36), p=0.21	No association between any HW measures and influenza infection	Moderate risk of bias
Torner et al (2015), Spain	Study design: case-control	RID(s) assessed: influenza A (H1N1)	Population: children in community during 2009	aOR (95% CI): frequent HW more than 5 times	Frequent HW more than 5 times per day	Critical risk of bias

Study information		Intervention/Exposure/Objective	Patient characteristics	Outcomes	Key findings	Quality
<p>Trial #: not reported</p> <p>Funder: Ministry of Science and Innovation, Institute of Health Carlos III, Research Program on Influenza A/H1N1, and the Catalan Agency for the Management of Grants for University Research</p> <p>Industry sponsored: no</p>	<p>Study setting: community</p> <p>Study duration/follow-up: 22 months</p>	<p>Exposure: handwashing and handsanitizer use</p> <p>Observed vs. self-reported: self-reported</p> <p>Comparator: controls matched for age, hospital/geographical area, and hospitalization date</p>	<p>pandemic and 2010-11 post-pandemic</p> <p>Total N (exposure, control): 478 (239, 239)</p> <p>Age: 5.4 (SD ± 4.5)</p> <p>% female: 42.3%</p>	<p>per day: 0.62 (0.39 – 0.99), p=0.04</p>	<p>was a significant protective factor for influenza</p>	
<p>Liu et al (2016), China</p> <p>Trial #: not reported</p> <p>Funder: none reported</p> <p>Industry sponsored: not reported</p>	<p>Study design: case-control</p> <p>Study setting: school/workplace</p> <p>Study duration/follow-up: four months</p>	<p>RID(s) assessed: influenza</p> <p>Exposure: handwashing practices and the frequency of handwashing</p> <p>Observed vs. self-reported: self-reported</p> <p>Comparator: matched controls</p>	<p>Population: patients with influenza</p> <p>Total N (exposure, control): 200 (100, 100)</p> <p>Age, median (IQR): 10 (5.5 to 25) for cases; 10 (5-25) for controls</p> <p>% female: 48% of controls; 41% of cases</p>	<p>ORs decreased as hand-washing scores improved, 0.26 to 0.029, p<0.001</p>	<p>Higher hand-washing scores and better hygienic habits were associated with reduced odds of influenza infection</p>	<p>Serious risk of bias</p>
<p>Doung-ngern et al (2020), Thailand</p> <p>Trial #: not reported</p> <p>Funder: Department of Disease Control, MoPH</p> <p>Industry sponsored: no</p>	<p>Study design: retrospective case-control</p> <p>Study setting: community</p> <p>Study duration/follow-up: cases identified as</p>	<p>RID(s) assessed: COVID-19</p> <p>Exposure: COVID-19 protective behaviors</p> <p>Observed vs. self-reported: self-reported</p> <p>Comparator: asymptomatic contacts who never tested positive</p>	<p>Population: asymptomatic contacts of COVID-19 patients who later tested positive</p> <p>Total N (exposure, control): 1,050 (211, 839)</p>	<p>Crude OR (95% CI), compared to no HW: sometimes: 0.41 (0.18, 0.91); often: 0.19 (0.08, 0.46), p<0.001; aOR (95% CI), compared to no HW: sometimes: 0.34 (0.14, 0.81); often: 0.33 (0.13, 0.87), p=0.045</p>	<p>HW was significantly associated with a lower risk for COVID-19</p>	<p>Serious risk of bias</p>

