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Workplace interventions to reduce the risk of SARS-CoV-2 infection outside of healthcare settings (Review)

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[Intervention Review]

Workplace interventions to reduce the risk of SARS-CoV-2 infection outside of healthcare settings

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ABSTRACT

Background

Although many people infected with SARS-CoV-2 (severe acute respiratory syndrome coronavirus-2) experience no or mild symptoms, some individuals can develop severe illness and may die, particularly older people and those with underlying medical problems. Providing evidence-based interventions to prevent SARS-CoV-2 infection has become more urgent with the spread of more infectious SARS-CoV-2 variants of concern (VoC), and the potential psychological toll imposed by the coronavirus disease 2019 (COVID-19) pandemic.

Controlling exposures to occupational hazards is the fundamental method of protecting workers. When it comes to the transmission of viruses, such as SARS-CoV-2, workplaces should first consider control measures that can potentially have the most significant impact. According to the hierarchy of controls, one should first consider elimination (and substitution), then engineering controls, administrative controls, and lastly, personal protective equipment (PPE).

Objectives

To assess the benefits and harms of interventions in non-healthcare-related workplaces to reduce the risk of SARS-CoV-2 infection relative to other interventions, or no intervention.

Search methods

We searched MEDLINE, Embase, Web of Science, Cochrane COVID-19 Study Register, the Canadian Centre for Occupational Health and Safety (CCOHS), Clinicaltrials.gov, and the International Clinical Trials Registry Platform to 14 September 2021. We will conduct an update of this review in six months.

Selection criteria

We included randomised control trials (RCT) and planned to include non-randomised studies of interventions. We included adult workers, both those who come into close contact with clients or customers (e.g. public-facing employees, such as cashiers or taxi drivers), and those who do not, but who could be infected by co-workers. We excluded studies involving healthcare workers. We included any intervention to prevent or reduce workers' exposure to SARS-CoV-2 in the workplace, defining categories of intervention according to the hierarchy of hazard controls, i.e. elimination; engineering controls; administrative controls; personal protective equipment.

Data collection and analysis

We used standard Cochrane methods. Our primary outcomes were incidence rate of SARS-CoV-2 infection (or other respiratory viruses), SARS-CoV-2-related mortality, adverse events, and absenteeism from work. Our secondary outcomes were all-cause mortality, quality of life, hospitalisation, and uptake, acceptability, or adherence to strategies. We used the Cochrane RoB 2 tool to assess the risk of bias, and GRADE methods to assess the certainty of evidence for each outcome.

Main results

Elimination of exposure interventions

We included one study examining an intervention that focused on elimination of hazards. This study is an open-label, cluster-randomised, non-inferiority trial, conducted in England in 2021. The study compared standard 10-day self-isolation after contact with an infected person to a new strategy of daily rapid antigen testing and staying at work if the test is negative (test-based attendance). The trialists hypothesised that this would lead to a similar rate of infections, but lower COVID-related absence. Staff (N = 11,798) working at 76 schools were assigned to standard isolation, and staff (N = 12,229) at 86 schools to the test-based attendance strategy.

The results between test-based attendance and standard 10-day self-isolation were inconclusive for the rate of symptomatic PCR-positive SARS-COV-2 infection rate ratio ((RR) 1.28, 95% confidence interval (CI) 0.74 to 2.21; 1 study, very low-certainty evidence)).

The results between test-based attendance and standard 10-day self-isolation were inconclusive for the rate of any PCR-positive SARS-COV-2 infection (RR 1.35, 95% CI 0.82 to 2.21; 1 study, very low-certainty evidence).

COVID-related absenteeism rates were 3704 absence days in 566,502 days-at-risk (6.5 per 1000 days at risk) in the control group and 2932 per 539,805 days-at-risk (5.4 per 1000 days at risk) in the intervention group (RR 0.83; 95% CI 0.55 to 1.25). The certainty of the evidence was downgraded to low, due to imprecision.

Uptake of the intervention was 71 % in the intervention group, but not reported for the control intervention.

The trial did not measure other outcomes, SARS-CoV-2-related mortality, adverse events, all-cause mortality, quality of life, and hospitalisation.

We found one ongoing RCT about screening in schools, using elimination of hazard strategies.

Personal protective equipment

We found one ongoing non-randomised study on the effects of closed face shields to prevent COVID-19 transmission.

Other intervention categories

We did not find studies in the other intervention categories.

Authors' conclusions

We are uncertain whether a test-based attendance policy affects rates of PCR-postive SARS-CoV-2 infection (any infection; symptomatic infection) compared to standard 10-day self-isolation amongst school and college staff. Test-based attendance policy may result in little to no difference in absence rates compared to standard 10-day self-isolation.

As a large part of the population is exposed in the case of a pandemic, an apparently small relative effect that would not be worthwhile from the individual perspective may still affect many people, and thus, become an important absolute effect from the enterprise or societal perspective.

The included study did not report on any other primary outcomes of our review, i.e. SARS-CoV-2-related mortality and adverse events. No completed studies were identified on any other interventions specified in this review, but two eligible studies are ongoing. More controlled studies are needed on testing and isolation strategies, and working from home, as these have important implications for work organisations.

PLAIN LANGUAGE SUMMARY

Interventions to reduce the risk of coronavirus SARS-CoV-2 (severe acute respiratory syndrome coronavirus-2) infection among workers outside healthcare settings

What is the aim of this review?

Coronavirus (COVID-19) is a respiratory infectious disease that has spread globally. People infected with SARS-CoV-2 (severe acute respiratory syndrome coronavirus-2) can develop critical illnesses and may die, particularly older people, and those with underlying medical problems. Different interventions that attempt to prevent or reduce workers' exposure to SARS-CoV-2 in the workplace have been implemented during the pandemic. This Cochrane Review evaluated the effects of these interventions on the COVID-19 infection-rate, absenteeism, COVID-19-related mortality, and adverse events.

What was studied in this review?

We searched for studies that examined interventions according to the following four categories: 1) elimination (for example self-isolation strategies); 2) engineering controls (for example barriers to separate or distance co-workers, and workers from members of the public); 3) administrative controls (for example working from home); 4) personal protective equipment (for example use of face masks or other types of face covering). We included studies of any worker outside the healthcare setting. We searched for studies without language or time restrictions.

What are the main findings of this review?

We screened more than 13 thousand reports, and included one study, conducted in 162 secondary and post-secondary schools in England, from March to June 2021. The study enrolled more than 24 thousand workers. In the 86 schools in the control group (standard isolation), staff who were considered COVID-19 contacts through contact tracing were required to self-isolate at home for 10 days. In the 76 schools in the intervention group (test-based attendance), staff who were considered COVID-19 contacts through contact tracing were not required to isolate. Instead, they took a daily rapid test (lateral flow antigen test) for seven days. If the rapid test was negative, the staff member could go to work. If the rapid test was positive, the staff member would self-isolate. The researchers wanted to know if there was a difference in COVID-related absence between the two methods.

We are uncertain whether a strategy of test-based attendance changes COVID-19 infection rates (any infection; symptomatic infection) compared with routine isolation after contact with a person with COVID-19. COVID-related absence may be lower or similar in the test-based attendance group. However, we were uncertain about these findings, because the number of infections was very low among the participants. Mortality, adverse events, quality of life, and hospitalisation were not measured. Seventy-one per cent of the test-based attendance group followed the strategy; the researchers did not report on compliance for the standard isolation group.

We identified one ongoing study that also addressed the effects of screening in schools.

Another ongoing study is evaluating the effects of using a face shield to prevent COVID-19 transmission.

We did not find any studies that studied engineering or administrative controls.

How up-to-date is this review?

We searched for studies that were available up to 14 September 2021.

Summary of findings 1. Test-based attendance compared to routine isolation after contact with a SARS-CoV-2 positive person

Test-based attendance compared to standard 10-day self-isolation after contact with a SARS-CoV-2-positive person						
Patient or population: school staff **Setting:** schools in England **Intervention:** test-based attendance after contact with a SARS-CoV-2-positive person (category: elimination) **Comparison:** standard 10-day self-isolation after contact with a SARS-CoV-2-positive person						
Outcomes	**Anticipated absolute effects* (95% CI)**		**Relative effect (95% CI)**	**№ of participants (studies)**	**Certainty of the evidence (GRADE)**	**Comments**
	Risk with standard 10-day self-isolation	Risk with **test-based attendance**				
Rates of symptomatic PCR-positive SARS-CoV-2 infection *(over 13-week follow-up)*	Low risk of infection 38.1 cases per 100,000 persons per week	48.7 cases per 100,000 persons per week	RR 1.28 (0.74 to 2.21)	24,027 staff in 162 schools (1 RCT)	⊕⊖⊖⊖ Very low [1,2]	We are uncertain whether test-based attendance affects rates of symptomatic PCR-positive SARS-CoV-2 infection compared to standard 10 day self-isolation.
Rates of any PCR-positive SARS-CoV-2 infection *(over 13-week follow-up)*	Low risk of infection 53.8 cases per 100,000 population per week	72.4 cases per 100,000 population per week	RR 1.35 (0.82 to 2.21)	24,027 staff in 162 schools (1 RCT)	⊕⊖⊖⊖ Very low [1,2]	We are uncertain whether test-based attendance affects rates of any PCR-positive SARS-CoV-2 infection compared to standard 10 day self-isolation.
SARS-CoV-2-related mortality	-	-	-	-	-	This outcome was not measured.
Adverse events	-	-	-	-	-	This outcome was not measured.
COVID-related absenteeism from work Days absent per 1000 working days *(over 13-week follow-up)*	Low risk of absence 6.5 days per 1000 working days	5.4 days per 1000 working days	RR 0.83 (0.55 to 1.25)	24,027 staff in 162 schools (1 RCT)	⊕⊕⊖⊖ Low [2]	In absolute terms, this is an MD of 0.07 days. Assuming 225 working days per person per year, this corresponds to an average reduction of 0.25 day (95% CI - 0.66 to 0.51) absence per person per year in the test-based attendance group, over the standard 10-day self-isolation group.

All-cause mortality	-	-	-	-	-	This outcome was not measured.
Quality of life	-	-	-	-	-	This outcome was not measured.
Hospitalisation	-	-	-	-	-	This outcome was not measured.
Adherence to strategies: uptake of rapid antigen test *(over 13-week follow-up)*	Use of self-isolation not reported	Only measured in this group; 179/253 (71%) contacts of an index case adhered to test-based attendance	-	253 (1 RCTs)	-	Not estimable because adherence was only measured in the test-based attendance group.

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the average risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

CI: confidence interval;**MD:** mean difference;**RR:** rate ratio;

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

[1] downgraded one level for risk of bias: considerable missing data for PCR-tests for staff (data were available for 76% control schools and 83% intervention schools)
[2] downgraded two levels for imprecision: the confidence intervals are wide and the 95% CI crosses the line of no effect

BACKGROUND

Description of the condition

Coronavirus disease 2019 (COVID-19) is an infectious disease caused by the novel coronavirus SARS-CoV-2 (severe acute respiratory syndrome coronavirus-2), which first appeared in late 2019. Its development was declared a global health emergency on 31 January 2020, and a pandemic on 11 March 2020 (WHO 2020a).

The principal mode of SARS-CoV-2 transmission is exposure to respiratory fluids carrying this virus. Generally, exposure occurs in these three, not mutually exclusive, ways:

- inhalation of very fine respiratory droplets and aerosol particles;
- deposition of respiratory droplets and particles on exposed mucous membranes in the mouth, nose, or eye by direct splashes and sprays; or
- touching mucous membranes with hands that have been soiled either directly by virus-containing respiratory fluids or by touching surfaces with the virus on them (CDC 2021a; CDC 2021b).

Prior to vaccination, studies showed that estimated proportions of asymptomatic people and their relative contribution to transmission varied widely (O'Keeffe 2021). Some estimates suggest 30% are asymptomatic (Byambasuren 2020; Oran 2021); and most others experience mild symptoms, such as cough, fever, headache, fatigue, and other nonspecific symptoms (Gandhi 2020). But there is a spectrum of illness severity. Some people develop severe illness, particularly older people and those with underlying medical problems, such as cardiovascular disease, diabetes, chronic respiratory disease, or cancer, and might have a fatal outcome. People with severe cases may require critical care due to respiratory failure, sepsis, or multi-organ failure (Berlin 2020). In addition, some adults and children can develop long-term debilitating effects after the disease, resulting in so-called post-acute sequelae of SARS-CoV-2 infection (PASC, also known as 'long COVID' (Bruchfeld 2020; Osmanov 2021)). On average, it takes five to six days from the infection to the development of symptoms, but it has been reported to take as little as two days (for example, incubation is shorter for the Omicron variant, detected in late 2021), and up to 14 days (Lauer 2020; Yu 2020). The median time from symptom onset to diagnosis ranges between four and eight days, with hospital admission around day six for those with more severe disease (Chotirmall 2021). The infection fatality rate has been estimated to be around 0.68%, but variability in testing activity means any such estimate is uncertain (Meyerowitz-Katz 2020).

The pandemic has had profound impacts on the nature and availability of work worldwide (Semple 2020; Sim 2020). As part of the public health response to SARS-CoV-2, governments and the private sector across the globe have temporarily closed non-essential workplaces; that is, workplaces that do not operate or provide services that are typically essential to continued, critical infrastructure viability (CISA 2021). This has resulted in large numbers of workers moving to remote work, while others have lost their jobs or had their hours significantly reduced. As societies have begun to re-open, following widespread vaccination of parts of their populations, it is essential to identify workplace interventions that will enable safe reintegration into the workplace for individuals and society at large.

Since the advent of the pandemic, epidemiological studies have explored strategies to prevent or reduce infection rates among healthcare workers (Chou 2020; Nguyen 2020). However, many non-healthcare workers (non-HCWs) are also at increased risk (Kim 2020). These include police, workers providing social or homecare services, childcare, and education, cleaners, those in the hospitality industry, public transport workers and taxi drivers, and workers in the meat processing industries, amongst others (Sim 2020).

COVID-19 outbreaks occurred in meat and poultry processing facilities, particularly in 2020, in the earlier part of the pandemic, in countries worldwide, including Germany, the UK, Ireland, Portugal, and the USA (Durand-Moreau 2020; Günther 2020; Herstein 2021; Price 2020). Studies showed that meat processing plants might be transmission vectors, playing a role in local community transmission (Althouse 2020; Taylor 2020). For example, data from Nebraska, USA, indicated that the total excess COVID-19 morbidity associated with proximity to livestock plants was 236,000 to 310,000 (6% to 8% of all US cases), with 4300 to 5200 deaths (3% to 4% of all US deaths), during April to July 2020 (Herstein 2021).

