Healthcare Personnel Use of N95 Respirators or Medical/ Surgical Masks for Protection Against Respiratory Infections: A Systematic Review and Meta-Analysis

Plain Language Summary

Background

Respiratory illnesses, whether seasonal or novel, can negatively impact the resilience of health systems and can cause morbidity and mortality among personnel and patients. When considering the hierarchy of controls to reduce the risk of respiratory infections, personal protective equipment are generally less effective than other elements due to their reliance on individual behavior; however, they remain a critical component in healthcare settings. Laboratory studies have demonstrated that N95 respirators provide better filtration than surgical or medical masks. In the real world, among healthcare personnel caring for patients in healthcare settings, the peer-reviewed evidence is inconsistent on whether the outcomes of respiratory illness or infection are different among N95 respirator users and medical/surgical mask users.

Research Question

For healthcare personnel caring for patients with respiratory infections, what is the effectiveness of N95 respirators compared to medical/ surgical masks to prevent symptomatic illnesses or laboratory-confirmed infection?

Methods

Authors searched MEDLINE, EMBASE, Global Health (OVID), Cochrane Library, Nursing and Allied Health Database (ProQuest), and Scopus, and included all studies that directly compared the use of N95 respirators to the use of medical or surgical masks to prevent any respiratory infection among healthcare personnel. Data was extracted, critically appraised, and the primary outcome of laboratory confirmed respiratory infection was quantitatively aggregated while secondary outcomes of clinical and self-reported infections, and adverse events were narratively aggregated.

Results

The current review found no difference in laboratory-confirmed seasonal viral respiratory infection (VRI) among healthcare personnel using N95 respirators compared with those using surgical/ medical masks during routine care of patients (Pooled RR: 0.96 (95%CI: 0.88 – 1.04); I^2 = 17%). For the outcome of novel VRI, the heterogeneity was too high to form meaningful conclusions when the results are close to the null (I^2 = 89%). N95 respirators were more effective than surgical masks for the prevention of bacterial infection and colonization (Pooled RR: 0.46 (95%CI: 0.34 – 0.62); I^2 = 0%). Sensitivity analyses revealed the inclusion of studies that did not meet inclusion criteria but for whom N95 respirator and facemask use was mutually exclusive did not meaningfully improve the heterogeneity (I^2 = 83%). However, the analysis of studies or data reporting ≤25% coworker or community exposures of healthcare personnel to novel VRIs found N95 respirators were more effective at preventing novel respiratory illnesses than surgical/ medical masks (Pooled RR: 0.63 (0.50 – 0.81); I^2 = 0%). There was no difference in VRI for symptom-based outcomes, however, N95 respirators were more effective than surgical/medical masks for self-reported VRI. No hospitalizations stemming from adverse events were found in the literature, however difficulty breathing, headaches, and dizziness; skin barrier damage and itching; fatigue; and difficulty talking were more frequently reported among N95 respirator users.

Context

This is the first systematic review to focus on the inclusion of studies that identify the mutually exclusive use of N95 respirators or medical/ surgical masks among healthcare personnel and to aggregate adverse events. The inclusion criteria likely contribute to the differences in results for effectiveness between the current review and other recently published reviews.

Introduction

The Healthcare Infection Control Practices Advisory Committee (HICPAC) is a federal advisory committee to the Centers for Disease Control and Prevention (CDC), that provides advice and guidance on infection prevention and control in healthcare settings to the agency. One of HICPAC's chartered functions is to provide recommendations to CDC on the update of CDC's infection control guidelines. In 2021, HICPAC created a workgroup to update the CDC Guideline for Isolation Precautions, 2007, with expertise in the fields of infectious disease, infection prevention, occupational health, nursing, healthcare epidemiology, and healthcare management with technical input from CDC including from the Division of Healthcare Quality Promotion and the National Institute of Occupational Safety and Health (NIOSH). One of the primary functions of this workgroup was to reassess the categories of transmission-based precautions (TBP). It is important to highlight that TBP categories are developed to be applied across pathogens and categories of pathogens to prevent transmission during routine patient care. TBP categories are not developed to be specific to one single pathogen. It is in this broader context that the workgroup was tasked by the committee to review the 2007 TBP categories to see if the elements of PPE within each category require changes, or if, in a post-pandemic era, entirely new categories are needed. Face protection is one of the elements of PPE included in multiple categories of TBP, and which the Workgroup reviewed.

Medical or surgical masks and N95 respirators, plays a critical role in protecting healthcare personnel from exposures to infectious respiratory illnesses in healthcare facilities. In laboratory settings, N95 respirators have been proven to be more efficacious than surgical or medical masks at filtering particles and challenge viruses in lab settings.[1-5] Despite the evidence that N95 respirators are better than medical masks at filtering particles, the evidence of effectiveness of surgical masks relative to N95 respirators to prevent transmission of viral respiratory infections in actual use, has been less conclusive.[6] This distinction is important. Efficacy, or efficaciousness, is the ability of an intervention to produce a desired effect (e.g., an N95 respirator filtering 95% of particles) under controlled conditions, such as a laboratory experiment.[7, 8] Effectiveness, meanwhile, is the ability of an intervention to produce that same desired and meaningful protective effect when it is delivered under "real world" circumstances, e.g., in the context of providing healthcare .[7, 8] It is in this context that HICPAC's Isolation Guideline Update Workgroup requested CDC conduct a systematic literature review to answer the question: for healthcare personnel caring for patients with respiratory infections, what is the effectiveness of medical/surgical masks compared with N95 respirators in preventing infection?