Study information		Intervention/Exposure/Objective	Patient characteristics	Outcomes	Key findings	Quality
	being asymptomatic during March 1-31, 2020; contacts phoned from April 30-May 27, 2020		Age: most in both groups 15-65, ranged from less than 15 to more than 65 % female: cases: 30.8%; controls: 48.2%			
Lio et al (2021), China Trial #: not reported Funder: none reported Industry sponsored: not reported	Study design: case-control Study setting: community Study duration/follow-up: fourteen-day follow-up	RID(s) assessed: COVID-19 Exposure: handwashing practices within 14 days, frequency of handwashing in various situations Observed vs. self-reported: self-reported Comparator: those who didn't test positive	Population: patients with COVID-19 and travelers from high-risk countries undergoing quarantine Total N (exposure, control): 1,137 (24, 1,113) Age, mean: 28.85 ± 13.23 % female: 55.6%	Crude OR (95% CI), HW: handling food or cooking: 0.186 (0.071–0.485), p<0.005; after a toilet trip: 0.355 (0.130–0.971), p<0.05), after outdoor activity: 0.027 (0.007–0.104), p<0.005; after sneezing or coughing: 0.286 (0.127–0.648), p<0.005; after handling pets: 0.324 (0.142–0.739), p<0.01; before touching the mouth and nose area: 0.156 (0.069–0.353), p<0.005; reduction in risk of infection: HW after outdoor activities: 97.9%; before touching the mouth/nose area: 69.7%	Decent HW habits showed protective effects on COVID-19 infection	Serious risk of bias
Liu et al (2021), United States Trial #: not reported	Study design: case-control Study setting:	RID(s) assessed: COVID-19 Exposure: frequency of engaging in "increased hand washing" or "hand	Population: children affected by COVID-19 and households contacts comprising	SAR % (95% CI): increase HW or sanitizer use: 19 (9-36), p=0.01	Increased HW or hand sanitizer use had a significantly lower SAR compared to those who	Critical risk of bias

Study information		Intervention/Exposure/Objective	Patient characteristics	Outcomes	Key findings	Quality
Funder: none reported Industry sponsored: not reported	households Study duration/follow-up: fourteen-day follow-up	sanitizer use" Observed vs. self-reported: self-reported Comparator: those who didn't test positive	both children and adults Total N (exposure, control): 65 (15, 50) Age, median (IQR): index patient age: 2 years (1=10); household contact age: 36 (8-42) % female: not reported		did not	
Speaker et al (2021), United States Trial #: not reported Funder: none Industry sponsored: no	Study design: case-control Study setting: community Study duration/follow-up: not reported	RID(s) assessed: COVID-19 Exposure: protective behaviour, washing hands after possible exposure, and washing hands for at least 20 seconds Observed vs. self-reported: self-reported Comparator: age and gender matched to controls from electronic health records	Population: adults with a positive PCR result Total N (exposure, control): 339 (113, 226) Age, median: 54 % female: 63%	Rates, cases vs. negative controls: HW/sanitizing hands after possible exposure: p=0.24; for at least 20 seconds: p=0.60	There was no significant difference in rates of HW/sanitizing hands after possible exposure or for at least 20 seconds between cases compared to negative controls	Critical risk of bias
Hara et al (2022), Japan Trial #: not reported Funder: grant for Research on Emerging and Re-emerging Infectious Diseases, Health and	Study design: case-control Study setting: households, community	RID(s) assessed: COVID-19 Exposure: washing hands for a minimum of 20 seconds upon returning home, utilizing disinfectants based on chlorine or ethanol	Population: patients with COVID-19 and residence of Saga Prefecture and Fukuoka Prefecture Total N (exposure,	OR (95% CI): HW for more than 20 s each time: 0.60 (0.41–0.88), which indicates	Personal protective health behaviors are negatively associated with COVID-19 infection	Critical risk of bias

Study information		Intervention/Exposure/Objective	Patient characteristics	Outcomes	Key findings	Quality
Labour Science Research Grants from the Ministry of Health, Labour and Welfare Industry sponsored: no	Study duration/follow-up: three months and 22 days (4 June-26 Sept, 2021)	Observed vs. self-reported: self-reported Comparator: individuals with negative COVID-19 tests who were in close contact with cases	control): 577 (398, 179) Age, mean: cases: 41.7 ± 14.7; controls: 46.9 ± 19.3 % female: cases: 47.7; controls: 61.5			
Francis et al (2023), United Kingdom Trial #: not reported Funder: National Institute for Health and Care Research School for Primary Care Research Industry sponsored: no	Study design: case-control Study setting: community Study duration/follow-up: data collection occurred from November 2020 to June 2021	RID(s) assessed: COVID-19 Exposure: use of NPIs during the two weeks before their illness and two weeks prior to completing their questionnaire Observed vs. self-reported: self-reported Comparator: study population not meeting definition for COVID-19	Population: adults with COVID-19 Total N (exposure, , control): 37,758 (2,814, 24,944) Age: most participants 25-79 % female: 62%	Association between NPI and COVID-19 infection, unadjusted OR (95% CI): HW when arriving home: 0.57 (0.46, 0.73); HW before eating: 1.65 (1.31, 20.6)	HW when arriving home was associated with a reduced odds of COVID-19 infection; HW before eating was associated with an increased odds of COVID-19	Moderate risk of bias
Cajar et al (2022), Denmark Trial #: not reported Funder: IMK Almene Fond Industry sponsored: no	Study design: case-control web-based survey Study setting: community Study duration/follow-up: testing done in November and December 2020, questionnaire	RID(s) assessed: COVID-19 Exposure: COVID-19-related behaviors Observed vs. self-reported: self-reported Comparator: matched negative and untested controls	Population: cases of lab-confirmed COVID-19 infection Total N (exposure, control): 93,121 (11,854, 81,267) Age, median (IQR): 44 (30,55) % female: 58.9%	IRR, negative control; untested control: hand sanitizer use: 0.79, p<0.001; 0.98, p=0.58; HW: 1.09, p=0.0087; 1.30, p<0.001	Hand sanitizer use was associated with a lower rate of infection; however, frequent HW was associated with a higher risk	Serious risk of bias