Studies also reported that essential workers in livestock processing plants were more likely to be from an ethnic minority compared to non-essential workers (Reid 2021; Waltenburg 2021). Migrant workers, in particular, have experienced a disproportionately high risk of adverse outcomes with COVID-19 (Roberts 2020). In some instances, meat processing workplaces are crowded, and social distancing is difficult. Ambient temperature, humidity, ventilation, air recirculation, and aerosolisation are also significant factors facilitating SARS-CoV-2 dissemination and transmission in these environments (Donaldson 2020; Kumar 2021; Middleton 2020; Morris 2020; Ursachi 2021). Policy responses to the ongoing operational activity of meat processing industries had to find a balance between supporting essential supply chains and mitigating SARS-CoV-2 transmission (Taylor 2020). In the first few months of the pandemic, and prior to the availability of COVID-19 vaccines, face masks and partition barriers, for example, showed a statistically significant reduction in COVID-19 incidence in some meat processing facilities (Herstein 2021). Other strategies to decrease transmission include screening workers for symptoms, appropriate sickness and absence policy changes, and disinfection of high-touch surfaces. Businesses and employers can play a crucial role in preventing or slowing the spread of SARS-CoV-2 within the workplace.

Providing evidence-based interventions to prevent SARS-CoV-2 infection among non-HCWs has become more urgent with the re-opening of the economy, the spread of more infectious SARS-CoV-2 variants of concern (VoC), and the potential psychological toll imposed by the COVID-19 pandemic (Allen 2021). The lessons learned from the experience with the COVID-19 pandemic will likely inform the appropriate risk mitigation measures that need to be in place to reduce adverse societal impacts of possible future waves of the pandemic, and for future pandemics of a similar nature.

Description of the intervention

This review focused on non-healthcare work settings. We attempted to include all workers in close contact with potentially infectious individuals, such as public transportation personnel, cashiers in grocery stores, and staff in restaurants. We also included workers without close contact with clients and the potential to be infected by colleagues, such as office workers,

or break rooms in other non-healthcare work settings. Adopting the classic epidemiological triad model of Agent, Host, and Environment (Khan 2020), and using a hierarchy of control concepts in occupational health and safety studies (as outlined in a Canadian Centre for Occupational Health and Safety document (CCOHS 2020)), we included any type of intervention to limit SARS-CoV-2 transmission that could be implemented in workplaces of interest. Accordingly, we included these types of interventions.

- The elimination of procedures, or substitution of alternative methods, or both, to achieve the same workplace outcomes, but reduce the risk of SARS-CoV-2 exposure. This might include automating processes or providing education regarding COVID-19 symptoms and sickness-absence policies for workers with symptoms.
- Engineering controls are the controls built into the design of the plant, equipment, or process. These measures do not rely on human behaviour, since they are 'in place' at all times. In the case of COVID-19, engineering controls may reduce viral transmission, for example, by providing barriers or by reconfiguring workplaces to minimise contact with co-workers or clients, and with environmental measures, such as reengineering of air ventilation and purification methods.
- Administrative controls are processes that limit a worker's exposure through rules or procedures. Administrative controls may reduce potential viral transmission in the workplace through health check declarations prior to coming to the workplace, flexible working hours, and by providing appropriate spacing between workers in the workplace.
- Personal protection equipment (PPE). Although engineering and administrative controls should be considered first, because they do not rely on human behaviour and usually have fewer side effects, the use of PPE should also be considered, because so far, we do not know if the other strategies are fully effective. Workers in all risk groups may need one or more piece of PPE, including face masks or respirators, face shields, goggles, gloves, and gowns, based on their job tasks and their risk levels.

How the intervention might work

Realising that COVID-19 is primarily spread from person to person, it is essential to reduce the risk of exposure to SARS-CoV-2, based on workers' potential levels of exposure in their workplaces. Within the concept of the hierarchy of controls, elimination of coronavirus is preferred over other control measures. However, it may not always be possible to eliminate COVID-19 from the workplace; to minimise the probability of exposure to SARS-CoV- 2, other measures may be needed to avoid new infections due to the spread of the virus. Engineering controls, followed by administrative controls, and PPE, potentially have the most significant impact on controlling the exposure to COVID-19.

The epidemiological triad concept outlines that the agent causes the disease, the host harbours the disease, and the environment allows, or facilitates disease transmission (Khan 2020). The Canadian Centre for Occupational Health and Safety used a hierarchy of controls, i.e. a step-by-step approach to eliminating or reducing risks by ranking risk controls from the highest level of protection and reliability, through to the lowest and least reliable protection, in their proposed workplace safety guide for reducing SARS-CoV-2 (CCOHS 2020). Our group considered that the interventions might work by reducing or eliminating transmission of the agent to the host by reducing the duration of infectiousness after a person becomes infected; reducing or eliminating the likelihood of infection per contact between a susceptible person and an infectious person; and reducing or removing the contact rate of an infectious person with healthy individuals (Delamater 2019). In addition to the use of PPE, several studies reported that measures, like social distancing, appropriate hand hygiene, addressing ventilation systems, addressing work procedures (such as self-administered health screening), minimising face-to-face contacts, and other endeavours, helped to reduce transmissions (Baptista 2021; Clancy 2021; Faghri 2021; Haug 2020, US OSHA 2020; OSHA 2021).

Why it is important to do this review

Work is an integral part of life and is central to individual identity, social roles, social status, and meeting financial and psychosocial needs. There is strong evidence that employment leads to better health, improving people's quality of life and well-being in many realms (Waddell 2006).

During this COVID-19 pandemic, there have been massive declines in economic activities, manifested by sharp declines in states' gross domestic product, and sharp increases in unemployment, beginning as early as March 2020 (Fomenko 2021). Further, measures to prevent and control infections implemented during the pandemic – such as physical distancing, quarantine, and restrictions on social contacts – contributed to adverse mental health issues, including increased depression and anxiety (Rauschenberg 2021; Sigahi 2021). Much of the research since the advent of the COVID-19 pandemic has focused on preventing or reducing infection among healthcare workers. At present, there are at least six Cochrane Reviews associated with COVID-19 interventions to prevent infection among healthcare workers (Burton 2020a; Burton 2020b; Burton 2020c; Houghton 2020; Nagraj 2020; Verbeek 2020). So far, non-healthcare workers have received less attention. However, providing evidence-based interventions to prevent workplace-related COVID-19 transmission among non-healthcare workers has become more urgent with the re-opening of the economy, the spread of more infectious SARS-CoV-2 variants, and the potential psychological toll imposed by the COVID-19 pandemic (Altmann 2021; Htay 2020; Moore 2021; Shaw 2020).

OBJECTIVES

To assess the benefits and harms of interventions in non-healthcare-related workplaces to reduce the risk of SARS-CoV-2 infection relative to other interventions, or no intervention.

METHODS

Criteria for considering studies for this review

Types of studies

We included any study that compared outcomes in an intervention group to outcomes in a control group that did not get the intervention, or that got an alternative intervention. We included randomised control trials (RCT) and non-randomised studies of interventions (NRSI); that is, prospective experimental studies with a concurrent control group in which the allocation of participants to intervention and control groups was not random (e.g. participants chose by themselves, or control participants belonged to another work organisation).

We did not include observational studies, such as natural experiments, in which the researchers did not introduce the intervention, because the causal pathways can be difficult to identify. We did not include cross-sectional studies, because disease incidence can fluctuate rapidly, and any temporal association is impossible to determine. We did not include mathematical modelling studies due to their many assumptions.

We included studies reported as full-text articles, those published as abstracts only, and unpublished data. We also included preprints. We did not impose any language or date restrictions.

Types of participants

We included adults (> 18 years), both those who come into close contact with people (e.g. public-facing employees, such as cashiers or taxi drivers), and those who do not, but who can be infected by co-workers. We excluded studies involving healthcare workers (including dentists and other dental health professionals), as they are considered in separate Cochrane Reviews. We included studies on workers at social and homecare services if they were not caring for people with SARS-CoV-2. We included studies in paid workers (i.e. employed workers), and excluded studies exclusively in people working on a volunteer basis. We excluded studies in children in primary and secondary school, and students in post-secondary educational facilities.

We planned to include studies on severe acute respiratory syndrome (SARS) and the Middle East respiratory syndrome (MERS). We planned to differentiate between direct evidence from SARS-CoV-2 studies, and indirect evidence from SARS and MERS studies in subgroup analyses (Subgroup analysis and investigation of heterogeneity).

We included any study in which at least 80% of the participants met the review criteria defined above, or if there were separate data available for the relevant subset of participants of interest. We planned to explore differences in subgroup analyses.

Types of interventions

We included interventions that attempted to prevent or reduce workers' exposure to SARS-CoV-2 in the workplace. We defined categories of interventions according to the hierarchy of hazard controls. Consequently, eligible interventions for our review were as follows.

Elimination (i.e. eliminating the source of SARS-CoV-2)

- Polymerase chain reaction (PCR) or rapid antigen testing with self-isolation policy, and quarantining close contact co-workers policy
- Education regarding COVID-19 symptoms, and sickness absence policy for symptomatic workers
- Automated processes (e.g. production lines)
- Engineering controls
- Walk-through disinfection systems
- Air purification systems (including, but not limited to, misting or fogging machines, or high-efficiency particulate absorbing (HEPA) filters)
- Installation of, or improvement to ventilation (including installation of new systems)
- Barriers to separate or distance co-workers and workers from members of the public (e.g. perspex, glass, metal shield)
- Use of ultraviolet (UV) lighting
- Reconfiguration of the workplace to minimise contact with the public (e.g. safe collection points for customers)
- Closing work areas to prevent groups of people from assembling (including cafeterias)

Administrative controls

- Vaccination of workers (where this existed specific to a workforce or workplace)
- Distancing between colleagues in the workplace (so-called social distancing), including details of distance used (e.g. 1 m, 2 m, etc.)
- Hand-washing protocols (including use of hand sanitisers)
- Working from home (WFH; where it was possible). Also, allowing flexible work hours to facilitate home-schooling, and other caregiver responsibilities.
- Checking temperature (i.e. thermal screening) upon entering the workplace (could also include formal screening for symptoms)
- Workplace cleaning and disinfecting regimes (i.e. infection prevention and control (IPC) policies and standard operating procedures)
- Use of online, rather than face-to-face meetings (i.e. remote working arrangements)
- Cancelling or curtailing work-based travel
- Variation in start times, finish times, lunch, and other work breaks to minimise contact with work colleagues (i.e. staggered rosters)
- Forming 'isolation bubbles' within the workplace to avoid mixing between different work teams (i.e. staffing bubbles)
- Facilitating travel to work in private cars, rather than having to use public transport (e.g. paying for parking)
- Cancelling work-related out-of-hour social activities
- Introducing one-way walk systems in workplaces
- Paid sick days

Personal protective equipment (PPE), including, but not limited to:

- Use of face masks or other types of face covering, including respirators, surgical masks, or self-made masks, e.g. N95, N99, FFP2, FFP3, FRSM Type IIR, KN-95, KN94, other respirators
- Using face shields, visors, anti-mist screens
- Using goggles, glasses
- Using gloves, double gloves
- Using long-sleeved, water-resistant gowns and other water-resistant, or disposable body coverings, double gowns
- Using shoe covers
- Using caps

We included interventions not listed here that aimed to reduce exposure to SARS-CoV-2 in the workplace.

We included combinations of eligible interventions.

Eligible interventions may be compared to:

- Standard IPC practices in the workplace before the COVID-19 pandemic (e.g. what deviation, if any, from pre-existing IPC standard operating procedures were initiated since the COVID-19 epidemic);
- No intervention to reduce exposure to SARS-CoV-2;
- A different intervention to reduce exposure to SARS-CoV-2; or
- Various combinations of interventions to reduce exposure to SARS-CoV-2.

Types of outcome measures

Where applicable, we specified relevant time frames, and how the outcomes may be measured. However, we acknowledge that exact details are difficult to determine in a rapidly changing situation, and additional measures may be important. We considered the following follow-up times for outcome measurement: short-term, defined as less than 3 months after the intervention started; medium-term, defined as between 3 and 12 months; and long-term, defined as 12 months or longer. When multiple time points were reported, we included the longest follow-up time from each study for analysis. We reported all follow-up time data descriptively.

We considered SARS-CoV-2 infections and other respiratory diseases (SARS, MERS) as surrogates for exposure to SARS-CoV-2, (SARS-CoV-1, MERS-CoV). Development of a core outcome set (COS) for COVID-19 prevention interventions, the COS COVID-P study, is underway (COMET 2021). Work so far recommends that COVID-19 infection is an essential outcome to measure in prevention studies, but has found that a number of different definitions are used (COMET 2021).

Primary outcomes

1. Incidence rate of SARS-CoV-2 infection (or other respiratory viruses)
2. SARS-CoV-2-related mortality
3. Adverse events, including but not limited to cutaneous and respiratory reactions, accidents, depression, anxiety (as defined by the authors)
4. Absenteeism from work

Depending on the unit of intervention, the denominator for primary outcomes was either the number of workplace employees, if the intervention was directed towards workers; or the number of workplaces, if the intervention was directed at the workplace, or a part of it. In summary, the intervention might take place at either the individual or the workplace level.

The primary analysis from outcomes relating to COVID-19 included all direct evidence, regardless of the risk of bias. When SARS or MERS were targeted, we planned to report outcome data separately, as a subgroup in forest plots, and not combine them with COVID-19 data.

We accepted any definition of a case of COVID-19 provided by the study authors. When both suspected and confirmed cases were given for the same study, we used the most reliable measure (e.g. cases confirmed through PCR test).

Secondary outcomes

1. All-cause mortality
2. Quality of life (as defined by authors)
3. Hospitalisation
4. Uptake, acceptability, or adherence to strategies (e.g. use of hand sanitiser, wearing of face masks, degree of social distancing), measured using ordinal (e.g. Likert scale) or dichotomous (e.g. yes/no) data measures

Search methods for identification of studies

Electronic searches

We conducted a systematic literature search to identify all published and unpublished trials eligible to include in this review. We adapted the search strategy we developed for MEDLINE Ovid to use in the other electronic databases (see Appendix 1). We used the following search strategies to develop our search.

- We modified COVID-19 terms for the MEDLINE strategy from the CADTH Respiratory Pandemics (including COVID-19, SARS, and MERS) MEDLINE filter (covid.cadth.ca/literature-searching-tools/cadth-covid-19-search-strings/#covid-19-medline).
- We modified the study design filter from the CADTH Randomised Controlled Trials/ Controlled Clinical Trials, based on MEDLINE OVID, Embase Elsevier, and PsycINFO filters (www.cadth.ca/resources/finding-evidence/strings-attached-cadths-database-search-filters#rand).
- The workplace's text words for occupational categories were informed by the Centers for Disease Control and Prevention Interim List of Categories of Essential Workers (www.cdc.gov/vaccines/covid-19/categories-essential-workers.html).

We imposed no language restrictions. We planned to translate key sections of potentially eligible non-English language papers, or arrange for people proficient in the publications' languages to assess the full text for potential inclusion.