Methods

This document was created at the request of the Isolation Guideline Update Workgroup (hereafter referred to as the Workgroup) of HICPAC to inform their work to update to the Guideline for Isolation Precautions, 2007. The workgroup membership consists of subject matter expertise in the fields of infectious disease, infection prevention, occupational health, nursing, healthcare epidemiology, and healthcare management. Federal technical expertise was available to answer workgroup questions from CDC.

Topic & Question Development

The workgroup requested technical input from CDC in the form of a systematic literature review to answer the following question:

- For healthcare personnel caring for patients with respiratory infections, what is the effectiveness of N95 respirators compared to medical/ surgical masks to prevent symptomatic illnesses or laboratory-confirmed infection?

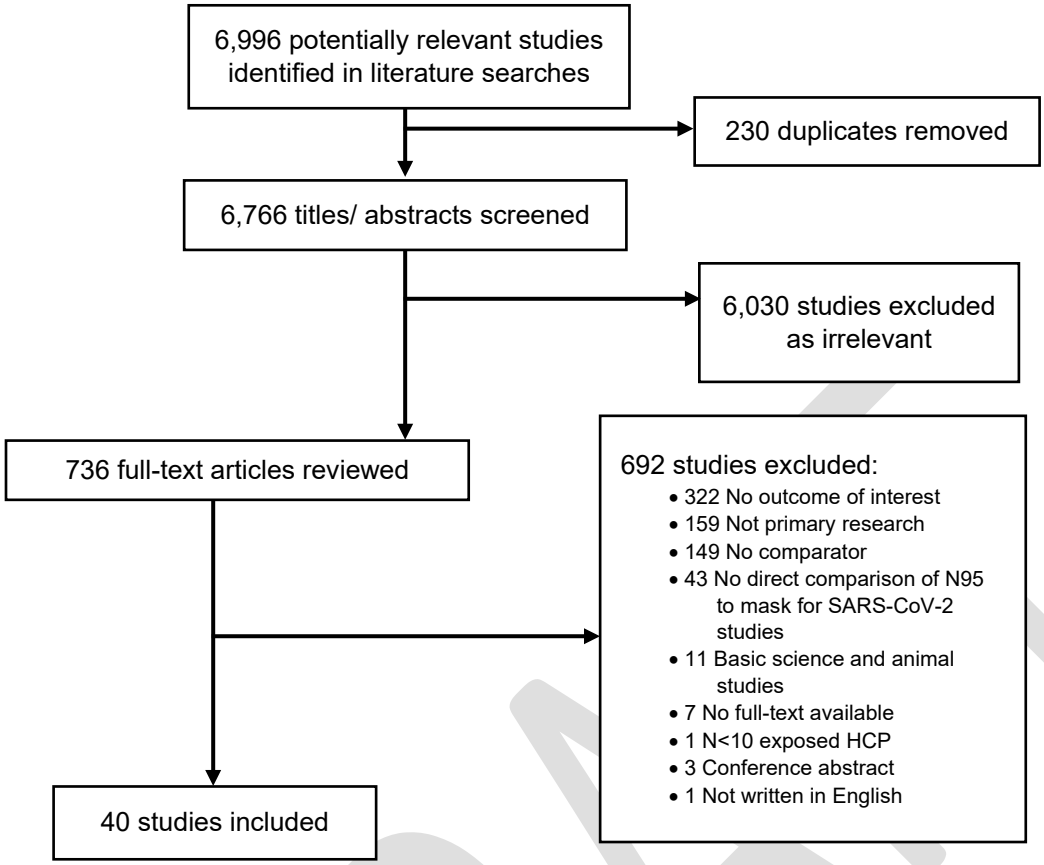
Literature Search & Study Selection

A CDC informationist (J.T.) developed search strategies from the key question and performed these searches in MEDLINE, EMBASE, Global Health (OVID), Cochrane Library, Nursing and Allied Health Database (ProQuest), and Scopus from the start of each database to August 3, 2023. Potentially relevant titles and abstracts retrieved by the literature search were uploaded into Covidence[9], screened by two reviewers (D.O.S., C.N.S., E.C.S., D.B., M.C.H., or J.H.), and included if they were relevant to the research question. The population of interest was healthcare personnel, the interventions and comparators of interest included N95 respirators and face protection with similar levels of protection (e.g., FFP2/FFP3), and surgical or medical masks including any numbers of layers. Full-text articles of these selected articles were also screened by two reviewers (D.O.S., C.N.S., E.C.S. , D.B., M.C.H., or J.H.). Full texts were excluded if they met one of the following criteria:

- No full-text available;
- Not written in English;
- Not conducted in humans;
- Not primary research;
- Conference abstract or poster;
- Healthcare personnel performing AGPs (for which N95s are recommended);
- No comparator (e.g., studies examining N95 compared to no N95);
- No outcomes of interest;
- N < 10 exposed healthcare personnel; and
- Does not directly compare outcomes among healthcare personnel who used N95 respirators and those who used medical/ surgical masks.

