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# Efficacy of eye protection in reducing respiratory disease transmission in healthcare workers: a mechanism-informed narrative synthesis

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## ADMINISTRATIVE INFORMATION

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**Review stage at the time of initial registration -** Data analysis.

**Conflicts of interest -** None declared.

**INPLASY registration number:** INPLASY2026110068

**Amendments -** This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 19 November 2026 and was last updated on 19 November 2026.

## INTRODUCTION

**Review question / Objective** Objective: to inform a risk-based approach to eye protection (goggles, face shields and visors) against respiratory disease transmission in healthcare workers, taking account of causal mechanisms.

Questions:
1. Does eye protection reduce respiratory infection in healthcare workers, and in which circumstances?
2. What do the mechanisms of disease and of the intervention predict about the size of any effect, for different pathogens and exposure scenarios?
3. What can the existing studies show, given their designs, biases and power, and how have their findings been interpreted in later reviews and guidance?

**Rationale** Eye protection is recommended for healthcare workers against several respiratory pathogens, and universal eye protection was widely adopted during the COVID-19 pandemic. The evidence usually cited is observational and has been summarised in earlier reviews, some of which pooled crude estimates and paid limited attention to bias. Eye protection is rarely worn on its own: it aligns with masks, respirators, gowns and gloves, so associations with infection may reflect the whole protective ensemble or the careful worker rather than the eyewear specifically. The role of the eye also differs by pathogen. For some viruses, such as adenovirus and H7 avian influenza, the eye is a site of active infection. For others it is at most an entry route. A new review, which interprets each study against these mechanisms, is needed to establish what the evidence can and cannot show.

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**Condition being studied** Respiratory infections transmitted to healthcare workers in the course of their work, including SARS-CoV-1, SARS-CoV-2, MERS-CoV, influenza, respiratory syncytial virus and any other respiratory pathogen. Of particular interest is whether the eye is a site of active infection or only an entry route for each pathogen, and what share of the infectious dose is likely to reach the eye under different exposure scenarios (close-range droplet projection, procedures, and shared air).

## METHODS

**Search strategy** Respiratory infections transmitted to healthcare workers in the course of their work, including SARS-CoV-1, SARS-CoV-2, MERS-CoV, influenza, respiratory syncytial virus and any other respiratory pathogen. Of particular interest is whether the eye is a site of active infection or only an entry route for each pathogen, and what share of the infectious dose is likely to reach the eye under different exposure scenarios (close-range droplet projection, procedures, and shared air).

**Participant or population** Healthcare workers of any role (for example doctors, nurses, allied health professionals, paramedics, care workers, laboratory staff and support staff with patient contact) in any healthcare setting, in any country.

**Intervention** Eye protection worn at work: goggles, face shields or visors, used all or some of the time. Ordinary prescription or reading spectacles are not counted as eye protection.

**Comparator** No eye protection, or eye protection used less often or in a more restricted way than in the intervention group. Comparisons may be between people (for example cases and controls) or between periods (for example before and after eye protection was introduced).

**Study designs to be included** All quantitative designs that compare infection between people or periods differing in eye protection: randomised trials, cohort studies, case-control studies, cross-sectional and seroprevalence studies, outbreak investigations, and before-after or interrupted time series studies of institutional eye-protection policies. Laboratory and simulation studies of device performance were not appraised as primary studies but informed the mechanistic account. Qualitative studies were excluded and will be covered separately.

**Eligibility criteria** Included: studies that examine an eye protection device in a healthcare setting, report an infection outcome in healthcare workers, compare people or periods differing in eye protection, and enter eye protection into the analysis as a variable, separately from the rest of the protective equipment.Excluded: studies in which:• no one, or everyone, wore eye protection;• eye protection was not measured, or was measured only as availability or perceived use;• eye protection appeared only within a composite variable or risk tier (for example “appropriate PPE”);• there was no infection outcome or no comparison group;• the infection outcome was subjective (for example, symptoms prompting a PCR request);• the participants were not healthcare workers.Editorials, letters, comments, non-systematic reviews, guidelines, news items, meeting abstracts, book chapters, and retracted publications and errata were excluded.Studies in which eye protection was separately measured but changed together with other measures were included but classified as non-contributory (Tier 4).

**Information sources** Databases searched in October – November 2026:
– PubMed (MEDLINE): 751 records.
– CINAHL: 150 records.
– Web of Science Core Collection: 646 records.
– Cochrane Library: two systematic reviews.