We searched the following electronic databases from their inception:

- Cochrane Central Register of Controlled Trials (CENTRAL; 2021, Issue 9) in the Cochrane Library; (searched 20 September 2021; Appendix 2);
- MEDLINE Epub Ahead of Print, In-Process & Other Non-Indexed Citations, MEDLINE® Daily and Ovid MEDLINE® Ovid (1946 to 14 September 2021; Appendix 1);
- Embase Elsevier (Embase.com; 16 September 2021; Appendix 2);
- NIOSHTIC-2 (OSH-UPDATE; National Institute for Occupational Safety and Health bibliographic database; oshreferences.ccohs.ca; searched 14 September 2021; Appendix 3);
- HSELINE (OSH-UPDATE; Health and Safety Executive Library and Information Service; oshreferences.ccohs.ca; searched 14 September 2021; Appendix 3);
- CISDOC (OSH-UPDATE; International Labor Organization Occupational Safety and Health bibliographic database; oshreferences.ccohs.ca; searched 14 September 2021; Appendix 3
- CISILO (International Occupational Safety and Health Information Centre bibliographic database; oshreferences.ccohs.ca; searched 14 September 2021; Appendix 3;

- Web of Science Core Collections (searched 16 September 2021; Appendix 2)
  - Science Citation Index Expanded (SCI-EXPANDED; 1900 to 16 September 2021)
  - Social Sciences Citation Index (SSCI; 1956 to 16 September 2021)
  - Arts & Humanities Citation Index (A&HCI; 1975 to 16 September 2021);
  - Conference Proceedings Citation Index - Science (CPCI-S; 1990 to 16 September 2021)
  - Conference Proceedings Citation Index - Social Science & Humanities (CPCI-SSH; 1990 to 16 September 2021)
  - Emerging Sources Citation Index (ESCI; 2015 to 16 September 2021)
- Cochrane COVID-19 Study Register (covid-19.cochrane.org/); via the Cochrane Register of Studies (crsweb.cochrane.org/; searched 20 September 2021; Appendix 2);
- World Health Organization (WHO) COVID-19 Global literature on coronavirus disease (search.bvsalud.org/global-literature-on-novel-coronavirus-2019-ncov/; searched 20 September 2021).

We also searched for unpublished and ongoing trials in ClinicalTrials.gov (www.clinicaltrials.gov/), the WHO International Clinical Trials Registry Platform (www.who.int/clinical-trials-registry-platform), and medRxiv (www.medrxiv.org/; searched 20 September 2021; Appendix 2).

If studies were published in languages other than those the review team could accommodate (Danish, Dutch, English, French, German, Italian, Portuguese, Spanish, and Swedish), we planned to involve Cochrane's TaskExchange platform to identify people within Cochrane to translate these studies.

We will conduct an update of this review in six months.

Searching other resources

We checked the reference lists of all primary studies and review articles identified by the search strategies for additional references. We planned to contact experts in the field to identify further unpublished studies.

Data collection and analysis

Selection of studies

We screened titles and abstracts using Covidence (Covidence). Pairs of review authors (ABP, KN, SR, KS, EP, BNS, JEV, OS, SD, DM, TF, MB) independently screened titles and abstracts in, and excluded studies that did not fulfil the criteria for inclusion.

We retrieved the full text of potentially eligible records, and a pair of review authors (ABP, KN, SR, KS, EP, BNS, JEV, OS, DM, MB) independently assessed these to identify studies for inclusion. We resolved any disagreements through discussion, or if required, by consulting a third review author (SD or CM).

We recorded reasons for excluding studies assessed at the full-text screening stage, and reported this in the characteristics of excluded studies table, and a PRISMA flow chart.

We identified and excluded duplicates, and collated multiple reports of the same study, so that each study was the unit of interest.

If our systematic searches had identified studies conducted by authors of this review, we planned to avoid conflict of interest, by having all decisions concerning inclusion and exclusion, data extraction, and risk of bias assessment made by review authors who were not involved with the study.

Because of the breadth of the review, review authors communicated regularly while screening, to monitor the process and align judgments.

We documented the details of the search strategy, and the number of records retrieved from each database (total number retrieved) or internet search (total number screened) in accordance with PRISMA guidance (Page 2021).

Data extraction and management

We used a data collection form for study characteristics and outcome data, which was piloted on two studies, representing different intervention types. Pairs of review authors (ABP, KN, EP, BNS, SD, JEV, SR, KS) independently extracted the following study characteristics from included studies.

1. Publication details: author, study source (e.g. journal publication, preprint, peer-reviewed)
2. Methods: study design, total duration of the study, study location (e.g. country, city), study setting (e.g. type of workplace), withdrawals or missing data, and how they were handled
3. Participants: number included and randomised, mean age or age range, sex/gender, the severity of the condition, diagnostic criteria if applicable, inclusion criteria, and exclusion criteria
4. Interventions: description of the intervention (category and type), comparison, duration (including implementation date), intensity, and co-interventions
5. Outcomes: description of primary and secondary outcomes, measures specified and collected, and time points for reporting
6. Notes: funding, ethical approval, and notable conflicts of interest of trial authors

In the characteristics of included studies tables, we noted if outcome data were not reported in a usable way. We resolved disagreements by consensus, or by involving a third review author (SD, MB, or CM). One review author (ABP) transferred data into RevMan Web (RevMan Web 2020). A second review author (EP) checked study characteristics for accuracy against the primary study.

Assessment of risk of bias in included studies

Pairs of review authors (ABP, SR, KS, EP, BNS, JEV, SD) independently assessed the risk of bias for key outcomes reported in the included study (see list below), using the recent version of the Cochrane RoB 2 tool for cluster RCTs (Sterne 2019), and the criteria outlined in the *Cochrane Handbook for Systematic Reviews of Interventions* for each study design (Higgins 2021; hereafter referred to as the *Cochrane Handbook*). We resolved any disagreements through discussion, or by involving another author (MB or CM).

As we anticipated including a wide array of study designs, we elaborated on multiple potentially applicable tools below, following a recent comparable Cochrane Review on SARS-CoV-2 (Burns 2021).

For randomised controlled trials (RCTs), we used the Cochrane RoB 2 tool, which assesses the risk of bias according to these domains (Appendix 4):

1. Bias arising from the randomisation process;
2. Bias due to deviations from intended interventions; we were interested in the intention-to-treat effect;
3. Bias due to missing outcome data;
4. Bias in the measurement of the outcome;
5. Bias in the selection of the reported result;
6. Overall risk of bias.

As we included a cluster-RCT, we used the ROB 2 tool that assesses an additional domain relevant to the study design, namely, bias arising from the timing of identification or recruitment of participants in a cluster trial. If we had included cross-over trials, we would have used the relevant ROB 2 tool for this study design, which assesses the additional domain: bias arising from the period and carry-over effects.

We used the Excel Tool to implement the RoB 2; last accessed 17 December 2021.

We graded each potential risk of bias as high, low, or some concerns, and provided a quote from the study report, together with a justification for our judgment, in the risk of bias tables. We planned to add additional ROB 2 domains, for other study designs, to the risk of bias tables. We summarised the risk of bias judgments across different studies for each of the domains listed. When information on the risk of bias related to unpublished data or correspondence with a trial author, we planned to note this in the risk of bias table.

Had we included NRSIs, pairs of review authors (ABP, SR, KS, EP, BNS, JEV, SD) would have independently used the ROBINS-I tool to assess the risk of bias of these studies (Sterne 2016). Our target trial against which we planned to assess the risk of bias would be a trial in which adults were assigned to a group with interventions in place that aimed to reduce COVID-19 infection at the workplace, or standard practice, or alternative interventions. We considered the following variables as potential confounders: age, sex, ethnicity, comorbidities, and socioeconomic status. We planned to note any other workplace intervention that was implemented at the same time. We expected that these confounders could potentially affect any of our prespecified outcomes. We planned first to use the signalling questions as prescribed in the ROBINS-I tool, and then assess the risk of bias if these questions indicated a potential risk of bias. We planned to assess the following risk of bias domains.

1. Bias due to confounding
2. Bias in selection of participants into the study
3. Bias in classification of interventions
4. Bias due to deviations from the intended interventions (effect of assignment to intervention)
5. Bias due to missing outcome data
6. Risk of bias in measurement of outcomes
7. Risk of bias in the selection of the reported result
8. The overall risk of bias

We planned to judge the risk of bias of NRSIs in each domain as low, moderate, serious, or critical.

We assessed the risk of bias for the following key outcomes, which we included in the summary of findings tables.

1. The incidence rate of SARS-CoV-2 infection (or other respiratory viruses)
2. SARS-CoV-2-related mortality
3. Adverse events
4. Absenteeism from work
5. All-cause mortality
6. Quality of life
7. Hospitalisation
8. Adherence to strategies

For all outcomes, we used the longest reporting time point to assess the risk of bias.

We would have reported the risk of bias for each type of study design separately, however, we only included one study.

Overall risk of bias

We made judgements about the overall risk of bias of trials measuring a particular result according to guidance for the RoB 2 tool (Sterne 2019). We judged a study's overall risk of bias for a particular result as low if we judged it was at low risk of bias for all domains for this result; to raise some concerns if we judged that it raised some concerns in at least one domain for that result, but was not at high risk of bias for any domain; and high when we judged one or more domains at high risk of bias, or we had some concerns for multiple domains for that result. We would have used similar guidance for the ROBINS-I tool if we had included NRSIs (Sterne 2016). We would have judged the overall risk of bias as low if we judged the study at low risk of bias for all domains; as moderate if we judged it at low or moderate risk of bias for all domains; as serious if we judged the risk of bias of at least one domain at serious, but none of the others were at critical risk of bias; and at critical risk of bias if we judged at least one domain at critical risk of bias.

When considering treatment effects, we considered the risk of bias for the studies that contributed to that outcome. We decided not to include any study at critical risk of bias in the analyses.

Assessment of bias in conducting the systematic review

We conducted the review according to the published protocol, and reported any deviations in the Differences between protocol and review section of the review (Pizarro 2021).

Measures of treatment effect

We entered the outcome data for each study into the data tables in RevMan Web to calculate the treatment effects (RevMan Web 2020). When multiple studies reported the same outcome measure, we converted these effect estimates to a common format to allow meta-analysis, comparison, or both. We planned to use odds ratios (OR) for binary outcomes, mean differences (MD) or standardised mean differences (SMD) for continuous outcomes, or other types of data as reported by the study authors. We planned to calculate MDs

when outcomes were measured in the same way, and SMDs when they were measured by similar but different tools. We planned to interpret SMDs in the following manner: 0.2 = small effect; 0.5 = moderate effect; 0.8 = large effect (Schünemann 2020). When binary measures of effect estimates were reported using an alternative format to an OR, we planned to convert alternative effect estimates (risk ratios, risk differences, rate ratio) into odds ratios, using available information (e.g. baseline or control group risk). If it was not possible to convert the reported estimates into OR, we reported them as reported in the included studies.

If only effect estimates and their 95% confidence intervals (CI) or standard errors (SE) were reported in studies, we planned to enter these into RevMan Web, and calculate treatment effects using the generic inverse-variance method (RevMan Web 2020). We planned to ensure that higher scores for continuous outcomes had the same meaning for the particular outcome, explain the direction to the reader, and report when the directions were reversed, if this was necessary. When the results could not be entered for a meta-analysis, we planned to describe them in the characteristics of included studies table, and enter the data into an additional table for easy reference.

For non-randomised studies, we planned to extract the estimate of intervention effect, together with a measure of precision (confidence interval or standard error), and information about the method of analysis, and adjustment for confounders. If both unadjusted and adjusted intervention effects were reported, our preference was to choose adjusted effects. Some non-randomised studies report multiple adjusted estimates from analyses, including different sets of covariates. If multiple adjusted estimates of intervention effect were reported, we planned to choose the one that we judged would minimise the risk of bias due to confounding, after discussion between review authors (see Chapter 25, Section 25.2.1).

Unit of analysis issues

For studies that use a cluster-randomised design, and report sufficient data to include in the meta-analysis, but do not make an allowance for the clustering, we inflated the standard errors, using the design effect. We calculated the design effect based on a fairly large assumed intra-cluster correlation coefficient. We assumed that 0.10 was a realistic estimate, by using studies about implementation research as an analogy (Campbell 2001). We explored this assumption using sensitivity analysis, as clustering may be high in the context of COVID-19. We followed the methods described in the *Cochrane Handbook* for the calculations (Higgins 2021). Cluster-randomisation might have been at the level of the workplace (e.g. a factory), a subset of the workplace (e.g. department or shift), or a larger unit (e.g. a geographical area), and we took care to ensure that the analysis made appropriate adjustment for clustering at the correct level.

When cross-over trials reported continuous outcomes, with which the authors did not report a paired analysis, we planned to perform a paired analysis, based on a reported or imputed correlation between the outcomes of the intervention and the control condition, as advised in Chapter 16 of the *Cochrane Handbook* (Higgins 2021). For dichotomous outcomes, we intended to adjust the confidence intervals for the paired analysis according to Elbourne 2002.

When multiple trial arms were reported in a single trial, we planned to include only the relevant arms. Had we combined two comparisons (e.g. intervention A versus no intervention and intervention B versus no intervention) in the same meta-analysis, we planned to halve the no intervention group to avoid double-counting.

Dealing with missing data

We contacted investigators or study sponsors to verify key study characteristics and obtain missing numerical outcome data when needed (e.g. when a study is identified as abstract only). When we were unable to obtain the missing data, and we thought they would introduce serious bias, we explored the impact of including such studies in the overall assessment of results with a sensitivity analysis.

If numerical outcome data were missing, such as standard deviations (SD) or intra-cluster correlation coefficients (ICC), and we could not obtain them from the authors, we planned to calculate them from other available statistics, such as P values, according to the methods described in the *Cochrane Handbook* (Higgins 2021).

Assessment of heterogeneity

We assessed the clinical homogeneity of the results of included studies based on similarity of population, intervention, outcome, and follow-up.

- We considered any workplace populations as similar enough to combine.
- We considered interventions as similar when they were from the same sub-category within the hierarchy of controls (listed in Types of interventions).
- We considered any outcome measure relating to the rate of SARS-CoV-2 as similar enough to combine. We did not combine data on SARS-CoV-2 with data on SARS or MERS.
- We categorised follow-up times as follows: short-term as less than 3 months after the intervention had begun; medium-term as between 3 and 12 months; and long-term as 12 months or longer. We considered that short- and long-term follow-up times were different, whereas we planned to combine short- and medium-term outcomes, or medium- and long-term outcomes where relevant.

We planned to assess for heterogeneity and define follow-up times after evaluating the included studies. We reached decisions after consulting the entire review team, considering both Cochrane and occupational medicine viewpoints.