To ensure completeness of the review, reviewers examined the bibliographies of relevant systematic literature reviews and meta-analyses. All studies included and analyzed in these reviews were screened as above. The results of the study selection process are depicted in *Figure 1.*

Figure 1. Results of the Study Selection Process



Data Extraction and Evaluation

Studies meeting inclusion criteria were reviewed, and relevant data was extracted into standardized evidence tables. Data were extracted as presented in the studies or in the supplementary data. Critical appraisal of individual studies was conducted using the Internal Validity Assessment (IVA) Tool developed in the Division of Healthcare Quality Promotion at the CDC. The IVA tool consists of 34 signaling prompts abstracted from validated critical appraisal tools, that guide the identification of critical threats to the internal validity of each study.[10-14] These threats are then used to guide the assessment of confidence in the findings for each outcome. The Appendix includes the signaling prompts used to assess the threats to internal validity across the domains of study conduct, and the results of the validity assessment for the current review are presented in The Supplemental File.

Data Synthesis

The primary outcome for this effort was lab-confirmed respiratory illness. Secondary outcomes included clinical respiratory illness, self-reported respiratory illness, and physical, psychological, and work-related adverse events. All outcomes were synthesized narratively. For primary and secondary outcomes, the results were stratified by pathogen type (i.e. bacterial and viral). Viral pathogens were further stratified by seasonal and novel viral infection/illness. If an outcome was reported in less than three studies, the data on this outcome was determined to be insufficient and this outcome was not synthesized.

The primary outcome of all lab-confirmed respiratory illness, stratified by pathogen type and frequency of occurrence, was meta-analyzed using RStudio.[15] Results of random effects models are reported in the narrative and tables, fixed effect model results can be found in the funnel plots in the Appendix. Analyses were stratified by pathogen category (i.e., bacterial or viral respiratory pathogens) and by the temporal and spatial occurrence

of the pathogen (i.e., seasonal occurrence or novel and emerging pathogens). Heterogeneity, and the confidence in the pooled measure of effect, was assessed using the I^2 statistic and the associated p-value for heterogeneity.

Two post-hoc sensitivity analyses were conducted. The first, Sensitivity Analysis A, included studies that did not meet the inclusion criteria of: "did not directly compare N95s and surgical/ medical masks." This entailed a thorough review of all studies meeting this exclusion criteria retrieved via the systematic literature review and the bibliographies of systematic reviews, meta-analyses, and technical reports published between August 2022 and August 2023. Quantitative data from these studies was included in this sensitivity analysis only if the source studies did not meet the other exclusion criteria and the use of N95 respirators and surgical/medical could be confirmed as mutually exclusive.

The second sensitivity analysis, Sensitivity Analysis B, was conducted to understand the effect of non-patient related exposures on respiratory illness outcomes among healthcare personnel. There were significant non-patient exposures reported across retrieved studies, including those retrieved for Sensitivity Analysis A. These included coworker contacts on breaks, community contacts via public transport, and family contacts at home including roommates, partners, and children living in the home. Sensitivity Analysis B was conducted to focus on the effectiveness of N95 respirators versus surgical/ medical masks among healthcare personnel to prevent infections from patient-related exposures. Studies were included if less than 25% of healthcare personnel reported exposures in the community, household, or coworker exposure, and sub-populations of studies that only reported exposures to patients, and not outside exposures. In all cases, inclusion was determined by data presented in the individual studies. One study[16] required extraction of data from a supplementary data set. Individual participants were included from this study only one time if they were negative on the first screening, involved in direct patient care, reported the exposure occurred in the workplace, wore an N95 respirator or surgical mask during the exposure, did not commute via shared transport, and had maintained appropriate PPE within 6 feet of infected individuals within the previous month. For an additional study,[17] the results of two of the four study locations were excluded from analysis due to higher rates of community exposures at those sites. All other studies were included in their entirety.

GRADE-ing Evidence

The evidence for each outcome was assessed according to its strength, direction, consistency, and directness across all studies. The assessment of each of these domains was scored according to the GRADE[18] methodology. These were narratively summarized into an overall confidence in the evidence which included an assessment of the likelihood that the findings will change.

Results

Primary Outcome

This systematic review identified 21 articles[17, 19-38] reporting on 18 studies evaluating the effectiveness of N95s compared to surgical/medical masks at preventing the transmission of respiratory illnesses from patients to HCP. The body of evidence includes five RCTs,[17, 23, 29, 31-33, 36] six cohort studies,[19, 22, 24, 26, 28, 30, 35] four case-control studies,[20, 21, 27, 38] one before-after study,[37] and two cross-sectional studies.[25, 34] Two studies report outcomes from the same RCT, one[31] reporting on viral illnesses and the other[32] reporting bacterial illnesses. One study[23] reports results from a per protocol analysis of a RCT[36] and another[24] reports follow-up data for a cohort study.[26] Fourteen studies[17, 19-22, 26-31, 33, 35, 36] report on viral respiratory illness (VRIs), three [32, 33, 37] report on bacterial respiratory illnesses, four[29, 31, 33, 36] report on influenza-like illness (ILI), four report on acute respiratory illness (ARI)[17, 36] or clinical respiratory illness (CRI)[31, 33], and four[25, 26, 34, 38] report on self-reported respiratory infections.