Study information		Intervention/Exposure/Objective	Patient characteristics	Outcomes	Key findings	Quality
	administered in December 2020 and January 2021					
Cross-sectional surveys						
Skolmowska et al (2020), Poland Trial #: not reported Funder: Polish Ministry of Science and Higher Education Industry sponsored: no	Study design: cross-sectional survey Study setting: regional Study duration/follow-up: one month	RID(s) assessed: COVID-19 Exposure: hand hygiene practices Observed vs. self-reported: self-reported Comparator: regions with high COVID-19 morbidity vs. regions with low COVID-19 morbidity	Population: adolescents Total N (i exposure, control): 1,222 Age: not reported % female: not reported		Individuals residing in regions with lower COVID-19 morbidity exhibited better HH practices than those in regions with higher COVID-19 morbidity	Critical risk of bias
Xu et al (2020), China Trial #: not reported Funder: School of Public Health and Management of Chongqing Medical University and The Science and Technology Association of Chongqing Municipal Government Industry sponsored: no	Study design: comparative cross-sectional survey Study setting: community Study duration/follow-up: not reported	RID(s) assessed: COVID-19 Exposure: adherence to handwashing Observed vs. self-reported: self-reported Comparator: those without COVID-19	Population: adults Total N (exposure, control): 8,158 Age: 18-39 years: 62%, 40-59: 36%, 60: 3% % female: 63%	Infection risk; RR (95% CI): did not wash their hands vs. did: 2.28% vs 0.65%; 3.53 (1.53-8.15), p=0.009	There was a significantly increased risk of COVID-19 infection for those who did not wash their hands	Serious risk of bias