As well as visual inspection of forest plots, we planned to use the I^2 and the Chi^2 statistics to assess heterogeneity amongst the trials in each analysis. If we identified substantial heterogeneity, we planned to report it, and explore possible causes by prespecified subgroup analysis. We considered the following ranges to interpret I^2: 0% to 40% might not be important; 30% to 60% may represent moderate heterogeneity; 50% to 90% may represent substantial heterogeneity; 75% to 100%: considerable heterogeneity (Deeks 2022). We considered that $P < 0.1$ for the Chi^2 test indicated the presence of heterogeneity.

Assessment of reporting biases

We planned to create and examine a funnel plot to explore possible small study biases, if we pooled more than 10 trials in any single meta-analysis.

Data synthesis

We planned to pool data from studies we judged to be clinically homogeneous, as defined in the Assessment of heterogeneity section, using RevMan Web (RevMan Web 2020). If more than one study provided usable data in any single comparison, we planned to perform a meta-analysis. We planned to use a random-effects model because we believed that the intervention type and study designs would always lead to heterogeneity.

We planned to include all eligible RCTs in one primary analysis. Had we included NRSIs, we would have included all eligible NRSIs, except those at critical risk of bias, in a separate primary analysis.

We planned to refer to the Synthesis without meta-analysis (SWiM) in systematic reviews guidelines, if we were unable to pool data in a meta-analysis (Campbell 2020).

Subgroup analysis and investigation of heterogeneity

We planned to carry out the following subgroup analyses.

1. Dose (intensity, duration of the intervention)
2. Sector (transportation, agriculture, tourism, manufacturing, construction, forestry and fishing, mining and quarrying, electricity, gas, steam and air conditioning supply, water supply; sewerage, waste management and remediation activities, wholesale and retail trade; repair of motor vehicles and motorcycles, transportation and storage, accommodation and food service activities, information and communication, financial and insurance activities, real estate activities, professional, scientific, and technical activities, administrative and support service activities, public administration and defence; compulsory social security, education, human health and social work activities, arts, entertainment and recreation, other service activities, activities of households as employers; undifferentiated goods- and services-producing activities of households for own use, activities of extraterritorial organisations and bodies (UN 2008))
3. Geographic region (Africa, Asia, Caribbean, Central America, Europe, North America, Oceania, and South America)
4. Country income level (high, upper-middle, lower-middle, low-income)
5. The time frame of the pandemic during which the study was conducted (early and late, based upon the median)
6. Studies in which both intervention and control groups use PPEs
7. Studies that included only a subset of relevant participants
8. SARS-CoV-2 studies versus indirect evidence from SARS and MERS studies
9. Funding (public/governmental versus industry/commercial)
10. Public-facing versus non-public-facing workplaces

We intended to re-analyse the four primary outcomes in subgroup analyses. We planned to use the Chi² test to test for subgroup interactions in RevMan Web (RevMan Web 2020).

Sensitivity analysis

We planned to conduct these sensitivity analyses to assess the robustness of our conclusions on the key outcomes of interest.

1. Study results grouped by overall risk of bias: low risk of bias versus some concerns versus high risk of bias, in the case of trials; and studies with low versus moderate versus serious versus critical risk of bias, in the case of NRSIs
2. Excluding studies with missing data, thought to introduce serious bias
3. Excluding studies with estimated ICCs (or using alternative ICCs)
4. Non-peer-reviewed publications (preprints, abstracts only) versus peer-reviewed publications

We also planned to perform sensitivity analyses to check how our assumptions influenced the conclusions of the review.

Summary of findings and assessment of the certainty of the evidence

We planned to create summary of findings tables for each comparison of a workplace intervention with no intervention, or standard practices.

For these comparisons, we reported the following outcomes.

1. The incidence rate of SARS-CoV-2 infection (or other respiratory viruses)
2. SARS-CoV-2-related mortality
3. Adverse events
4. Absenteeism from work
5. All-cause mortality
6. Quality of life
7. Hospitalisation
8. Adherence to strategies

We used the five GRADE considerations (overall risk of bias according to ROB 2/ROBINS-I; consistency of effect; imprecision; indirectness; and publication bias) to assess the certainty of a body of evidence related to the studies that contributed to the prespecified outcomes. We used methods and recommendations described in the *Cochrane Handbook* (Higgins 2021), using GRADEpro GDT software (GRADEpro GDT). We justified all decisions to down- or upgrade the quality of studies using footnotes.

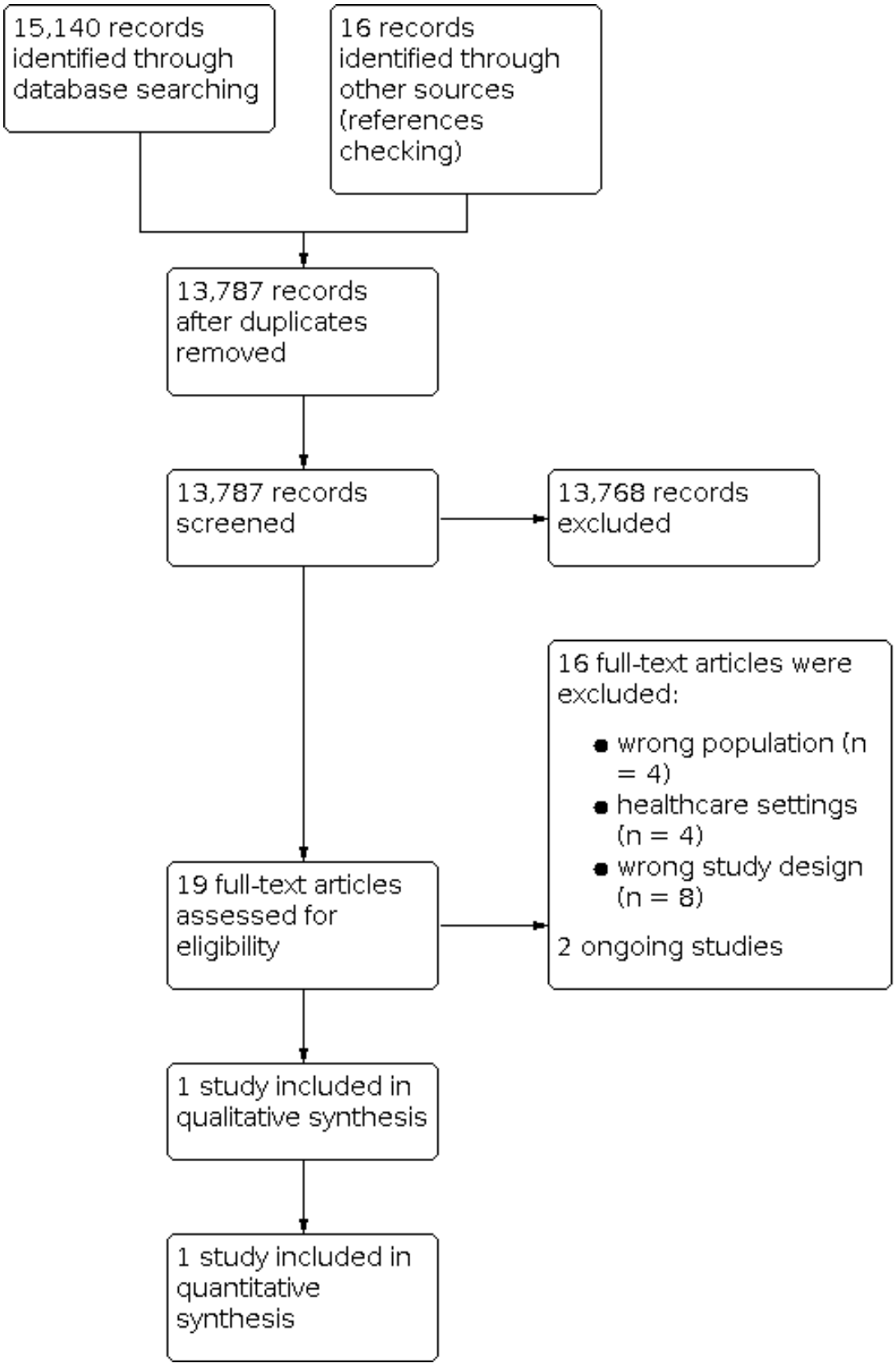
We prioritised the evidence from RCTs. Because we included non-randomised studies, if necessary, we planned to compile an additional summary of findings table showing all our GRADE decisions about the certainty of evidence and their justifications. If we included RCTs and non-RCTs for the same outcome, we planned to base our GRADE assessments on the evidence from RCTs. If only a non-RCT reported a key outcome, we planned to assess it using GRADE.

RESULTS

Description of studies

We provided results of the search in the study flow diagram (Figure 1).

Figure 1. Flow diagram



See Characteristics of included studies; Characteristics of excluded studies; Characteristics of ongoing studies for details.

Results of the search

The literature search run in September 2021 yielded 15,140 records identified through database searching (including 29 from CCOHS searches) and 16 records identified through other sources (references checking; Figure 1). After we removed duplicates, we screened 13,787 titles and abstracts, and excluded 13,768. We screened the full text of 19 records, and excluded 16.

We included one randomised controlled trial (RCT) enrolling 24,027 adults (Young 2021). We identified two ongoing trials (NCT04647305; NCT04878809).

Included studies

Elimination of exposure interventions

Study design

Young 2021 is an open-label, cluster-randomised, non-inferiority (non-inferiority margin < 50% relative increase of infection transmission), controlled trial, conducted in 162 secondary schools and post-secondary education colleges in England, UK, in 18 March 2021 to 27 June 2021. Schools were randomly assigned (1:1) to either a policy of test-based attendance (intervention group) or a standard 10-day self-isolation (control group). Randomisation was performed in blocks of two, and stratified using nine strata to ensure a sample representative of schools and colleges in England; stratification was performed according to school type, size, presence of a sixth form, presence of residential students, and proportion of students eligible for free school meals (as a marker of social deprivation). Schools reported the numbers of staff and students present on each school day, absent for COVID-19-related reasons, and absent for other reasons. Data for the outcome were taken from the NHS Test and Trace service.

Participants

Eighty-six intervention schools (staff N = 11,798) and seventy-six control schools (staff N = 12,229) actively participated; additional national data allowed most non-participating schools to be included in the analysis of student co-primary outcomes.

Intervention

Intervention group: policy of test-based attendance. All schools followed the national policy of offering twice-weekly asymptomatic testing with lateral flow device (LFD). School-based SARS-CoV-2 contacts were offered daily LFD testing over seven days, to allow continued school attendance, i.e. LFD-negative contacts remained at school (self-isolation restricted to individuals with positive results). Participants who agreed to daily contact testing, swabbed their own anterior nose; swabs were tested by school staff using a SARS-CoV-2 antigen LFD (Orient Gene, Huzhou, China).

Control group: policy of standard 10-day self-isolation after contact with a school-based SARS-CoV-2-positive person. All schools offered twice-weekly asymptomatic testing with LFD.

We categorised both interventions, the active and the control, as different forms of eliminating the exposure, which is at the top of the hierarchy of controls.

Outcomes

The included study reported on one primary outcome of interest: the incidence rate of SARS-CoV-2 infection, measured as both symptomatic polymerase chain reaction (PCR)-positive, and any PCR-postive SARS-CoV-2 infection. The study authors argued that the first was the most valid measure of SARS-CoV-2 transmission in their study, as the latter may have been affected by the intervention. We only used the first measurement in this review. It also reported on two of the secondary outcomes of interest: absence from work, as the number of COVID-19-related absences across all students and staff, and uptake of the intervention (which was only assessed in the intervention schools). We only used the data for staff, as we did not include students as participants.

Ongoing studies

We identified two ongoing studies (NCT04647305; NCT04878809).

Elimination of exposure interventions

One study was a Spanish non-randomised study on COVID-19 screening in schools, enrolling students older than six years, teachers, administrative and service staff attending or working at school (NCT04878809). Its intervention falls under the category of elimination of exposure. Asymptomatic and symptomatic participants in two schools were assessed with rapid antigen detection tests in nasal and nasopharyngeal swabs to compare the incidence of SARS-CoV-2 infection. Depending on the initial results, they were further tested by either rapid antigen detection tests in nasal swabs (self-taken); rapid antigen detection tests in nasopharyngeal swabs taken by trained teachers; or PCR nasopharyngeal swabs performed under clinical practice.

Personal protective equipment interventions

The other was a Colombian randomised controlled trial comparing closed face shields (COVPROSHIELD) plus surgical face masks and surgical face masks alone to prevent COVID-19 transmission (NCT04647305). It falls under the category of personal protective equipment. Inclusion criteria were: adults with negative reverse transcription polymerase chain reaction (RT-PCR) tests and negative SARS-CoV-2 serological anti-SARS-CoV-2 tests, living in a geographic area with active COVID-19 transmission, and working outside the home for at least two days a week during the last week. The prespecified outcomes were measured at day 21, and are COVID-19 incidence ; adherence to closed face shield use; and percentage of seroconversion.

Other interventions

We did not find any studies that fell under the intervention categories of engineering controls or administrative controls.

Excluded studies

We did not exclude any of the 16 full-text study reports because of the type of intervention.