Narrative Synthesis

The evidence from three cluster RCTs,[23, 31, 33, 36] two noninferiority RCTs,[17, 29] six cohort studies,[19, 22, 26, 28, 30, 35] and three case-control studies[20, 21, 27] is heterogenous and inconsistent on the effectiveness of surgical/medical masks for preventing the transmission of laboratory-confirmed VRIs, including SARS,[30] influenza,[22, 29, 36] and SARS-CoV-2,[17, 19-21, 26-28, 35] among HCP when compared to N95 respirators. Results are inconsistent, with five studies[19, 21, 26, 27, 31] that include 8,473 HCP suggesting N95s are more effective at preventing VRIs among HCP than surgical/medical masks and eight studies[17, 20, 22, 23, 28-30, 33, 36] that include 9,271 HCP suggesting no difference. However, when stratifying by the occurrence of VRI, the evidence from four studies[29, 31, 33, 36] suggests that for the outcome of seasonal laboratory confirmed VRI, there is no difference in the effectiveness of surgical/medical masks compared to N95 respirators. The evidence for the outcome of novel laboratory confirmed VRI from 11 studies remains heterogenous and inconsistent on the prevention of novel VRIs transmission among HCP, including SARS,[30] pandemic influenza,[22, 29] and SARS-CoV-2.[17, 19-21, 26-28, 35] Studies were conducted in the U.S.,[23, 28, 36] Canada,[17, 21, 29, 30] France,[20] Italy,[35] Switzerland,[26] China,[31, 33] Thailand,[22] India,[27] Indonesia,[19] Pakistan,[17] Israel,[17] and Egypt.[17] HCP included in these studies work in inpatient[17, 20, 22, 29, 31, 33] and outpatient settings.[23, 36] These studies are at risk of confounding by use of eye protection,[17, 19-23, 26-31, 33, 35, 36] patient mask use,[17, 19-23, 26-31, 33, 35, 36] coworker[17, 19, 21-23, 27-31, 33, 35, 36] and community[17, 19-22, 27-30, 35] exposures, and HCP tasks.[17, 19, 21, 22, 27, 29, 30, 35] Seven studies[20, 21, 26-28, 30, 35] are at risk of recall bias due to the retrospective collection of exposure data, and 11 studies[19-22, 26-28, 30, 31, 33, 35] do not measure mask compliance objectively. Additionally, four studies[19, 21, 27, 30] have small sample sizes, and of the 12 studies[17, 19-22, 26, 28-31, 35, 36] reporting confidence intervals, eight are wide[17, 20, 22, 28-31, 35] and include the null.[17, 20, 22, 26, 28-31, 33, 35] A subgroup analysis in one study[17] identified between country heterogeneity which correlated with different COVID-19 strains circulating during the study period. Results from Canada, Israel, and Pakistan where HCP were exposed to pre-Omicron COVID-19 strains suggest N95s were more effective than medical masks; however, in Egypt where HCP were exposed to Omicron, there was no difference observed. Low N95 respirator fit test failure rates reported in two cluster RCTs[31, 33] implemented in China may impact the generalizability of results to U.S. populations. The two noninferiority RCTs have a preset noninferiority limit of -9%[29] or a margin corresponding to a relative effect sized of two.[17] Importantly, several studies[20, 28, 35] indicate transmission to HCPs occurred outside of patient-HCP contacts.

Quantitative Syntheses

The outcome of all lab-confirmed VRI included seasonal VRIs such as adenovirus; human metapneumovirus; coronaviruses 229E/NL63 and OC43/HKU1; parainfluenza viruses 1, 2, and 3; influenza viruses A and B; respiratory syncytial viruses A and B; or rhinoviruses A/B; and novel illnesses including H1N1; SARS-CoV-1, and SARS-CoV-2. The meta-analysis of these 12 studies[4, 17, 20-22, 27, 29-31, 33, 35, 36] revealed that the heterogeneity was too high to formulate meaningful conclusions when the results are close to the null (I^2 = 85%) (Figure 5). When stratifying the outcome by seasonal and novel VRI, the seasonal VRI analysis included four RCTs[29, 31, 33, 36] and indicated no difference in the occurrence of VRI among healthcare personnel wearing N95 respirators compared with those wearing surgical/ medical masks during routine care of patients (Pooled RR: 0.96 (95%CI: 0.88 – 1.04); I^2 = 17%) (Figure 3). When examining only studies reporting novel respiratory illness outcomes[4, 17, 20-22, 27, 30, 35], the meta-analysis revealed that for novel pathogens, the heterogeneity was again too high to form meaningful conclusions when the results are close to the null (I^2 = 89%) (Figure 2). Two RCTs reported bacterial outcome data that could be meta-analyzed.[32, 33] N95 respirators were found to be more effective than surgical masks for the prevention of bacterial colonization (Pooled RR: 0.46 (95%CI: 0.34 – 0.62); I^2 = 0%) (Figure 4). Funnel plots for the novel and seasonal primary analyses were examined and did not have signs of publication bias (Supplementary Material).