Trial registries, searched October 2026: ClinicalTrials.gov, WHO ICTRP and ISRCTN, for “goggles” and “face shield”.

Other sources: expert recommendation, earlier systematic reviews, reference lists, forward citation tracking, large language model prompting and AI citation matching.

**Main outcome(s)** Respiratory infection in healthcare workers, confirmed by laboratory test, by seroconversion, or by a recognised clinical case definition (for example probable SARS in 2003, or influenza-like illness).

**Additional outcome(s)** None. Antibody titres in people already infected were not treated as an infection outcome.

**Data management** Studies are managed in EndNote. Each included study is being appraised with a bespoke AI appraisal tool (EAGLE2.0). The tool runs a large language model (Claude, Anthropic) against a set of versioned knowledge documents, which include the draft explanatory account. Before each appraisal it checks for supplementary material referred to in the paper. Counts, estimates, model handling and sample-size statements are then checked by the review

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team against the full text of every included study, and the AI appraisals were corrected. Corrections are recorded as annotations on each appraisal. The knowledge documents and the annotated appraisals will be deposited on Zenodo.

**Quality assessment / Risk of bias analysis** Bespoke, design-specific appraisal templates have been developed for eye-protection studies, informed by standard risk-of-bias tools and topic-specific knowledge (e.g. on oculotropism). Bias analysis considers first confounding by other protective equipment, then careful-worker confounding, epidemic phase, recall after diagnosis, control selection, ascertainment and risk-based adoption. For each bias the direction in which it would move the eye-protection estimate is recorded: towards apparent protection, towards the null, or towards apparent harm.
Each study is placed in a tier according to what its design can isolate:
• Tier 1 (the target design): for any given study design, the best possible design for that study (a theoretical benchmark against which real studies are compared).
• Tier 2 (contributing to causal inference): a concurrent comparison in which eye protection is separated from respiratory protection, by design or analysis, with other equipment unchanged or adjusted for.
• Tier 3 (some useful findings): crude comparisons, uncontrolled before-after studies, and cross-sectional studies not meeting the Tier 2 condition.
• Tier 4 (non-contributory): no comparison of eye protection on its own, an outcome other than incident infection, fewer than three events in either group of the main comparison, or internal inconsistency.

For each study, the smallest protective effect the intervention could have detected (80% power, two-sided 5% significance) is calculated from its own numbers.

**Strategy of data synthesis** Mechanism-informed narrative synthesis (MINS).
1. A draft explanatory account of how eye protection might work was prepared from background sources and expert input before primary studies were examined. It is then being tested and refined against them.
2. Studies are grouped by pathogen, because the account predicts a different role for the eye in different pathogens, and then by tier.
3. Estimates are not pooled, because the studies differ widely in design, device, exposure and in whether eye protection was separated from respiratory protection.
4. Instead, the synthesis:
– sets each study's estimate alongside the smallest effect it could detect;
– for the larger studies that reported every variable examined, compares the crude association of eye protection with that of items with no plausible effect against respiratory infection;
– identifies the biases operating in each study and their direction;
– looks for internal tests of confounding (for example, equipment use when workers had no patient contact).
5. Findings are compared with the effects the mechanisms predict under each exposure scenario.
6. Finally, the synthesis traces how claims about eye protection were constructed and travelled through earlier reviews and guidance.

**Subgroup analysis** No statistical subgroup analyses. Findings are being examined separately by pathogen and by tier.

**Sensitivity analysis** None. The robustness of each study's estimate is examined through the bias analysis, the smallest detectable effect, and comparison with items of no plausible effect.

**Language restriction** None. Studies published in Chinese and Spanish turned up in the search; these were read in the original and either rejected or included as appropriate.

**Country(ies) involved** United Kingdom.

**Other relevant information** This review is one of a series of mechanism-informed reviews of personal protective measures against respiratory infection, alongside reviews of community mask use (INPLASY 202550024) and mask mandates (INPLASY 202540045). Masks and respirators for healthcare workers are the subject of a separate, ongoing review. The review is supported by a UKRI programme that uses philosophy of science to extend systematic review methodology by incorporating mechanistic evidence.

**Keywords** eye protection; goggles; face shields; healthcare workers; respiratory infection; COVID-19; SARS; influenza; occupational health; mechanism-informed narrative synthesis; systematic review.

**Dissemination plans** Publication in a peer-reviewed journal. The AI appraisal tool's knowledge documents and the annotated appraisals will be deposited on Zenodo.

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## Contributions of each author

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