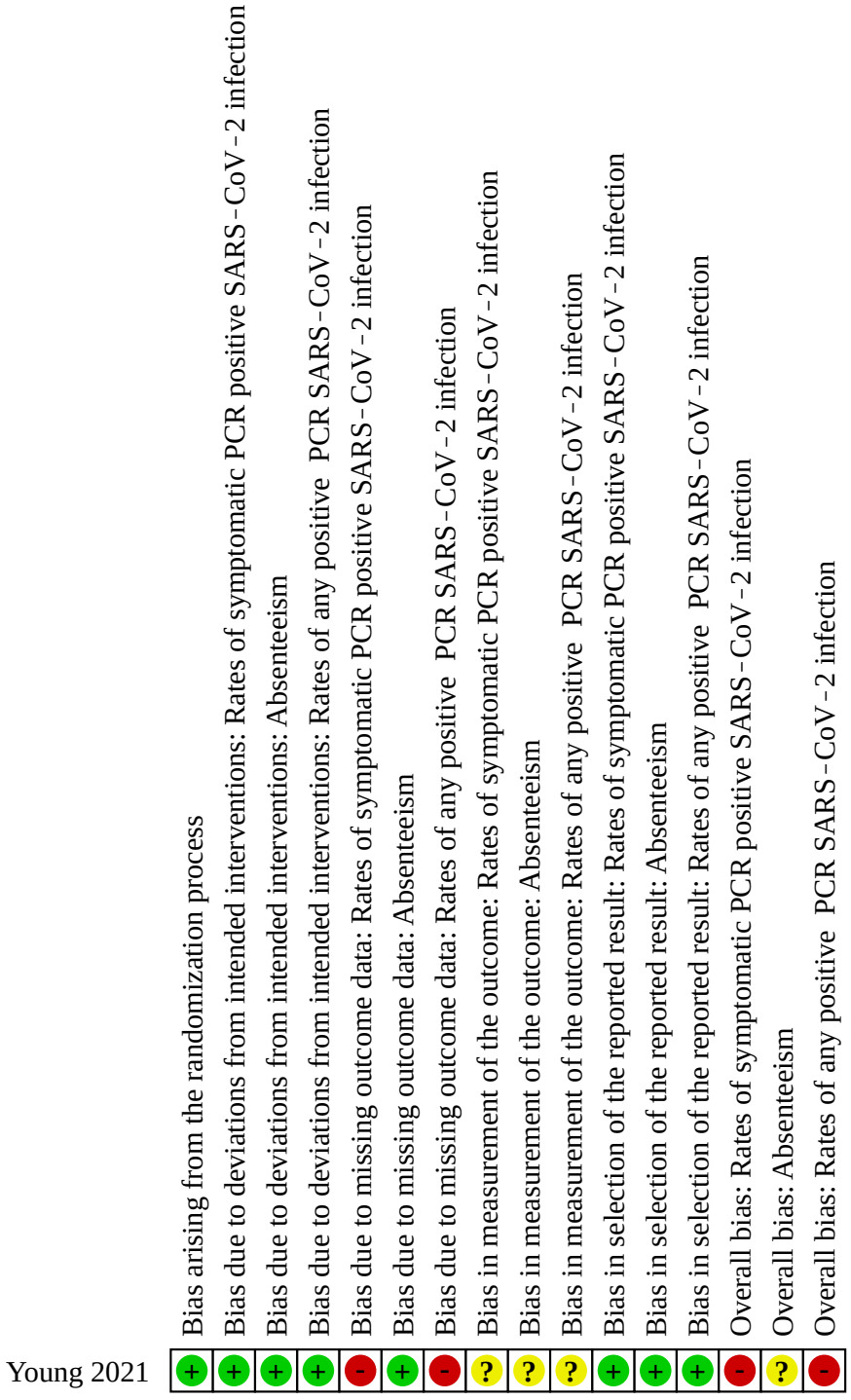
We excluded four studies because of population, i.e. conducted in communities and not at the workplace (Bundgaard 2021; NCT04630054; NCT04740320; NCT05022472). We excluded four studies because they were conducted in a healthcare setting (Bhaskar 2020; Falsey 1999; NCT05008627; Tagliabue 2021). We excluded the remaining eight studies because of the study design, i.e. studies conducted without a concurrent controlled group

(Bielecki 2021; Cave 2021; Edwards 2021; Guy 2021; Herstein 2021; Iddins 2021; Ma 2020; Marshall 2020).

Risk of bias in included studies

-e assessed the risk of bias for the results and outcomes reported in the included study: rate of symptomatic PCR-positive SARS-CoV-2 infections, rate of any positive PCR SARS-CoV-2 infections, and rate of COVID-related school absences (for the staff). See Figure 2; Risk of bias table for Analysis 1.1; Risk of bias table for Analysis 1.2).

Figure 2. Risk of bias summary



Bias arising from the randomisation process

We judged the risk of bias as low for these three outcomes, as randomisation was done using statistical software, and the allocation was concealed until after members of the clusters were enrolled. The cluster effect was taken into account in the trial's analyses.

Risk of bias arising from the timing of identification or recruitment of participants

We judged the risk of bias as low for the three outcomes, as all participants were identified and recruited before the clusters were randomised.

Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)

We judged the risk of bias for the three outcomes as low; participants were aware that they were in a study, but not that they were in a trial; intention-to-treat (ITT) analyses were undertaken.

Risk of bias due to missing outcome data

We judged the risk of bias as low for absenteeism. We judged the risk of bias as high for PCR SARS-CoV-2 infection (any positive PCR SARS-CoV-2 infection, and symptomatic positive PCR SARS-CoV-2 infection), because data for staff for this outcome were available for 76 (76%) control schools and 85 (83%) intervention schools.

Risk of bias in the measurement of the outcome

We had some concerns about the risk of bias in the measurement of the three outcomes. The trial used different methods to assess the outcomes in the intervention and control groups; it used study data for actively participating schools, and national administrative data for non-participating schools.

Risk of bias in the selection of the reported result

We judged the risk of bias for the three outcomes as low; the outcome data were analysed according to a prespecified analysis plan that was finalised before the unblinded outcome data were available.

Overall risk of bias

We had some concerns for the overall risk of bias for absenteeism, because we had some concerns of risk of bias in the measurement of outcomes; and we judged high risk for PCR SARS-CoV-2 infection, because staff data for this outcome were only available for 76% of the control schools and 83% of the intervention schools.

Effects of interventions

See: **Summary of findings 1** Test-based attendance compared to routine isolation after contact with a SARS-CoV-2 positive person

Test-based attendance versus standard isolation after contact with a SARS-CoV-2 positive person

We included one study (enrolling 24,027 working staff (Young 2021)). We reported the certainty of the evidence in Summary of findings 1.

Primary outcomes

Incidence rate of SARS-CoV-2 (or other viruses) infection

Test-based attendance did not lead to a non-inferior rate of symptomatic PCR-positive SARS-COV-2 infection compared to standard 10-day self-isolation after contact with a SARS-CoV-2 positive person (rate ratio (RR) 1.28, 95% confidence interval (CI) 0.74 to 2.21; 1 study, 24,027 participants; very low-certainty evidence; Analysis 1.1). The rates of symptomatic PCR-postive SARS-COV-2 infection in staff were 57 per 819,487 days at risk (48.7 cases per 100,000 population per week) in the test-based attendance group, and 43 per 790,219 days at risk (38.1 cases per 100,000 population per week) in the standard 10-day self-isolation group.

Test-based attendance did not lead to a non-inferior rate of any PCR-positive SARS-COV-2 infection compared to standard 10-day self-isolation after contact with a SARS-CoV-2 positive person (RR 1.35, 95% CI 0.82 to 2.21; 1 study, 24,027 participants; very low-certainty evidence; Analysis 1.2). Rates of any PCR-positive SARS-CoV-2 infections in staff were 85 per 821,569 days at risk (72.4 cases per 100,000 population per week) in the test-based attendance group, and 61 per 793,653 days at risk (53.8 cases per 100,000 population per week) in the standard isolation group.

Absenteeism

The results between test-based attendance and standard 10-day self-isolation were inconclusive for absenteeism (RR 0.83, 95% CI 0.55 to 1.25; 1 study, 24,027 participants; low-certainty evidence; Analysis 1.3). Absentee rates in staff were 2932 per 539,805 days at risk (5.4 cases per 1000 working days) in the test-based attendance group, and 3704 in 556,502 days at risk (6.5 per 1000 working days) in the standard 10-day self-isolation group. In absolute terms, this was, on average, a reduction of 0.07 day (95% CI -0.66 to 0.51) of absence in the test-based group, over the follow-up period of 13 weeks. Extrapolated to a year, this corresponds to an average reduction of 0.25 days of absence per person in the test-based attendance group, compared to the standard 10-day self-isolation group, assuming 225 working days per person per year.

SARS-CoV-2-related mortality

The included study did not report this outcome.

Adverse events

The included study did not report this outcome.

Secondary outcomes

All-cause mortality

The included study did not report this outcome.

Quality of life

The included study did not report this outcome.

Hospitalisation

The included study did not report this outcome.

Uptake, acceptability, or adherence to strategies

In the test-based attendance group, uptake of the rapid antigen test among staff who were identified as a contact of an index case was

179/253 (71%). The uptake in the 10-day self-isolation group was not reported.

DISCUSSION

Summary of main results

We included one open-label, non-inferiority, cluster-randomised controlled trial investigating the effects of test-based attendance compared to standard isolation on COVID-related absence and symptomatic polymerase chain reaction (PCR)-positive SARS-CoV-2 infection rates, after contact with a SARS-CoV-2-positive person. Participants were staff at 162 secondary schools and colleges in England.

We are uncertain whether test-based attendance after contact with a SARS-CoV-2 positive person compared to standard 10-day self-isolation affects rates of symptomatic PCR-positive SARS-CoV-2 infection (rate ratio (RR) 1.28, 95% confidence interval (CI) 0.74 to 2.21, very low certainty evidence), and any PCR-positive SARS-COV-2 infection (RR 1.35, 95% CI 0.82 to 2.21; 1 study, 24,027 participants; very low certainty evidence). For COVID-related absence, the rate ratio of test-based attendance versus routine isolation was 0.83 (95% CI 0.55 to 1.25; low certainty evidence). In absolute terms, this was an average 0.07-day reduction of absence in the intervention group. Extrapolated to a year, this corresponds to an average reduction of 0.25 days of absence (95% CI -0.66 to 0.51) per person in the test-based attendance group when compared to the standard 10-day self-isolation group, assuming 225 working days per person per year. This suggests that test-based attendance may offer, at most, a trivial reduction in days of absence per person from the individual perspective. Because a large part of the population is exposed, this could potentially be an important benefit from the viewpoint of employers or society, but the limited data available from this single trial means that the imprecision of the estimated benefit is too great to draw firm conclusions.

The included study did not measure other primary outcomes of this review (SARS-CoV-2-related mortality, adverse events).

The included study reported on the uptake of the intervention, but only provided data for the test-based attendance group (71%); none of the other secondary outcomes of interest were reported (all-cause mortality, quality of life, hospitalisation).

Overall completeness and applicability of evidence

Our review highlights the paucity of direct evidence. Many studies assessing relevant interventions were conducted among ineligible populations, i.e. in healthcare workers or in community (rather than occupational) settings. These populations are covered in other Cochrane Reviews (Jefferson 2020; Verbeek 2020).

The included study addressed only one of the interventions that could be implemented in the workplace to reduce the risk of infection – test-based attendance, using rapid antigen testing to attempt to reduce staff time away from work. In the two ongoing studies we identified, one also addresses the impact of daily rapid antigen testing in schools (NCT04878809), while the other investigates mask-wearing (NCT04647305). Evaluations of different relevant interventions exist, but not in settings included in this review.

The included study measured three of our prespecified outcomes; for one of these, results were only reported for the intervention group.

The generalisability of this study to other contexts, especially workplaces in low- and middle-income countries, is very uncertain, given the considerable geographical variation in disease incidence, other primary preventive measures (including vaccination rates), and accumulated immunity from past infection.

When the included trial was completed, infection rates were low (2%), and results could be very different with higher infection rates. For example, in a context where the rate of COVID-19 infection is higher, there is an increased probability that a negative rapid antigen test would be false, which could impact the effectiveness of a test-based attendance programme. On the other hand, with higher infection rates, there would also be higher absenteeism due to self-isolation. These benefits could be balanced with the potential harms of different self-isolation strategies after contact with an infected person.

The included trial was performed in the UK from March to June 2021, and to some extent, the vaccination programme may have influenced results for staff. The COVID-19 vaccination roll-out began in the UK on 8 December 2020. Until the end of the study period (4 May 2021), 60.5% (first dose) and 27.6% (second dose) of the UK population over the age of 12 years were vaccinated in the UK (NHS 2021). However, given the phased vaccination roll-out, at the time of this study, none of the students would have been vaccinated; they would not be offered the COVID-19 vaccine in the UK until after August/September 2021. Given the inconclusive, very low certainty evidence supporting the effectiveness of workplace testing and self-isolation, occupational physicians will need to assess evidence from non-workplace settings to translate to the workplace setting.

Quality of the evidence

We assessed the certainty of the evidence for the outcomes as low to very low (see Summary of findings 1). We downgraded outcomes because of imprecision: the confidence intervals were wide and included both appreciable benefit and harm, and risk of bias: we judged a high risk of detection bias because of considerable missing staff PCR-test data.

We did not explore publication bias using funnel plots because we included fewer than 10 trials.

Potential biases in the review process

Given the recent emergence of COVID-19 infection, we aimed to design a protocol that would be inclusive, to encompass as many relevant interventions as possible.

Cochrane Information Specialists designed and ran the search strategy. Although some studies might have been missed, we think this is unlikely, since we manually searched the references of the included study, and carried out searches in databases that focus on occupational health studies and evidence. Our choice to include only randomised trials and studies with a concurrent control group resulted in us including one study only; in the next update of the review, we will consider also including case-control studies and interrupted time series.

Agreements and disagreements with other studies or reviews

There are numerous factors influencing incidence rates of SARS-CoV-2, and as the rates fluctuate substantially and unpredictably over time, assessing the possibly small contribution of preventive measures in the workplace in a complex societal context of a pandemic, requires well-conducted trials with a contemporary control group. Therefore, we chose to only include studies with such a control group. A rapid review that included observational studies on COVID-19 prevention and control measures in workplace settings included 61 studies, conducted in meatpacking, manufacturing, and office settings, which addressed various types of interventions (Ingram 2021; literature searched 19 April 2021). Only five of the studies in the review were conducted outside of healthcare facilities, and none of these five studies included a concurrent control. For these reasons, a comparison between the findings of that review and this review was not possible.

Seventy-two studies met the inclusion criteria for a systematic review and meta-analysis on the effectiveness of public health measures in reducing the incidence of COVID-19 and SARS-CoV-2 transmission, 35 of which assessed individual interventions (literature searched 7 June 2021). Thirty-four of these studies were observational, and one was a randomised controlled trial (Talic 2021). None of the 16 studies included in a rapid systematic review on school closure and management practices during COVID-19 were reported as randomised or non-randomised studies of an intervention, or included a concurrent control arm (Viner 2020). All 34 studies included in a systematic review of empirical studies comparing the effectiveness of non-pharmaceutical interventions against COVID-19 were ecological studies, with data aggregated at the population level (Mendez-Brito 2021). A Cochrane Scoping Review on measures in the school setting to contain the COVID-19 pandemic included 42 studies, only two of which used experimental or quasi-experimental designs (Krishnaratne 2020; literature searched 8 October 2020).

This confirms the lack of randomised and controlled trials available, as reported in our review.

AUTHORS' CONCLUSIONS

Implications for practice

Amongst school and college staff, we are uncertain whether test-based attendance affects incidence rates of PCR-positive SARS-CoV-2 infection (any infection; symptomatic infection) compared to standard 10-day self-isolation. Data on COVID-related absence suggests that test-based attendance may result in little to no difference in days of absence. However, while the small number of days of absence per person per year observed was trivial from the individual level, this sort of reduction could have a relevant impact from the perspective of an employer or the society.

The certainty of the evidence was low to very low, and only one randomised trial was available. The included study did not report on any of the other primary outcomes of our review, i.e. SARS-CoV-2-related mortality and adverse events. Adherence to the intervention was reported for the intervention group only. No completed studies were identified on any other interventions specified in this review, but two eligible studies are ongoing.

As infection rates can increase exponentially in the case of an epidemic or pandemic, an apparently small relative effect that would not be worthwhile at the individual level, may become an important absolute effect overtime at the societal level, if introduced early, especially in a setting where a strategy aims to postpone disease spread and avoid overburdening a healthcare system.