Study information		Intervention/Exposure/Objective	Patient characteristics	Outcomes	Key findings	Quality
<p>Karout et al (2020), United States</p> <p>Trial #: not reported</p> <p>Funder: none</p> <p>Industry sponsored: no</p>	<p>Study design: comparative cross-sectional survey</p> <p>Study setting: community</p> <p>Study duration/follow-up: one month</p>	<p>RID(s) assessed: COVID-19</p> <p>Exposure: handwashing and handsanitizer use</p> <p>Observed vs. self-reported: self-reported</p> <p>Comparator: those without COVID-19</p>	<p>Population: Latino adults</p> <p>Total N (exposure, control): 410 (76, 334)</p> <p>Age: 35-44 years: 47.6%; 45-54 years: 19.3%; ≥55 years: 12.9%</p> <p>% female: 66%</p>	<p>Wash hands or use hand sanitizer: cases: never: 48.7%; sometimes: 31.6%; always: 19.7%; controls: never: 0%; sometimes: 78.7%; and always: 21.3%, p<0.001</p>	<p>Cases were significantly less likely to wash their hands or use hand sanitizer compared to controls</p>	<p>Critical risk of bias</p>
<p>Abd (2021), Iraq</p> <p>Trial #: not reported</p> <p>Funder: none reported</p> <p>Industry sponsored: not reported</p>	<p>Study design: cross-sectional survey</p> <p>Study setting: community</p> <p>Study duration/follow-up: not reported</p>	<p>RID(s) assessed: COVID-19</p> <p>Exposure: COVID-19 mitigation habits</p> <p>Observed vs. self-reported: self-reported</p> <p>Comparator: those without COVID-19</p>	<p>Population: adults</p> <p>Total N (exposure, control): 348</p> <p>Age: 15-49 years</p> <p>% female: 61.49%</p>	<p>28.03% of infected patients vs. 53.73% of healthy patients, p<0.001; Pearson correlation: -0.245, p<0.001</p>	<p>There was a correlation between HW and COVID-19 such that those who washed their hands were significantly less likely to be positive</p>	<p>Serious risk of bias</p>
<p>Anan et al (2021), Japan</p> <p>Trial #: not reported</p> <p>Funder: University of Occupational and Environmental Health, Japan; Japanese Ministry of Health, Labour and Welfare; Anshin Zaidan; Collabo-Health Study Group; Hitachi Systems, Ltd.; and Chugai Pharmaceutical</p>	<p>Study design: cross-sectional survey</p> <p>Study setting: regional</p> <p>Study duration/follow-up: not reported</p>	<p>RID(s) assessed: COVID-19</p> <p>Exposure: COVID-19 NPI habits</p> <p>Observed vs. self-reported: self-reported</p> <p>Comparator: those without COVID-19</p>	<p>Population: full-time workers</p> <p>Total N (exposure, control): 27,036</p> <p>Age, mean for each region: 46.5, 45.8, 47.1, 47.8</p> <p>% female, for each region: 49.3%, 49.2%,</p>	<p>OR (95% CI), for the region with the highest infection rates: washing hands after using the bathroom: 1.08 (0.97-1.20, p=0.157); disinfecting hands with sanitizer when going outdoors: 1.17 (1.01-1.35, p<0.001); disinfecting or washing hands after touching</p>	<p>Those who lived in regions with higher infection rates were more likely to disinfect hands with alcohol sanitizers when going outdoors, disinfect or washing hands after touching high-touch surfaces, and carry alcohol sanitizers when going out</p>	<p>Serious risk of bias</p>

Study information		Intervention/Exposure/Objective	Patient characteristics	Outcomes	Key findings	Quality
Co., Ltd. Industry sponsored: yes			48.9%, 48.5%	frequently touched surfaces: 1.33 (1.18-1.51, p<0.001); carrying sanitizer when going out: 1.32 (1.17-1.49, p<0.001)		
Badri et al (2021), United States Trial #: not reported Funder: none reported Industry sponsored: not reported	Study design: cross-sectional survey Study setting: community Study duration/follow-up: not reported	RID(s) assessed: COVID-19 Exposure: COVID-19-related behaviors, including handwashing and sanitizer use Observed vs. self-reported: self-reported Comparator: adults without COVID-19	Population: adults Total N (exposure, control): 314 (209, 105) Age, median (IQR): 52 (42-61) for intervention, 54 (44-62) for control % female: 53.8%	aOR (95% CI): hand sanitizer use: 0.26 (0.13-0.53); washed hands often: 0.55 (0.21-1.44)	Hand sanitizer use decrease odds of testing positive for COVID-19, but HW did not	Serious risk of bias
Sharif et al (2021), Bangladesh Trial #: not reported Funder: none reported Industry sponsored: not reported	Study design: cross-sectional survey Study setting: urban areas vs. village areas Study duration/follow-up: 16 months	RID(s) assessed: COVID-19 Exposure: hand hygiene practices Observed vs. self-reported: self-reported Comparator: participants categorized into three groups based on their frequency of hand washing or hand sanitizer use: those who used hand washing or hand sanitizer appropriately, those who used it moderately, and those who did not use it at all	Population: children, adults Total N (exposure, control): 1,690 Age: 34 ± 3.9 % female: 45.3%	Age-adjusted OR: 0.46, 95% CI: 0.27–0.97. Washing and cleaning hands by soaps/hand sanitizers: reduced risk of infection (p=0.005), hospitalization (p=0.02), ICU admission (p=0.05) and death (p=0.005)	HW contributed to a decreased risk of infection	Moderate risk of bias
Ahmed et al (2022),	Study design: cross-	RID(s) assessed: COVID-19	Population: households	Areas hardest hit by	COVID-19 cases	Serious risk of