Sensitivity Analyses

The full list of studies examined for inclusion in Sensitivity Analysis A, and the reasons for maintaining exclusion status can be found in Table 13. This sensitivity analysis resulted in the inclusion of seven additional studies.[16, 39-

[44] The addition of these studies did not meaningfully improve the heterogeneity of the meta-analysis to the point where the null results of the analysis can confidently be interpreted or applied (I^2 = 83%) (Figure 6).

Finally, the exclusion of studies where >25% of exposures, as reported by healthcare personnel, occurred in non-patient situations, resulted in the inclusion of only three studies reporting seasonal illnesses[31, 33, 36] and five studies reporting novel illnesses.[16, 17, 27, 30, 42, 44] Sensitivity Analysis B. The Sensitivity Analysis B for seasonal laboratory-confirmed VRI resulted in no difference between N95 respirators and surgical/ medical masks (Pooled RR: 0.80 (0.55 – 1.18); I^2 = 43%) (Figure 7). However, for Novel laboratory confirmed VRI, Sensitivity Analysis B indicated that for healthcare exposures, N95s are more effective at preventing novel respiratory illnesses than surgical/ medical masks (Pooled RR: 0.63 (0.50 – 0.81); I^2 = 0%) (Figure 8). Funnel plots for the sensitivity analyses were examined and did not have signs of publication bias (Supplementary Material).

Secondary Outcomes

Effectiveness Against Other Viral Respiratory Illness Outcomes

The evidence from three cluster RCTs[31, 33, 36] and one noninferiority RCT[29] suggests there is no difference in the effectiveness of surgical/medical masks compared to N95 respirators at preventing ILI among HCP. Studies defined ILI as the presence of a fever of at least 100°F[36] or 38°C[29, 31, 33] plus at least one respiratory symptom or the presence of a cough[29, 36] or sore throat.[36] These studies are conducted in the U.S.,[36] Canada,[29] and China[31, 33] during months corresponding to influenza season in the northern hemisphere. HCP included in these studies work in emergency departments,[29, 31, 33, 36] respiratory wards,[31, 33] medical units,[29] pediatric units,[29] and outpatient settings.[36] These studies are at risk of confounding by use of eye protection,[29, 31, 33, 36] patient mask use,[29, 31, 33, 36] coworker[29, 31, 33, 36] and community[29] contact, and HCP task. Mask compliance was above 50% for three studies,[29, 31, 33] however it was self-reported in two studies.[31, 33] One study[36] which measured participants' mask-wearing behaviors as they entered and exited patient care rooms reported compliance below 50%, however, HCP in the N95 respirator group were more compliant than those in the medical mask group.

The evidence from three cluster RCTs[31, 33, 36] and one noninferiority RCT[17] is inconclusive and inconsistent on the effectiveness of surgical/medical masks at preventing ARI[17, 36] or CRI[31, 33] among HCP when compared to N95 respirators. Two studies[31, 33] reported on CRI, which was defined as two or more respiratory symptoms or one respiratory symptom with a systemic symptom. Two studies[17, 36] reported on ARI, which was defined as at least one sign and two symptoms with or without laboratory confirmation[36] or as fever with cough.[17] These studies are conducted in the U.S.,[36] Canada,[17] China ,[31, 33] Pakistan,[17] Israel,[17] and Egypt[17] during months corresponding to influenza season in the northern hemisphere. HCP included in these studies work in emergency departments,[31, 33, 36] respiratory wards,[31, 33] acute care facilities,[17] long-term care facilities,[17] and outpatient settings.[36] These studies are at risk of confounding by use of eye protection,[17, 31, 33, 36] patient mask use,[17, 31, 33, 36] coworker[17, 31, 33, 36] and community[17] contact. Mask compliance was above 50% for three studies,[17, 31, 33] however it was self-reported in two studies.[31, 33] One study[36] which measured participants' mask-wearing behaviors as they entered and exited patient care rooms reported compliance below 50%, however, HCP in the N95 respirator group were more compliant than those in the medical mask group.