Implications for research

More randomised and non-randomised studies of interventions to reduce SARS-CoV-2 infection rates in workplaces outside the healthcare setting should be conducted because the effects of most interventions used in the workplace are unknown. Even though randomised experiments in workplace settings are more difficult to conduct, some randomised controlled studies have been conducted, and prove that this is possible. Also, the use of a concurrent non-randomised control group should not be difficult to organise, but would greatly enhance the possibility of inference, compared to studies that do not have a control group.

Given the very high variation of risk in the workplaces, testing in representative samples in different settings could help identify true benefits and harms of interventions that attempt to prevent or reduce workers' exposure to SARS-CoV-2 in the workplace. Preferably, interventions that are high in the hierarchy of hazard controls should be evaluated, because they have potentially the biggest impact: elimination of the source of SARS-CoV-2 and engineering controls. This means more studies of testing strategies are needed, especially because testing on a large scale has been proven to be feasible in workplaces (Rosella 2022). Also, the effects of working from home should be evaluated, as this has a large impact on both the workers and the organisation. The studies should have a minimum follow-up of three months, and measure the effect on SARS-CoV-2 absenteeism and adverse effects.

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Editorial and peer-reviewer contributions

The following people conducted the editorial process for this article:

- Sign-off Editor (final editorial decision): Lisa Bero, Professor of Medicine and Public Health and Chief Scientist, Center for Bioethics and Humanities, University of Colorado Anschutz Medical Campus;

- Managing Editor (selected peer reviewers, collated peer-reviewer comments, provided editorial guidance to authors, edited the article): Colleen Ovelman, Cochrane Central Editorial Service;
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* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Young 2021

Study characteristics	
Methods	Cluster randomised trial. Designed as non-inferiority trial, (non-inferiority margin < 50% relative increase of infection transmission)
Participants	24,027 adults working in schools in England; 86 schools were assigned to the intervention group, and 76 schools to the control group. Duration of the study: March to June 2021
Interventions	**intervention group**: policy of offering daily lateral flow device (LFD) testing over 7 days for contacts, to allow continued school attendance, i.e. LFD-negative contacts remaining at school **control group**: policy of isolation of contacts for 10 days All participating schools offered twice-weekly asymptomatic testing with LFDs as per national policy. Those testing positive were sent into self-isolation and asked to confirm the results with a PCR test within the following two days. Symptomatic individuals were isolated along with their household, and asked to obtain an urgent PCR test.

Young 2021 *(Continued)*

	National guidelines were followed to identify close contacts of students and staff testing positive by LFD or PCR. These contacts were required to self-isolate for 10 days if they had been in contact with a case less than 48 hours before symptom onset. Schools in the intervention group offered daily contact testing to contacts as an alternative to self-isolation. Requirements for this procedure included the contact being school-based, asymptomatic, and able to test on-site at the school. Contacts not consenting to daily testing were required to self-isolate at home for 10 days. Those with household members who had tested positive and were currently self-isolating were excluded. Those participating in daily testing, self-tested their anterior nose using a SARS-CoV-2 antigen LFD. Contacts testing negative were informed and released from self-isolation for classes, however, requested to self-isolate after school, on weekends, and on holidays. Those who had tested negative five times over at least seven days were released from self-isolation. School-based contacts testing positive were required to self-isolate with their household, and their contacts were informed to repeat this process. Schools provided a list of students, staff, demographics, and identifying information. The number of students and staff present, absent for COVID-19 reasons, and absent for other reasons were also reported. One study staff was employed at each school. Data were obtained from schools who had stopped participating, where available. Each positive PCR and LFD case was recorded, apart from LFD-positive PCR-negative cases. Following this, the school-based contacts, whether consent was given, and subsequent LFD results were noted. Further, routine PCR tests done by staff and students outside the study were obtained from the National Health Service (NHS). Study-specific PCR testing was also done for contacts in both study groups on day two and seven of testing or isolation.
Outcomes	**Primary outcomes:** • Number of school absences due to COVID-19 • In-school SARS-CoV-2 transmission (rates of symptomatic PCR-positive infections recorded by NHS Test and Trace, after controlling for community case rates) **Secondary outcomes:** • Estimated rate of symptomatic and asymptomatic SARS-CoV-2 infections outside first order contacts • Daily contact testing participation rates in the intervention group • Proportion of contacts testing positive on asymptomatic study PCR tests and symptomatic routine PCR tests • Performance characteristics of LFD testing versus PCR testing • Participation in weekly active COVID-19 case finding • Behavioural outcomes for pupils, parents, and staff • Estimated number of infections acquired in schools and transmission cluster sizes
Notes	Funding: UK Government, Department of Health and Social Care

LFD: lateral flow device

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Bhaskar 2020	Healthcare setting
Bielecki 2021	Study design: a natural experiment with no active intervention by a manager or researcher
Bundgaard 2021	Settings: community-based study, not a workplace setting
Cave 2021	Study design: no concurrent controlled group

Study	Reason for exclusion
Edwards 2021	Study design: no concurrent controlled group; modelling study
Falsey 1999	Healthcare settings
Guy 2021	Study design: no concurrent control group
Herstein 2021	Study design: no concurrent control group
Iddins 2021	Study design: no concurrent controlled group
Ma 2020	Study design: no concurrent controlled group
Marshall 2020	Study design: no concurrent controlled group
NCT04630054	Population: conducted in communities
NCT04740320	Population: conducted in communities
NCT05008627	Healthcare settings
NCT05022472	Population: conducted in communities
Tagliabue 2021	Healthcare setting

Characteristics of ongoing studies *[ordered by study ID]*

NCT04647305

Study name	Effectiveness and adherence to closed face shields to prevent COVID-19 transmission (COV-PROSHIELD)
Methods	non-inferiority randomised controlled trial
Participants	• Age 18 years or older • Negative RT-PCR test at the beginning of the study • Negative SARS-CoV-2 serological Elecsys Anti-Sars-CoV-2 test at the beginning of the study • Living in a geographic area with active COVID-19 transmission (number of cases reported locally) • Living in a geographic area that was determined by the Colombian National Statistics Department (DANE) to have a medium, medium-high, and high vulnerability index (higher prevalence of co-morbidities and social and economic vulnerabilities • Working outside the home for at least two days a week, during the last week
Interventions	Closed face shield + surgical face mask Surgical face mask only
Outcomes	COVID-19 incidence; time frame: 21 days of follow-up, RT-PCR test at day 21 Adherence to closed face shields use; time frame: 21 days of follow-up Percentage of participants with a positive serological test at baseline; time frame: serological test at day 1

NCT04647305 *(Continued)*	
	Percentage of seroconversion in the experimental group and active control group; time-frame: serological test at day 21
Starting date	16 January 2021 (completed March 2021)
Contact information	Andrea Ramirez Varela, University of Los Andes, Colombia
Notes	

NCT04878809	
Study name	Rapid screening circuit of COVID 19 in schools, pilot study
Methods	Non-randomised clinical trial
Participants	• Students older than 6 years, teachers, administrative and service staff who regularly attend and work at L'Horitzó school
Interventions	• Diagnosis of SARS-CoV-2 infection by rapid antigen detection tests in nasal and nasopharyngeal swabs, in asymptomatic and symptomatic participants who attend and work at L'Horitzó school. • John Talabot School will provide the incidence of infection by SARS-CoV-2 to compare with the incidence of infection from L'Horitzó School
Outcomes	Incidence rate of people infected with SARS-CoV-2; time frame: up to 8 weeks − incidence rate of asymptomatic people infected with SARS-CoV-2, detected by rapid antigen detection tests in nasal swabs (self -taken) Incidence rate of people infected with SARS-CoV-2; time frame: up to 8 weeks − incidence rate of symptomatic/asymptomatic people infected with SARS-CoV-2, detected by rapid antigen detection tests in nasopharyngeal swabs performed by trained teachers from L'Horitzó Incidence rate of people infected with SARS-CoV-2; time frame: up to 8 weeks − incidence rate of symptomatic people infected with SARS-CoV-2, detected by PCR nasopharyngeal performed under clinical practice
Starting date	7 May 2021 (completed June 2021)
Contact information	Fundación FLS de Lucha Contra el Sida, las Enfermedades Infecciosas y la Promoción de la Salud y la Ciencia, Spain
Notes	

RISK OF BIAS

Legend: Low risk of bias High risk of bias Some concerns

Risk of bias for analysis 1.1 Rates of symptomatic PCR positive SARS-CoV-2 infection

	Bias					
Study	**Randomisation process**	**Deviations from intended interventions**	**Missing outcome data**	**Measurement of the outcome**	**Selection of the reported results**	**Overall**
Young 2021	✓	✓	✗	~	✓	✗

Risk of bias for analysis 1.2 Rates of any positive PCR SARS-CoV-2 infection

	Bias					
Study	**Randomisation process**	**Deviations from intended interventions**	**Missing outcome data**	**Measurement of the outcome**	**Selection of the reported results**	**Overall**
Young 2021	✓	✓	✗	~	✓	✗

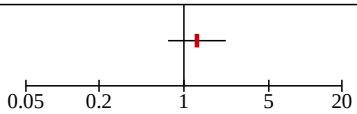
DATA AND ANALYSES

Comparison 1. Test-based attendance versus standard 10-day self-isolation

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1.1 Rates of symptomatic PCR positive SARS-CoV-2 infection	1		Rate Ratio (IV, Fixed, 95% CI)	Totals not selected
1.2 Rates of any positive PCR SARS-CoV-2 infection	1		Rate Ratio (IV, Fixed, 95% CI)	Totals not selected
1.3 Absenteeism	1		Rate Ratio (IV, Fixed, 95% CI)	Totals not selected

Analysis 1.1. Comparison 1: Test-based attendance versus standard 10-day self-isolation, Outcome 1: Rates of symptomatic PCR positive SARS-CoV-2 infection

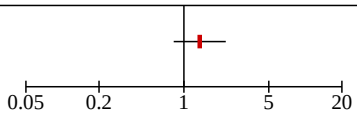
Study or Subgroup	log[Rate Ratio]	SE	Rate Ratio IV, Fixed, 95% CI	Rate Ratio IV, Fixed, 95% CI	Risk of Bias A	B	C	D	E	F
Young 2021	0.24686	0.279112	1.28 [0.74 , 2.21]		+	+	-	?	+	-



Risk of bias legend
(A) Bias arising from the randomization process
(B) Bias due to deviations from intended interventions
(C) Bias due to missing outcome data
(D) Bias in measurement of the outcome
(E) Bias in selection of the reported result
(F) Overall bias

Analysis 1.2. Comparison 1: Test-based attendance versus standard 10-day self-isolation, Outcome 2: Rates of any positive PCR SARS-CoV-2 infection

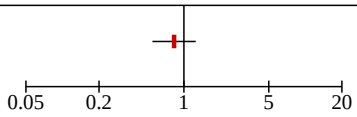
Study or Subgroup	log[Rate Ratio]	SE	Rate Ratio IV, Fixed, 95% CI	Rate Ratio IV, Fixed, 95% CI	Risk of Bias A	B	C	D	E	F
Young 2021	0.300105	0.251767	1.35 [0.82 , 2.21]		+	+	-	?	+	-



Risk of bias legend
(A) Bias arising from the randomization process
(B) Bias due to deviations from intended interventions
(C) Bias due to missing outcome data
(D) Bias in measurement of the outcome
(E) Bias in selection of the reported result
(F) Overall bias

Analysis 1.3. Comparison 1: Test-based attendance versus standard 10-day self-isolation, Outcome 3: Absenteeism

Study or Subgroup	log[Rate Ratio]	SE	Rate Ratio IV, Fixed, 95% CI	Rate Ratio IV, Fixed, 95% CI	Risk of Bias A	B	C	D	E	F
Young 2021	-0.18633	0.209438	0.83 [0.55 , 1.25]		+	+	+	?	+	?



Risk of bias legend
(A) Bias arising from the randomization process
(B) Bias due to deviations from intended interventions
(C) Bias due to missing outcome data
(D) Bias in measurement of the outcome
(E) Bias in selection of the reported result
(F) Overall bias

APPENDICES

Appendix 1. Search strategy: MEDLINE

Source: MEDLINE Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE® Daily and Ovid MEDLINE® 1946-Present (Ovid SP)

Searched by: Yuan Chi

Date of search: September 14, 2021

Annotations

- No publication date limitations or language limitations were applied.
- The COVID block is built by modifying CADTH COVID-19 MEDLINE and Respiratory Pandemics MEDLINE filters.https://covid.cadth.ca/literature-searching-tools/cadth-covid-19-search-strings/
- The study design block is built by modifying CADTH database search filter on Randomized Controlled Trials / Controlled Clinical Trials — Medline (Ovid).https://www.cadth.ca/resources/finding-evidence/strings-attached-cadths-database-search-filters#rand
- The text terms of occupational categories in the workplace/personnel block are built based on the categories of Essential Non-Healthcare Workers (Frontline essential workers (1b) and Other essential workers (1c)) from the Interim List of Categories of Essential Workers Mapped to Standardized Industry Codes and Titles developed by the Advisory Committee on Immunization Practices, Centers for Disease Control and Prevention.https://www.cdc.gov/vaccines/covid-19/categories-essential-workers.html
- The text terms of intervention block referenced the resources below:https://covid.cadth.ca/literature-searching-tools/cadth-covid-19-search-strings/https://www.ontario.ca/page/resources-prevent-covid-19-workplace, accessed 14 August 2021).https://www.who.int/publications/i/item/WHO-2019-nCoV-workplace-actions-policy-brief-2021-1, accessed 14 August 2021).http://www.ilo.org/global/topics/safety-and-health-at-work/resources-library/publications/WCMS_745549/lang--en/index.htm, accessed 15 August 2021).https://www.osha.gov/coronavirus/safework, accessed 15 August 2021).

Search strategy

COVID block

1. (coronavirus/ or betacoronavirus/ or coronavirus infections/) and (disease outbreaks/ or epidemics/ or pandemics/)

2. COVID-19/ or SARS-CoV-2/ or COVID-19 Vaccines/ or Severe Acute Respiratory Syndrome/ or the Middle East Respiratory Syndrome Coronavirus/

3. (nCoV* or 2019nCoV or 19nCoV or COVID19* or COVID or 2019 nCoV or nCov 2019 or SARS-CoV2 or SARS CoV-2 or SARS-COV-2 or SARSCOV-2 or SARSCOV2 or Severe Acute Respiratory Syndrome Coronavirus 2 or Severe Acute Respiratory Syndrome Corona Virus 2).ti,ab,kf,nm,ot,ox,rx,px.

4. ((new or novel or "19" or "2019" or Wuhan or Hubei or China or Chinese) adj3 (coronavirus* or corona virus* or betacoronavirus* or CoV or HCoV)).ti,ab,kf,ot.

5. ((coronavirus* or corona virus* or betacoronavirus* or SARS or MERS) adj3 (pandemic* or epidemic* or outbreak* or crisis)).ti,ab,kf,ot.