Study information		Intervention/Exposure/Objective	Patient characteristics	Outcomes	Key findings	Quality
Bangladesh Trial #: not reported Funder: none Industry sponsored: no	sectional survey Study setting: regional Study duration/follow-up: not reported	Exposure: secondary analysis of two surveys: one on national-level estimates of health indicators for women and children and another on confirmed COVID-19 cases throughout Bangladesh Observed vs. self-reported: self-reported Comparator: regions with high cases of COVID-19 vs. those with low cases	Total N (exposure, control): 64,400 Age: not reported % female: not reported	COVID-19 had ~50% HW coverage	increased at a higher pace where household HW was low; the district with the highest coverage of household HW had the lowest COVID-19 cases	bias
Folayan et al (2022), Nigeria Trial #: not reported Funder: partially funded by the NIH/NIA Industry sponsored: no	Study design: cross-sectional survey Study setting: 12 unspecific West African countries Study duration/follow-up: collected data between June 29 and December 31, 2020	RID(s) assessed: COVID-19 Exposure: participants asked about the impact of COVID-19 Observed vs. self-reported: self-reported Comparator: those without COVID-19	Population: adults Total N (exposure, control): 5,050 Age, mean (SD): 36.94 (11.47) % female: not reported	AOR (95% CI): testing positive for COVID-19 and difficulty washing hands often: 0.773 (0.659-0.907), p=0.002	Participants who had difficulty washing their hands often were more likely to test positive for COVID-19 than not	Serious risk of bias
Other observational study designs						
Al Lawati et al (2023), Oman Trial #: not reported Funder: none reported	Study design: retrospective study Study setting: pilgrimage to Karbala	RID(s) assessed: COVID-19 Exposure: survey sent to pilgrims about COVID-19 Observed vs. self-reported: self-	Population: Omani pilgrims Total N (exposure, control): 139	59.0% reported using hand sanitizer, p=0.661	No association between sanitation and COVID-19 infection	Moderate risk of bias

Study information		Intervention/Exposure/Objective	Patient characteristics	Outcomes	Key findings	Quality
Industry sponsored: not reported	Study duration/follow-up: not reported	reported Comparator: those without COVID-19	Age: mean: 42.6 ± 13.7 years; median: 42.0 (15-76) % female: 62.6%			
Uchida et al (2017), Japan Trial #: JP26860413, JP201447016A Funder: Grant-in-Aid for Young Scientists (B) from the Ministry of Education, Culture, Sports, Science and Technology, and a Health Labour Sciences Research Grant from The Ministry of Health, Labour and Welfare Industry sponsored: no	Study design: Cohort Study setting: community Study duration/follow-up: four months	RID(s) assessed: influenza Exposure: experiences with seasonal influenza, and vaccination, mask wearing and handwashing Observed vs. self-reported: self-reported Comparator: those without influenza	Population: children (7-12 years old) attending 29 public elementary schools in Matsumoto city Total N (exposure, control): 10,524 (2,149, 8,375) Age: not reported % female: 49%	OR (95% CI): 1.447 (1.274–1.644)	HW had no significant protective association and was associated with an increased likelihood of developing seasonal influenza	Serious risk of bias
Uchida et al (2017), Japan Trial #: JP26860413, JP201447016A Funder: Grant-in-Aid for Young Scientists (B) from the Ministry of Education, Culture, Sports, Science and Technology, and a Health Labour Sciences Research Grant from The Ministry of Health, Labour and Welfare	Study design: Cohort Study setting: community Study duration/follow-up: four months	RID(s) assessed: influenza Exposure: experiences with seasonal influenza, and vaccination, mask wearing and handwashing Observed vs. self-reported: self-reported Comparator: those without influenza	Population: children (7-12 years old) attending 29 public elementary schools in Matsumoto city Total N (exposure, control): 10,524 (2,149, 8,375) Age: not reported % female: 49%	Rs did not correlate significantly with HW (p = 0.105, p=0.594)	No protective effect for HW was observed for influenza	Serious risk of bias