The evidence from one cohort study,[24, 26] one case-control study,[38] and two cross-sectional studies[25, 34] suggests N95s are more effective than surgical/medical masks at preventing self-reported infections among HCP. Results are inconsistent, however there is a greater weight of the evidence that consists of two studies[24, 26, 38] including 4,029 HCP suggest N95s are associated with a decrease in self-reported SARS-CoV-2 infection. All four studies reported SARS-CoV-2 infection, and infection status and mask use were retrospectively self-reported via online questionnaire[24, 26, 34, 38] or survey.[25] One study[24, 26] cross-checked all positive tests and a random sample of negative laboratory-confirmed seroconversions with self-reported positive nasopharyngeal results, and another[38] included HCP who declared having an infection acquired in the workplace. The studies are conducted

in France,[38] Greece,[34] and Switzerland,[24, 26] and included HCP from various medical and medico-social establishments,[38] tertiary sector healthcare services,[34] acute care institutions,[24, 26] psychiatry clinics,[24, 26] and a rehabilitation clinic.[24, 26] One study[25] that was conducted online did not specify a location and included those who self-identified as clinicians who were recruited through social media posts. These studies are at risk of confounding by HCP task,[25, 34] coworker[25, 34] and community[25, 34, 38] contact, use of eye protection,[24, 26, 34] and patient mask use.[24, 26, 34, 38] All four studies are at risk of sampling bias due to convenience sampling, and recall bias due to the retrospective collection of exposure data.

Effectiveness Against Bacterial Respiratory Illness

The evidence from two cluster RCTs,[32, 33] and one before-after study[37] indicates N95s are more effective than surgical/medical masks at preventing laboratory-confirmed bacterial colonization among HCP. There are two studies[32, 33] reporting on *S. pneumonia*, *Legionella*, *B. pertussis*, *Chlamydia*, *M. pneumonia*, and *H. influenzae* type B, and one study[37] reporting on *M. tuberculosis* infection among HCP. The study reporting on tuberculosis used TST results to identify conversions among staff.[37] The studies were conducted in the U.S.[37] and China,[32, 33] and included HCP working in hospitals,[32, 33, 37] including emergency departments[33] and respiratory wards.[33] These studies are at risk of confounding due to patient mask use,[32, 33, 37] eye protection use,[32, 33, 37] coworker and community exposures,[32, 33, 37] and healthcare tasks.[32, 37] Of the two studies[32, 33] reporting confidence intervals, both are wide and one[33] includes the null.

Adverse Events

The current systematic literature review identified 22 studies[31, 45-65] reporting on adverse events related to the use of N95 respirators and surgical/medical masks among HCP. Only studies that provided a definition of what constituted an 'adverse event' were included in the current review; studies reporting on general adverse events were not captured. Most studies included self-reported outcomes[31, 46, 48-62, 64] and only three[59, 60, 64] of the twenty-two studies reported that HCP required medical interventions such as nasal decongestants, saline solutions for the nose, eye drops, analgesics, triptans, NSAIDs, and pain killers. None of the studies reported severe adverse events requiring hospitalization. The evidence indicates there is a higher frequency of adverse events among HCP wearing N95 respirators compared to surgical mask users. These outcomes included difficulty breathing, headaches, and dizziness;[31, 50-56, 58-61] skin barrier damage and itching;[31, 46, 48, 49, 51, 53, 54, 57, 58] fatigue;[50, 53, 61] and difficulty talking.[31, 45, 56, 58, 61] The evidence suggests no difference in pain.[48, 51, 54] Additionally, the limited data on dermatitis;[54, 62] acne;[48, 63] eye, nasal, and pulmonary symptoms;[64] and ocular surface changes[65] prohibit a complete assessment of these outcomes. Finally, the evidence is inconsistent and inconclusive on changes in vital signs such as SpO_2 and heart rate, both of which remained within normal range, among N95 respirator users and surgical mask users.[47, 55, 56, 61]

Discussion

2021-2023 saw the publication of several rapid reviews, systematic reviews, and meta-analyses on the effectiveness of N95 respirators compared to medical/ surgical masks. The current review takes a rigorous approach by focusing on the inclusion of studies that directly compare the mutually exclusive use of N95 respirators and medical/ surgical masks with no mixing of other types of face protection (e.g., PAPRs, cloth masks, or no mask use). Among the systematic reviews that included studies reporting the concurrent or possible concurrent use of masks and N95 respirators, all answered different questions or used different inclusion and exclusion criteria compared to the current review. One previously published review included studies published in English and in Chinese and reported no difference in seasonal laboratory-confirmed VRI and ILI, or pandemic laboratory-confirmed H1N1 by use of N95 respirator or medical/surgical mask.[66] However, that review[66] reported N95 respirators were more effective than medical/surgical masks for the prevention of beta-coronaviruses including Middle East Respiratory Syndrome and coronavirus disease. Another review reporting

N95 respirator use resulted in fewer viral respiratory was less inclusive, however it was unclear how they arrived at the inclusion of only eight studies.[1]

One very recent technical report published by The Royal Society examining non-pharmaceutical interventions used during the COVID-19 pandemic summarized the results of a rapid review commissioned to assess the effectiveness of face masks to reduce transmission of SARS-CoV-2.[67, 68] That review conducted a pathogen-specific analysis, which limited the studies they included. While they determined that the studies were too heterogeneous to conduct a systematic review, they concluded that N95 respirators are more effective than surgical/ medical masks. It is important to note that their limited number of relevant studies comprised studies reporting both laboratory-confirmed and self-reported outcomes.