6. ((Wuhan or Hubei) adj5 pneumonia).ti,ab,kf,ot.

7. (Severe Acute Respiratory Syndrome* or sudden acute respiratory syndrome* or SARS like or MERSCoV* or Middle East Respiratory or camel flu or EMC 2012).ti,ab,kf.

8. or/1-7

Workplace/personnel block

9. exp Occupational Health/ or Occupational Diseases/ or Occupational Exposure/ or Occupational Medicine/

10. Work/ or Workplace/ or Employment/ or Manpower/

11. (work or job or jobs).kf,kw.

12. (works* or worka* or worke* or workg* or worki* or workl* or workp* or occupat* or company* or offic* or busines* or laborer* or labourer* or manpower or employee*).ti,ab,kf,ot.

13. (community* or population-base* or office-base* or household or retail* or restaurant* or manufacturing or meat processing or administrators or bartenders or cashiers or chefs or cleaners or dishwashers or drive-thru operators or cooks or baker* or waiter* or

supervisor* or manager* or supplier* or machine operators or tradespeople or material handlers or painters or finishers or architects or engineers or contractors or customers or visitors or driver* or passenger* or clients or vendors or builder* or shipper* or plumber* or electrician* or technician* or police or cafe* or hotel* or accommodation or couriers or messengers or garden* or laundry or park* or sport*).ti,ab,kf,ot.

14. ((transport* or commut* or deliver* or transit or air or bus or train or rail or motor or vehicle or ship or car or taxi) adj5 (employ* or work* or people or crew* or pilot or staff or team* or service or driver* or passenger* or sector*)).ti,ab.

15. ((maintenance or trade or market* or retail* or shop* or store* or restaurant* or construction* or on-shore or outdoor or office or domestic or sanitation or social care or public or home or secur* fire or gym* or fitness or postal or repair or packaging or labeling or gasoline or legal or court or librar* or technical or television or film) adj5 (employ* or work* or people or crew* or staff or team* or service or sector or enterprise* or entrepreneur* or dealer*)).ti,ab.

16. ((firstline or first-line or frontline or public or customer* or coworker* or first responder*) adj3 (contact* or expos*)).ti,ab,kf,ot.

17. (((crowd* or close* or share*) adj3 (place* or space* or room*)) or (lunchroom* or changeroom* or breakroom* or break room)).ti,ab,kf.

18. or/9-17

Intervention block

19. Protective Devices/ or Ear Protective Devices/ or Eye Protective Devices/ or exp Gloves, Protective/ or Masks/ or Personal Protective Equipment/ or Protective Clothing/ or Respiratory Protective Devices/

20. (personal protect* or PPE or PPEs or protective device* or protective layer*).ti,ab,kf.

21. ((protect* or safe*) adj3 (glasses or eyeglasses or eyewear or cap or caps or equipment or garment* or clothing or clothes or apron* or suit or suits or shoe* or attire or shield* or gear)).ti,ab,kf.

22. (protect* adj2 (head or heads or face or faces or facial or foot or feet or hand or hands or eye or eyes or mouth or mouths or skin)).ti,ab,kf.

23. (facepiece* or face piece* or mask or masks or facemask* or faceshield* or face shield* or respirator or respirators or FFP1 or FFP2 or FFP3).ti,ab,kf.

24. ((surgical or procedure or respiratory or protect* or facial or face or N99 or N95 or N 99 or N 95) adj2 mask*).ti,ab,kf.

25. ((N99 or N95 or N 99 or N 95 or FFP or P100) adj3 respirator*).ti,ab,kf.

26. ((protect* or filter*) adj2 respirator*).ti,ab,kf.

27. (coverall* or boot or boots or donning or donned or doff or doffing or doffed or face cover* or facial cover* or glove or gloves or gloving or gown or gowns or gowning or goggle* or head cover* or headwear or hood or hoods or overshoe* or shoe cover* or smock or smocks or visor or visors).ti,ab,kf.

28. ((physical* or social) adj3 (distanc* or contact*)).ti,ab,kf.

29. (stagger* or barrier* or bubble* or hazard* or marking* or schedule* or reschedule* or adjust* or adapt* or ((work or traffic) adj3 flow*)).ti,ab,kf.

30. (hand* adj3 (sanit* or disinfect* or wash* or clean* or hygiene*)).ti,ab,kf.

31. (HVAC or HEPA or heat* or ventilat* or (air adj3 (condition* or purificat* or filter*)) or fresh air or mist* or fog*).ti,ab,kf.

32. (UV light* or ultraviolet light* or clean* or disinfect*).ti,ab,kf.

33. ((telework* or telecommut* or (tele or remote or mobile or distant* home)) adj3 (work* or office or job)).ti,ab,kf.

34. Vaccination/

35. (vaccin* or train* or screen* or policy or sick* or absent* or audit or surveillance).ti,ab,kf.

36. (((rapid or antigen or home-based or PCR or molecular-based) adj3 test*) or self-test*).ti,ab,kf.

37. (quarant* or self-isolat* or isolat* or outbreak or contact tracing).ti,ab,kf.

38. (close* or open* or reopen* or return or return-to-work).ti,ab,kf.

39. (((protect* or control) adj3 measure*) or ((source or engineering or administrative) adj3 control*)).ti,ab,kf.

40. or/19-39

Study design block

41. (Randomized Controlled Trial or Controlled Clinical Trial or Pragmatic Clinical Trial or Equivalence Trial or Clinical Trial, Phase III).pt.

42. Randomized Controlled Trial/

43. exp Randomized Controlled Trials as Topic/

44. Controlled Clinical Trial/

45. exp Controlled Clinical Trials as Topic/

46. Randomization/

47. Random Allocation/

48. Double-Blind Method/ or Double-Blind Studies/ or Single-Blind Method/ or Single-Blind Studies/

49. Placebos/ or Placebo/

50. Control Groups/ or Control Group/

51. (random* or sham or placebo*).ti,ab,hw,kf,kw.

52. ((singl* or doubl*) adj (blind* or dumm* or mask*)).ti,ab,hw,kf,kw.

53. ((tripl* or trebl*) adj (blind* or dumm* or mask*)).ti,ab,hw,kf,kw.

54. (control* adj3 (study or studies or trial* or group*)).ti,ab,kf,kw.

55. (Nonrandom* or non random* or non-random* or quasi-random* or quasirandom*).ti,ab,hw,kf,kw.

56. allocated.ti,ab,hw.

57. ((open label or open-label) adj5 (study or studies or trial*)).ti,ab,hw,kf,kw.

58. ((equivalence or superiority or non-inferiority or noninferiority) adj3 (study or studies or trial*)).ti,ab,hw,kf,kw.

59. (pragmatic study or pragmatic studies).ti,ab,hw,kf,kw.

60. ((pragmatic or practical) adj3 trial*).ti,ab,hw,kf,kw.

61. ((quasiexperimental or quasi-experimental) adj3 (study or studies or trial*)).ti,ab,hw,kf,kw.

62. (phase adj3 (III or "3") adj3 (study or studies or trial*)).ti,hw,kf,kw.

63. Interrupted Time Series Analysis/

64. exp Controlled Before-After Studies/

65. Comparative Study/

66. (controlled before-after stud* or time series).ti,ab,kf,kw,pt.

67. or/41-66

Combined search

68. 8 and 18 and 40 and 67

Appendix 2. Search strategy: Embase, Web of Science, Cochrane COVID-19 Study Register, Clinicaltrials.gov, and International Clinical Trials Registry Platform

No publication date limitations or language limitations were applied

Searched by: Maria Björklund

Embase Elsevier

Date of search: Sept 16, 2021

No publication date limitations or language limitations were applied

SARS-CoV-2/MERS block

#1 (betacoronavirus OR coronavirus) AND infections AND (disease AND outbreaks OR epidemics OR pandemics)

#2 'coronavirus disease 2019'/exp OR 'sars coronavirus'/exp OR 'severe acute respiratory syndrome coronavirus 2'/exp OR 'middle east respiratory syndrome coronavirus'/exp OR (covid AND vaccine*)

#3 ((((ncov* OR 2019ncov OR 19ncov OR covid19 OR covid OR 2019) AND ncov OR ncov) AND 2019 OR 'sars cov2' OR sars) AND 'cov 2' OR 'sars cov 2' OR 'sarscov 2' OR sarscov2 OR severe) AND acute AND respiratory AND syndrome AND coronavirus AND 2 OR (severe AND acute AND respiratory AND syndome AND corona AND virus)

#4 (new OR novel OR '2019' OR wuhan OR hubei OR china OR chinese) AND ((coronavirus* OR corona) AND virus* OR betacoronavirus OR cov OR hcov)

#5 ((coronavirus* OR corona) AND virus OR betacoronavirus OR sars OR mers) AND (pandemic* OR epidemic* OR outbreak* OR crisis)

#6 (wuhan OR hubei) NEAR/3 pneumonia

#7 (((((severe AND acute AND respiratory AND syndrome* OR sudden) AND acute AND respiratory AND syndrome* OR sars) AND like OR merscov* OR middle) AND east AND respiratory OR camel) AND flu OR emc) AND 2012

#8 #1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7

Workplace/personnel block

#9 'occupational health'/exp OR 'occupational disease'/exp OR 'occupational exposure'/exp OR 'occupational medicine'/ex

#10 'work'/exp OR 'workplace'/exp OR 'employment'/exp OR 'workforce'/exp

#11 work OR job OR jobs

#12 works* OR worka* OR worke* OR workg* OR worki* OR workl* OR workp* OR occupat* OR company* OR offic* OR busines* OR laborer* OR labourer* OR manpower OR employee*

#13 (community* or population-based* or office-based* or household or retail* or restaurant* or manufacturing or meat processing or administrators or bartenders or cashiers or chefs or cleaners or dishwashers or drive-thru operators or cooks or baker* or waiter* or supervisor* or manager* or supplier* or machine operators or tradespeople or material handlers or painters or finishers or architects or engineers or contractors or customers or visitors or driver* or passenger* or clients or vendors or builder* or shipper* or plumber* or electrician* or technician* or police or cafe* or hotel* or accommodation or couriers or messengers or garden* or laundry or park* or sport*)

#14 (transport* OR commut* OR deliver* OR transit OR air OR bus OR train OR rail OR motor OR vehicle OR ship OR car OR taxi) AND (employ* OR work* OR people OR crew* OR pilot OR staff OR team* OR service OR driver* OR passenger* OR sector*)

#15 (((maintenance OR trade OR market* OR retail* OR shop* OR store* OR restaurant* OR construction* OR 'on shore' OR outdoor OR office OR domestic OR sanitation OR social) AND care OR public OR home OR secur*) AND fire OR gym* OR fitness OR postal OR repair OR packaging OR labeling OR gasoline OR legal OR court OR librar* OR technical OR television OR film) AND (employ* OR work* OR people OR crew* OR staff OR team* OR service OR sector OR enterprise* OR entrepreneur* OR dealer*)

#16 (firstline OR 'first line' OR frontline OR public OR customer* OR coworker* OR first) AND responder* AND (contact* OR expos*)

#17 (crowd* OR close* OR share*) AND (place* OR space* OR room* OR lunchroom* OR changeroom* OR breakroom* OR break) AND room

#18 #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17

Intervention block

#19 'protective equipment'/exp OR 'ear protective device'/exp OR 'eye protective device'/exp OR 'glove'/exp OR 'protective glove'/exp OR 'mask'/exp OR 'protective clothing'/exp OR 'respiratory protection'/exp

#20 ((personal AND protect* OR ppe OR ppes OR protective) AND device* OR protective) AND layer*

#21 (protect* OR safe*) AND (glasses OR eyeglasses OR eyewear OR cap OR caps OR equipment OR garment* OR clothing OR clothes OR apron* OR suit OR suits OR shoe* OR attire OR shield* OR gear)

#22 protect* NEAR/2 (head OR heads OR face OR faces OR facial OR foot OR feet OR hand OR hands OR eye OR eyes OR mouth OR mouths OR skin)

#23 ((facepiece* OR face) AND piece* OR mask OR masks OR facemask* OR faceshield* OR face) AND shield* OR respirator OR respirators OR ffp1 OR ffp2 OR ffp3

#24 ((surgical OR procedure OR respiratory OR protect* OR facial OR face OR n99 OR n95 OR n) AND 99 OR n) AND 95 AND mask*

#25 (((n99 OR n95 OR n) AND 99 OR n) AND 95 OR ffp OR p100) AND respirator*

#26 (protect* OR filter*) NEAR/2 respirator*

#27 ((((coverall* OR boot OR boots OR donning OR donned OR doff OR doffing OR doffed OR face) AND cover* OR facial) AND cover* OR glove OR gloves OR gloving OR gown OR gowns OR gowning OR goggle* OR head) AND cover* OR headwear OR hood OR hoods OR overshoe* OR shoe) AND cover* OR smock OR smocks OR visor OR visors

#28 (physical* OR social) NEAR/3 (distanc* OR contact*)

#29 (stagger* OR barrier* OR bubble* OR hazard* OR marking* OR schedule* OR reschedule* OR adjust* OR adapt* OR work OR traffic) NEAR/3 flow*

#30 hand* NEAR/3 (sanit* OR disinfect* OR wash* OR clean* OR hygiene*)

#31 (hvac OR hepa OR heat* OR ventilat* OR air) AND ((condition* OR purificat* OR filter* OR fresh) AND air OR mist* OR fog)

#32 (uv AND light* OR ultraviolet) AND light* OR clean* OR disinfect*

#33 (telework* OR telecommut* OR tele OR remote OR mobile OR distant*) AND home AND (work* OR office OR job)

#34 'vaccination'/exp

#35 vaccin* OR train* OR screen* OR policy OR sick* OR absent* OR audit OR surveillance OR monitoring

#36 (rapid OR antigen OR 'home based' OR pcr OR 'molecular based') NEAR/3 (test* OR 'self test*')

#37 (quarant* OR 'self isolat*' OR isolat* OR outbreak OR contact) AND tracing

#38 close* OR open* OR reopen* OR return OR 'return to work'

#39 (protect* OR control) AND (measure* OR source OR engineering OR administrative) AND control*

#40 #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34 OR #35 OR #36 OR #37 OR #38 OR #39

Study design block

#41 ((randomized AND controlled AND ('trial'/exp OR trial) OR controlled) AND clinial AND ('trial'/exp OR trial) OR phase) AND 3 AND ('clinical'/exp OR clinical) AND ('trial'/exp OR trial)

#42 'randomized controlled trial (topic)' OR 'clinical trial (topic)'

#43 'randomization'/exp

#44 'double blind procedure'/exp OR 'single blind procedure'/exp

#45 'placebo'/exp OR placebo*

#46 'control group'/exp OR (control AND group*)

#47 random* OR sham

#48 (singl* OR doubl*) NEAR/3 (blind* OR dumm* OR mask*)

#49 (tripl* OR trebl*) NEAR/3 (blind* OR dumm* OR mask*)

#50 control* NEAR/3 (study OR studies OR trial* OR group*)

#51 (nonrandom* OR non) AND random* OR 'non random*' OR 'quasi random*' OR quasirandom*

#52 allocated

#53 (open AND label OR 'open label') AND (study OR studies OR trial*)

#54 (equivalence OR superiority OR 'non inferiority' OR noninferiority) NEAR/3 (study OR studies OR trial*)

#55 (pragmatic AND study OR pragmatic) AND studies

#56 (pragmatic OR practical) NEAR/3 trial*

#57 (quasiexperimental OR 'quasi experimental') NEAR/3 (study OR studies OR trial*)

#58 phase NEAR/3 (iii OR '3') NEAR/3 (study OR studies OR trial*)

#59 interrupted AND time AND series

#60 controlled AND 'before after' AND stud*

#61 'comparative study'/exp

#62 #41 OR #42 OR #43 OR #44 OR #45 OR #46 OR #47 OR #48 OR #49 OR #50 OR #51 OR #52 OR #53v OR #54 OR #55 OR #56 OR #57 OR #58 OR #59 OR #60 OR #61

#63 #8 AND #18 AND #40 AND #62

#64 #65 AND [embase]/lim NOT ([embase]/lim AND [medline]/lim)

Annotation: where proximity operator was not applicable AND was used in Embase.