Study information		Intervention/Exposure/Objective	Patient characteristics	Outcomes	Key findings	Quality
Industry sponsored: no						
Szczuka et al (2021), multiple Trial #: NCT04367337 Funder: none reported Industry sponsored: not reported	Study design: Cross-sectional Study setting: community Study duration/follow-up: five months	RID(s) assessed: COVID-19 Exposure: hand washing adherence Observed vs. self-reported: self-reported Comparator: those without COVID-19	Population: adults Total N (exposure, control): 6,064 Age: not reported % female: not reported		Higher HW adherence was associated with lower levels of COVID infections and mortality compared to beginning of the pandemic; increase in recent (2-week) cases of COVID morbidity/mortality was associated with higher levels of HW	Critical risk of bias
Ma et al (2020), China Trial #: not reported Funder: National Key R&D Program, Shandong Key Research and Development Program and Shandong Team-training Program for Talents of Superior Disciplines at Colleges Industry sponsored: no	Study design: cross-sectional Study setting: not reported Study duration/follow-up: not reported	RID(s) assessed: influenza Exposure: instant hand wiping with a towel soaked in water containing soap powder or sodium hypochlorite Observed vs. self-reported: observed Comparator: not reported	Population: individuals who were exposed to Low Pathogenic Avian Influenza Virus (AIV) Total N (exposure, control): not reported Age: not reported % female: not reported	Removal percentage (CI): 100% soap powder: 98.36% (96.11% to 99.31%); 0.05% Active Chlorine: 96.62% (94.37% to 97.97%); 0.25% Active Chlorine from Sodium Hypochlorite: 99.98% (99.94% to 99.99%)	Hand wiping with a wet towel soaked in water containing soap powder, active chlorine, or active chlorine from sodium hypochlorite is highly effective in reducing the presence of the Avian Influenza Virus on hands	Critical risk of bias
Modeling studies						
Zhang et al (2018), China Trial #: not reported Funder: Collaborative Research Fund provided by the Research Grants Council of Hong Kong	Study design: model Study setting: student office simulation study based on prior	RID(s) assessed: influenza A Model: influenza A transmission via long-range airborne, fomite and close contact	Population: students Total N: 39 students		Infection risk can be reduced if HW frequency is greater than six times per hour; however, HW alone is limited to reduce infection risk	Not assessed

Study information		Intervention/Exposure/Objective	Patient characteristics	Outcomes	Key findings	Quality
Industry sponsored: no	student surface touch behaviour from video cameras Study duration/follow-up: five days					
Zamir et al (2020), Pakistan Trial #: RG-DES-2017-01-17 Funder: Prince Sultan University Nonlinear Analysis Methods in Applied Mathematics (NAMAM) group number Industry sponsored: no	Study design: model Study setting: not reported Study duration/follow-up: not reported	RID(s) assessed: COVID-19 Model: optimal control model	Population: not reported		The mandatory use of sanitizer proves an essential effect in minimizing the transmission risk after 150 days compared to 250 days for HW	Not assessed
Alvarez-Pomar et al (2021), Colombia Trial #: not reported Funder: none reported Industry sponsored: not reported	Study design: model Study setting: simulated community Study duration/follow-up: simulation lasts 60 days	RID(s) assessed: COVID-19 Modelled objective: handwashing, assumed to be effective in reducing the risk of infection by 30% Comparator: no handwashing	Population: not reported		With no social distancing or mask wearing, HW has no effect on flattening the curve, mortality, or confirmed cases	Not assessed