Finally, two systematic reviews conducted to answer non-healthcare questions were examined as a part of the current review. One high profile systematic review reporting on a wide range of non-pharmaceutical interventions to prevent the transmission of VRI reported N95 respirator use among healthcare personnel, compared with no N95 respirator use in two SARS-CoV-1 studies, led to a reduction in VRI. The current review did not assess the benefit of N95 respirators compared with no use.[2] The second review reported on the use of any mask compared with no mask wearing, among patients or healthcare personnel and similarly found mask use reduced transmission of VRI.[69]

The strengths of the current review include the use of both quantitative and narrative aggregations along temporal variations in VRI, analysis by objective and subjective outcomes, and the inclusion of an adverse event analysis. It is important to note that while these adverse events are not considered severe, they might impact N95 respirator fit, healthcare personnel comfort and their adherence to N95 respirator use. Importantly, the current review examined all studies on a spectrum rather than categorizing them and grading them according to study type. While some study type specific nuances may be missing from this analysis that enable users to understand the limitations of each study more easily, the potential biases are tied to the study conduct and thus more easily generalizable across the body of evidence, especially for the observational studies.

It is important to note that the included studies represent the best available epidemiologic evidence for these outcomes. The seasonal analysis included well-conducted randomized controlled trials that are challenging to execute in individualistic societies where mask wearing is not a normative behavior. It is unlikely that these results will change unless a well-conducted randomized controlled trial is conducted using whole genome sequencing to ascertain the source of infections in healthcare personnel. For novel VRIs, it might be unethical to conduct a randomized controlled trial under these circumstances of an emerging pathogen for which limited information on transmission is available, it is possible that the observational studies resulting from the next novel pathogen epidemic or pandemic may change these findings. Future studies examining the effectiveness of N95 respirators and masks would be enhanced by clearly identifying whether healthcare personnel exposures and infections are patient-related rather than coworker or community related.

Appendix to Healthcare Personnel Use of N95 Respirators or Medical/ Surgical Masks for Protection Against Respiratory Infections: A Systematic Review and Meta-Analysis

A. Search Strategies

Table 1. Primary Search of MEDLINE (OVID), Embase (OVID), CINAHL (Ebsco), Scopus, Cochrane Library, and Clinicaltrials.gov

Database	Strategy	Records 08/03/2022	Records 08/25/2023
Medline (OVID) 1946-	*Masks/ OR Masks/st OR N95 Respirators/ OR (N95* OR KN95* OR FFP2 OR FFP3 OR FFP-2 OR FFP-3 OR KN100 OR KP95 OR KP100 OR PFF2 OR PFF3 OR R95 OR facemask* OR face-mask* OR surgical mask* OR medical mask* OR respirator OR respirators OR respiratory protective device*).ti,ab,kf. AND Cross Infection/ OR Infection Control/ OR exp Respiratory Tract Infections/tm OR (Influenza* OR parainfluenza OR flu-like OR H1N1 OR tuberculosis OR TB OR LTBI OR pneumo* OR respiratory illness* OR respiratory infect* OR respiratory disorder* OR respiratory syndrome* OR SARS* OR MERS* OR coronavir* OR corona virus* OR COVID* OR CoV OR CoV2 OR nCoV OR 2019nCoV OR 2019-nCoV OR sneeze* OR cough* OR droplet* OR aerosol* OR air-borne OR (prevent* ADJ5 transmi*) OR infection control OR nosocomial OR healthcare associated infection* OR health care associated infection* OR hospital acquired infection* OR cross infection* OR infectious disease*).ti,ab,kf. AND Exp Health Personnel/ OR exp health facilities/ OR Occupational Health/ OR (health worker* OR healthcare worker* OR health care worker* OR health personnel OR healthcare personnel OR health care personnel OR hospital OR hospitals OR health faclit* OR healthcare facilit* OR health care facilit* OR emergency department* OR emergency room* OR emergency service* OR EMT* OR doctor* OR nurse* OR physician* OR provider* OR clinician* OR practitioner* OR medical staff OR medical personnel).ti,ab,kf. Limit English (202208* OR 202209* OR 202210* OR 202211* OR 202212* OR 2023*).dt,ed.	2353	441
Embase (OVID) 1947-	exp filtering facepiece respirator/ or surgical mask/ OR (N95* OR KN95* OR FFP2 OR FFP3 OR FFP-2 OR FFP-3 OR KN100 OR KP95 OR KP100 OR PFF2 OR PFF3 OR R95 OR facemask* OR face-mask* OR surgical mask* OR medical mask* OR respirator OR respirators OR respiratory protective device*).ti,ab,kw.	3803 - duplicates =2349	847 - duplicates =620