Web of Science Core Collection (Clarivate Analytics)

Date of search: Sept 16, 2021

No publication date limitations or language limitations were applied

SARS-CoV-2/MERS block

#1 (coronavirus OR betacoronavirus OR coronavirus infection*) AND (disease outbreak* OR epidemic* OR pandemic*) (Topic)

#2 coronavirus OR betacoronavirus OR coronavirus infection* (Topic) and disease outbreak* OR epidemic* OR pandemic* (Topic)

#3 nCoV* OR 2019nCoV OR 19nCoV OR COVID-19 OR COVID19* OR COVID OR SARS-COV-2 OR SARSCOV-2 OR SARSCOV2 OR Severe Acute Respiratory Syndrome Coronavirus 2 OR Severe Acute Respiratory Syndrome Corona Virus 2 (Topic)

#4 (novel OR new OR "19" OR Wuhan OR Hubei OR China OR Chinese) (Topic) and (coronavirus* OR corona virus* OR betacoronavirus* OR CoV OR hCoV) (Topic)

#5 (coronavirus* OR corona virus* OR betacoronavirus* OR SARS OR MERS) (Topic) and (pandemic* OR epidemic* OR outbreak* OR crisis) (Topic)

#6 (Wuhan OR Hubei) (Topic) and pneumonia (Topic)

#7 Severe Acute Respiratory Syndrome* OR sudden acute respiratory syndrome OR SARS like OR MERSCov* OR Middle East Respiratory OR camel flu OR "EMC 2012" (Topic)

#8 #1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7

Workplace/personnel block

#9 work* OR workplace OR employ* OR manpower OR job* OR occupat* OR company* OR busines* OR laborer* OR labourer* (Topic)

#10 (community* or population-base* or office-base* or household or retail* or restaurant* or manufacturing or meat processing or administrators or bartenders or cashiers or chefs or cleaners or dishwashers or drive-thru operators or cooks or baker* or waiter* or supervisor* or manager* or supplier* or machine operators or tradespeople or material handlers or painters or finishers or architects or

engineers or contractors or customers or visitors or driver* or passenger* or clients or vendors or builder* or shipper* or plumber* or electrician* or technician* or police or cafe* or hotel* or accommodation or couriers or messengers or garden* or laundry or park* or sport*)

#11 (transport* or commut* or deliver* or transit or air or bus or train or rail or motor or vehicle or ship or car or taxi) (Topic) AND (employ* or work* or people or crew* or pilot or staff or team* or service or driver* or passenger* or sector*) (Topic)

#12 (maintenance or trade or market* or retail* or shop* or store* or restaurant* or construction* or on-shore or outdoor or office or domestic or sanitation or social care or public or home or secur* fire or gym* or fitness or postal or repair or packaging or labeling or gasoline or legal or court or librar* or technical or television or film) (Topic) AND

(employ* or work* or people or crew* or staff or team* or service or sector or enterprise* or entrepreneur* or dealer*) (Topic)

#13 (firstline or first-line or frontline or public or customer* or coworker* or first responder*) (Topic) AND (contact* or expos*) (Topic)

#14 (crowd* or close* or share*) (Topic)

AND (place* or space* or room* or lunchroom* or changeroom* or breakroom* or break room) (Topic)

#15 #9 OR #10 OR #11 OR #12 OR #13 OR #14

Intervention block

#16 protective (Topic) and device* OR ear device* OR eye device* OR glove* OR mask* OR layer (Topic)

#17 personal protective equipment OR PPE OR respiratory protective device (Topic)

#18 protect* OR safe* (Topic) and Glasses or eyeglasses or eyewear or cap or caps or equipment or garment* or clothing or clothes or apron or suits or suit or shoe* or attire or shield or gear (Topic)

#19 protect* (Topic) and Head or heads or face or faces or facial or foot or feet or hand or hands or eye or eyes or mouth or mouths or skin (Topic)

#20 facepiece* or face piece* or mask or masks or facemask* or faceshield* or face shield* or respirator or respirators or FFP1 or FFP2 or FFP3 (Topic)

#21 facepiece* or face piece* or mask or masks or facemask* or faceshield* or face shield* or respirator or respirators or FFP1 or FFP2 or FFP3 (Topic)

#22 N99 or N95 or N 99 or N 95 or FFP or P100 (Topic) and respirator* (Topic)

#23 protect* or filter* (Topic) and respirator* (Topic)

#24 coverall* or boot or boots or donning or donned or doff or doffing or doffed or face cover* or facial cover* or glove or gloves or gloving or gown or gowns or gowning or goggle* or head cover* or headwear or hood or hoods or overshoe* or shoe cover* or smock or smocks or visor or visors (Topic)

#25 (Physical or social) (Topic) and (Distanc* or contact*) (Topic)

#26 (stagger* or barrier* or bubble* or hazard* or marking* or schedule* or reschedule* or adjust* or adapt* or work or traffic) (Topic) and flow* (Topic)

#27 hand* (Topic) and (sanit* or disinfect* or wash* or clean* or hygiene*) (Topic)

#28 HVAC or HEPA or heat* or ventilat* or aircondition* or purificat* or filter* or fresh air or mist* or fog OR UV light* or ultraviolet light* or clean* or disinfect* (Topic)

#29 (telework* or telecommut*) or (tele or remote or mobile or distant* home) (Topic) and (work* or office or job) (Topic)

#30 Vaccin* OR training* OR screening OR policy* OR sick* OR absent* OR audit OR surveillance (Topic)

#31 Rapid or antigen or home-based or per or molecular-based (Topic) and self test (Topic)

#32 quarant* or self-isolat* or isoal* or outbreak or contact tracing or close* or open* or reopen* or return or return-to-work (Topic)

#33 (protect* or control) (Topic) and (measure* or source or engineering or administrative control*) (Topic)

#34 #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33

Study design block

#35 Randomized controlled trial OR controlled clinical trial OR pragmatic clinical trial OR equivalence trial OR randomly OR random*(Topic)

#35 Interrupted time series (Topic)

#37 Controlled Before-after study OR control before-after studies OR comparative study (Topic)

#38 Double-blind OR single-blind OR placebo OR sham OR control group* OR tripl* blind OR trebl* blind OR dumm* OR mask* (Topic)

#39 Non-random OR nonrandom OR quasirandym OR quasi-random (Topic)

#40 Open-label OR open label (Topic)

#41 Equivalence OR superiority OR non inferiority OR non-inferiority (Topic) and trials OR study OR studies (Topic)

#42 Pragmatic OR practical (Topic) and study OR studies (Topic)

#43 Quasi-experimental OR quasi experimental (Topic)

#44 #35 OR #36 OR #37 OR #38 OR #39 OR #40 OR #41 OR #42 OR #43

#45 #8 AND #15 AND #34 AND #44

Cochrane COVID-19 Study Register

Date of search: Sept 20, 2021

work* or occupation* or job* or office* or compan* or communit* or transport* or commut* or crowd* or (shar*AND space OR room*)

AND

shield* or distanc* or quarant* or clos* or open* or re-open* or schedule* or hand* or ventilation or HEPA or HVAC or administrative and control

AND

random* or controlled

Annotation: COVID-19 is already included by default in the study register, no search terms for covid are therefore included in searches here. The search strategy has been modified to fit the search interface available in the study register.

WHO COVID-19 Global literature on coronavirus disease

Date of search: Sept 20, 2021

Advanced search

work* OR occupation* OR office* OR compan* OR communit* OR transport* OR commut* OR crowd* OR (shar* AND (space OR room*))

AND

Protective device* OR PPE OR personal protective equipment OR mask* OR shield* OR glove* OR air condition* OR ventilation OR HVAC OR HEPA OR quarant* OR administrative control* OR (hand* AND (hygiene OR sanitize* OR wash* OR clean*))

AND

random* OR controlled

Annotation: COVID-19 is already included by default in the study register, no search terms for covid are therefore included in searches here. The search strategy has been modified to fit the search interface available in the study register.

Clinicaltrials.gov

Date of search: Sept 20, 2021

Condition or disease

corona virus OR coronavirus OR covid-19 OR covid* OR SARS* OR MERS*

Other terms

administrative control* OR quarantin* OR hand* OR HEPA OR air condition* OR PPE OR protect* OR mask* OR glove* OR shield* OR work* OR occupation* OR office* OR compan* OR communit* OR transport* OR commut* OR crowd* OR share OR sharing*

International Clinical Trials Registry Platform

Date of search: Sept 20, 2021

Title

work* OR occupation* OR office* OR compan* OR communit* OR transport* OR commut* OR crowd* OR (shar* AND (space OR room*))

OR Condition

work* OR occupation* OR office* OR compan* OR communit* OR transport* OR commut* OR crowd* OR (shar* AND (space OR room*))

AND Intervention

Protective device* OR PPE OR personal protective equipment OR mask* OR shield* OR glove* OR air condition* OR ventilation OR HVAC OR HEPA OR quarant* OR administrative control* OR hand*

Filters

Restrict to COVID-19

Recruitment status is ALL

Appendix 3. Search terms or strategies for NIOSHTIC-2, HSELINE, CISDOC, and CISILO

Searched by: Daphne Hamilton-Nagorsen

Date of search: Sept 20, 2021

Search keywords:

- coronavirus AND workplace
- SARS AND workplace
- MERS AND workplace
- coronavirus AND occupational health
- SARS AND occupational health
- MERS AND occupational health
- coronavirus AND protect*
- SARS AND protect*
- MERS AND protect*

Appendix 4. RoB 2.0 tool

Available atAvailable atdocs.google.com/spreadsheets/d/11XBay2onrdAyxNDq6jl05r9EURhR8orF/edit#gid=1884539043

HISTORY

Protocol first published: Issue 9, 2021

CONTRIBUTIONS OF AUTHORS

Conceiving the protocol: all review authors (ABP, KN, OS, EP, JEV, KJJ, CM, DM, BNS, SR, KS, TF, SD, MB)

Designing the protocol: all review authors (ABP, KN, OS, EP, JEV, KJJ, CM, DM, BNS, SR, KS, TF, SD, MB)

Coordinating the protocol and the review: ABP, MB

Writing the protocol: all review authors (ABP, KN, OS, EP, JEV, KJJ, CM, DM, BNS, SR, KS, TF, SD, MB)

Providing general advice on the protocol and the review: SD, KJJ

Screening search outputs and assessing study eligibility: ABP, KN, OS, EP, JEV, CM, DM, BNS, SR, KS, TF, SD, MB

Extracting and synthesising data: ABP, KN, OS, KJJ, CM, DM, SR, KS, TF, JV

Assessing risk of bias: ABP, KN, OS, KJJ, CM, DM, SR, KS, TF, SD, MB

Undertaking GRADE assessment: SD, MB

Revising the final review: all review authors (ABP, KN, OS, EP, JEV, KJJ, CM, DM, BNS, SR, KS, TF, SD, JV, MB)

DECLARATIONS OF INTEREST

ABP has no interest to declare.

KN has no interest to declare.

OS has no interest to declare.

EP has no interest to declare.

JEV has no interest to declare.

KJJ has no interest to declare.

DM has no interest to declare.

BNS has no interest to declare.

CM has no interest to declare.

KS: part of her salary was paid to her institution by funding from the National Core Study 'PROTECT' programme, managed by the Health and Safety Executive on behalf of HM Government (UK). The grant was from 1 October 2020 to 31 March 2022. She is the statistical editor for Cochrane Gynaecology & Fertility.

SR: part of the salary was paid to her institution by funding from the National Core Study 'PROTECT' programme, managed by the Health and Safety Executive on behalf of HM Government (UK). The grant was from 1 October 2020 to 31 March 2022. She is the statistical editor for Cochrane Gut.

TF has no interest to declare.

SD has no interest to declare.

JV has no interest to declare; he is an Editor at the Cochrane Work Group, but he was not involved in the editorial assessment of this review.

MB has received research funding from an ALF grant (non-profit – Lund University) for research projects not related to Cochrane.

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  to GR

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External sources

- Region Skåne, Skåne University Hospital, Lund University and Region Västra Götaland, Sweden, Sweden

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DIFFERENCES BETWEEN PROTOCOL AND REVIEW

Examples of personal protective equipment (PPE) were added to Types of interventions.

Description of the risk of bias tool for cluster trials was added to Assessment of risk of bias in included studies.

We further clarified the criteria for including non-randomised of studies interventions. The text referring to interrupted time series (ITS) in the section Measures of treatment effect was deleted, as this was erroneously left over from a draft version, and there was no intention to include ITS.

We reported both rates of symptomatic PCR-postive SARS-COV-2 infection and any PCR-postive SARS-COV-2 infection, whereas in the protocol we wrote, "We accepted any definition of a case of COVID-19 provided by the authors. In the case that both suspected and confirmed cases were given for the same study, we used the most reliable measure (e.g. cases confirmed through PCR test)."

Given that absenteeism played a pivotal role in the included study, we transferred absenteeism from a secondary to primary outcome, and included it in the SoF tables.

We added 'excluding studies with missing data thought to introduce serious bias' to Sensitivity analysis.

We originally planned to convert all binary measures to odds ratios, where possible. We only had one included trial, and the results were presented as rate ratios with adjustment for clustering. There was no direct conversion in this case, so estimation would be required and accuracy would be lost. As no meta-analysis was possible, there was no advantage in conversion, so we presented infection data as rate ratios with adjustment for clustering, as reported by the trial authors.

NOTES

Parts of the Methods section and Appendix 1 of the protocol were based on a standard template, established by the Cochrane Work Review Group.