Study information		Intervention/Exposure/Objective	Patient characteristics	Outcomes	Key findings	Quality
Endo et al (2021), Japan Trial #: not reported Funder: partially funded by Lnest Frabt Taisho Pharmaceutical Award Industry sponsored: yes	Study design: model Study setting: school Study duration/follow-up: not reported	RID(s) assessed: COVID-19 Model: effect of handwashing, based on a mathematical model of influenza virus transmission applied to model within-school transmissions of COVID-19	Population: students	Median estimates (95% credible intervals): relative susceptibility and HW: 1.54 (1.36-1.75); relative infectiousness: 1.27 (0.91-1.72)	HW was associated with increased susceptibility to COVID-19	Not assessed
Jayaweera et al (2021), Sri Lanka Trial #: not reported Funder: none reported Industry sponsored: not reported	Study design: model Study setting: community Study duration/follow-up: eight months	RID(s) assessed: COVID-19 Modelled objective: hand hygiene Comparator: social distancing, lockdown and isolation, contact tracing, facemask, quarantine efforts, health related benefits	Population: not reported	Mean Rts for HH was 3.88%	Enhancing HH measures has a modest positive impact on reducing the effective reproduction number, an indicator of a virus's transmission potential	Not assessed
Pitol et al (2021), Switzerland Trial #: not reported Funder: Swiss National Science Foundation Industry sponsored: no	Study design: model Study setting: community Study duration/follow-up: not reported	RID(s) assessed: COVID-19 Modelled objective: alcohol-based hand sanitizer	Population: not reported		Hand disinfection substantially reduces risks of transmission independent of the disease's prevalence and contact frequency	Not assessed
Arav et al (2021), Israel Trial #: not reported Funder: none	Study design: model Study setting: household/office	RID(s) assessed: COVID-19 Model: indoor agent-based transmission model	Population: two individuals who share the same indoor space	OR (95% CI): washing hands once per hour vs. 3 times a day: 0.72 (0.67–0.8)	Washing hands once per hour vs. three times a day reduces the risk of infection; HW every 30-40 mins governed	Not assessed

Study information		Intervention/Exposure/Objective	Patient characteristics	Outcomes	Key findings	Quality
Industry sponsored: no	Study duration/follow-up: not reported				by contact events on fomites and face may further reduce the risk of infection	
Brüggenjürgen et al (2021), Germany Trial #: not reported Funder: Open Access funding enabled and organized by Projekt DEAL Industry sponsored: not reported	Study design: model Study setting: not reported Study duration/follow-up: not reported	RID(s) assessed: COVID-19 Modelled objective: impact of NPIs on COVID-19 (test and isolate, keeping distance, masking, hand hygiene)	Population: not reported	Estimated mean efficacy: 7%	Estimated mean efficacy of HH was the lowest of all NPIs (keeping distance, test and isolate, masking, closure of restaurants)	Not assessed
Nannyonga et al (2021), Uganda Trial #: not reported Funder: none reported Industry sponsored: not reported	Study design: model Study setting: community Outcomes: Transmission	RID Assessed: COVID-19 Modelled objective: effectiveness of NPIs at reducing transmission	Population: adults		Coverage of handwashing at least 6x/day to reduce SAR to less than 1 is 70%, current coverage was around 26%	Not assessed
Ghoroghi et al (2022), United Kingdom Trial #: not reported Funder: Engineering and Physical Sciences Research Council in the UK	Study design: model Study setting: university foyer Study duration/follow-up: not reported	RID(s) assessed: COVID-19 Modelled objective: hand hygiene (handwash & using alcohol-based sanitizers)	Population: adults	For 50% of individuals performing HH, there is an 18% reduction in the mean probability of secondary infected individuals; for 70% performing HH, there is a 27% reduction, and if 100% perform HH, there	The larger the number of individuals performing HH, the lower the mean probability of secondary infected individuals	Not assessed

Study information		Intervention/Exposure/Objective	Patient characteristics	Outcomes	Key findings	Quality
Industry sponsored: no				is a 38% reduction		
Pham et al (2022), Singapore Trial #: not reported Funder: Wellcome Trust Industry sponsored: no	Study design: model Study setting: community Study duration/follow-up: not reported	RID(s) assessed: influenza Modelled objective: two hand hygiene approaches on infection probability: Fixed-Time Hand Washing: regular hand washing at set intervals, regardless of contamination events; Event-Prompted Hand Washing: hand washing after specific contamination events, with a delay following each occurrence	Population: not reported	Probability of infection: no HW: 10%; every 15 min: 6%; one minute after hand contamination events: 2%	Event-prompted HW is more effective than fixed-time HW in reducing the probability of infection	Not assessed
Joseph et al (2023), Zimbabwe Trial #: not reported Funder: Global Water Security and Sanitation Partnership (GWSP) of the World Bank and the ieConnect for Impact Program funded with UK aid from the UK government Industry sponsored: no	Study design: model Study setting: households Study duration/follow-up: 12 months	RID(s) assessed: COVID-19 Modelled objective: developed a hand-washing risk index, incorporating information on household-level access to hand-washing facilities with soap and water; two counterfactual scenarios for the probability of severe COVID-19: the first scenario assumes a uniform low handwashing risk across the country, reflecting improved handwashing access; the second scenario represents an ideal case where every household has access to a handwashing facility with soap and water, assigning a handwashing risk of 0	Population: children, adults	Mean prevalence of respiratory illness: reducing HW risk to the lowest observed levels: 0.39 to 0.32; with perfect HW: 0.39 to 0.15; perfect access to HW facilities: 0.025	Reducing HW risk and increasing access to HW facilities would reduce the prevalence of respiratory illness	Not assessed

AIV: Avian Influenza Virus; aOR: adjusted odds ratio; CI: confidence interval; HH: hand hygiene; HW: handwashing; IQR: interquartile range; IRR: incidence risk ratio; MI: mean incidence; NPI: non-pharmaceutical intervention; OR: odds ratio; RCT: randomized control trial; RD: risk difference; RID: respiratory infectious disease; Rts: time-varying reproduction number; SAR: secondary attack ratio; SD: standard deviation; SE: standard error; SITP: susceptible-infectious transmission probability

13.5 Appendix E: Risk of bias assessments

13.5.1 Risk of bias for randomized control trials

Study	Risk of bias domains					Overall
	D1	D2	D3	D4	D5	
Azman (2013)						
Cowling (2008)						
Cowling (2009)						
Hubner (2010)						
Larson (2010)						
Levy (2013)						
Ram (2015)						
Simmerman (2011)						
Talaat (2011)						

Domains:
D1: Bias arising from the randomization process.
D2: Bias due to deviations from intended intervention.
D3: Bias due to missing outcome data.
D4: Bias in measurement of the outcome.
D5: Bias in selection of the reported result.

Judgement
 High
 Some concerns
 Low
 No information

13.5.2 Risk of bias for non-randomized studies

Study	Risk of bias domains							Overall
	D1	D2	D3	D4	D5	D6	D7	
Ahmed (2022)	+	+	+	×	+	-	×	×
Al Lawati (2023)	-	+	+	+	+	-	+	-
Anan (2021)	-	+	+	+	-	-	×	×
Badri (2021)	-	+	+	-	×	-	+	×
Baretta (2023)	+	+	+	-	?	-	-	×
Baumkotter (2022)	+	+	+	-	+	-	×	×
Bricchi (2023)	+	!	?	?	?	?	?	!
Cajar (2022)	-	+	+	-	-	-	×	×
Castilla (2012)	-	+	+	-	+	×	-	×
Doshi (2015)	-	+	+	-	+	-	+	-
Doung-ngern (2020)	+	×	+	+	+	-	×	×
Folayan (2022)	+	+	+	-	+	-	×	×
Francis (2023)	+	+	-	-	-	+	-	-
Hara (2022)	!	×	-	×	+	×	!	!
Abd (2021)	-	+	-	-	+	-	+	×
Karout (2020)	!	+	?	?	?	?	?	!
Lio (2021)	×	+	-	-	+	-	×	×
Liu (2016)	×	+	-	-	+	-	×	×
Liu (2021)	×	+	-	×	+	-	!	!
Ma (2020)	-	+	+	-	+	-	!	!
Sharif (2021)	-	+	+	-	+	-	+	-
Skolmowska (2020)	×	+	+	-	+	-	!	!
Speaker (2021)	!	!	+	-	-	×	-	!
Szczuka (2021)	!	+	+	-	+	×	×	!
Torner (2015)	!	+	+	-	-	×	×	!
Uchida (2017)	×	-	+	×	-	-	-	×
Uchida (2018)	×	-	+	×	-	-	-	×
Xie (2020)	×	+	+	-	-	-	-	×
Xu (2020)	×	+	?	?	?	?	?	×
Zhang (2013)	!	+	+	+	-	-	-	×
Zhang (2013)	×	+	+	+	+	-	+	×

Domains:
D1: Bias due to confounding.
D2: Bias due to selection of participants.
D3: Bias in classification of interventions.
D4: Bias due to deviations from intended interventions.
D5: Bias due to missing data.
D6: Bias in measurement of outcomes.
D7: Bias in selection of the reported result.

Judgement
! Critical
! Serious
- Moderate
+ Low
? No information