Database	Strategy	Records 08/03/2022	Records 08/25/2023
	AND Cross Infection/ OR Infection Control/ OR exp Respiratory Tract Infection/ OR (Influenza* OR parainfluenza OR flu-like OR H1N1 OR tuberculosis OR TB OR LTBI OR pneumo* OR respiratory illness* OR respiratory infect* OR respiratory disorder* OR respiratory syndrome* OR SARS* OR MERS* OR coronavir* OR corona virus* OR COVID* OR CoV OR CoV2 OR nCoV OR 2019nCoV OR 2019-nCoV OR sneeze* OR cough* OR droplet* OR aerosol* OR air-borne OR (prevent* ADJ5 transmi*) OR infection control OR nosocomial OR healthcare associated infection* OR health care associated infection* OR hospital acquired infection* OR cross infection* OR infectious disease*).ti,ab,kw. AND Exp Health care Personnel/ OR exp health care facility/ OR Occupational Health/ OR (health worker* OR healthcare worker* OR health care worker* OR health personnel OR healthcare personnel OR health care personnel OR hospital OR hospitals OR health faclit* OR healthcare facilit* OR health care facilit* OR emergency department* OR emergency room* OR emergency service* OR EMT* OR doctor* OR nurse* OR physician* OR provider* OR clinician* OR practitioner* OR medical staff OR medical personnel).ti,ab,kw. NOT pubmed/medline NOT conference abstract status Limit English (202208* OR 202209* OR 202210* OR 202211* OR 202212* OR 2023*).dc,em.	unique items	unique items
CINAHL (Ebsco)	(MM "Masks") OR (MH "Masks/ST") OR (MH "N95 Respirators") OR (TI (N95* OR KN95* OR FFP2 OR FFP3 OR FFP-2 OR FFP-3 OR KN100 OR KP95 OR KP100 OR PFF2 OR PFF3 OR R95 OR facemask* OR face-mask* OR "surgical mask*" OR "medical mask*" OR respirator OR respirators OR "respiratory protective device*")) OR (AB (N95* OR KN95* OR FFP2 OR FFP3 OR FFP-2 OR FFP-3 OR KN100 OR KP95 OR KP100 OR PFF2 OR PFF3 OR R95 OR facemask* OR face-mask* OR "surgical mask*" OR "medical mask*" OR respirator OR respirators OR "respiratory protective device*")) AND (MH "Cross Infection") OR (MH "Infection Control") OR (MH "Respiratory Tract Infections+/TM") OR (TI (Influenza* OR parainfluenza OR flu-like OR H1N1 OR tuberculosis OR TB OR LTBI OR pneumo* OR "respiratory illness*" OR "respiratory infect*" OR "respiratory disorder*" OR "respiratory syndrome*" OR SARS* OR MERS* OR coronavir* OR "corona	452 - duplicates =179 unique items	98 - duplicates =48 unique items

Database	Strategy	Records 08/03/2022	Records 08/25/2023
	virus*" OR COVID* OR CoV OR CoV2 OR nCoV OR 2019nCoV OR 2019-nCoV OR sneeze* OR cough* OR droplet* OR aerosol* OR air-borne OR (prevent* N5 transmi*) OR "infection control" OR nosocomial OR "healthcare associated infection*" OR "health care associated infection*" OR "hospital acquired infection*" OR "cross infection*" OR "infectious disease*")) OR (AB (Influenza* OR parainfluenza OR flu-like OR H1N1 OR tuberculosis OR TB OR LTBI OR pneumo* OR "respiratory illness*" OR "respiratory infect*" OR "respiratory disorder*" OR "respiratory syndrome*" OR SARS* OR MERS* OR coronavir* OR "corona virus*" OR COVID* OR CoV OR CoV2 OR nCoV OR 2019nCoV OR 2019-nCoV OR sneeze* OR cough* OR droplet* OR aerosol* OR air-borne OR (prevent* N5 transmi*) OR "infection control" OR nosocomial OR "healthcare associated infection*" OR "health care associated infection*" OR "hospital acquired infection*" OR "cross infection*" OR "infectious disease*")) AND (MH "Health Personnel+") OR (MH "Health Facilities+") OR (MH "Occupational Health") OR (TI ("health worker*" OR "healthcare worker*" OR "health care worker*" OR "health personnel" OR "healthcare personnel" OR "health care personnel" OR hospital OR hospitals OR "health faclit*" OR "healthcare facilit*" OR "health care facilit*" OR "emergency department*" OR "emergency room*" OR "emergency service*" OR EMT* OR doctor* OR nurse* OR physician* OR provider* OR clinician* OR practitioner* OR "medical staff" OR "medical personnel")) OR (AB ("health worker*" OR "healthcare worker*" OR "health care worker*" OR "health personnel" OR "healthcare personnel" OR "health care personnel" OR hospital OR hospitals OR "health faclit*" OR "healthcare facilit*" OR "health care facilit*" OR "emergency department*" OR "emergency room*" OR "emergency service*" OR EMT* OR doctor* OR nurse* OR physician* OR provider* OR clinician* OR practitioner* OR "medical staff" OR "medical personnel")) Limit English ; exclude Medline records; Abstract Available		
Cochrane Library	[mh Masks] OR [mh "N95 Respirators"] OR (N95* OR KN95* OR FFP2 OR FFP3 OR FFP-2 OR FFP-3 OR KN100 OR KP95 OR KP100 OR PFF2 OR PFF3 OR R95 OR facemask* OR face-mask* OR "surgical mask" OR "surgical masks" OR (medical NEXT mask*) OR respirator OR respirators OR "respiratory protective device*"):ti,ab AND [mh "Cross Infection"] OR [mh "Infection Control"] OR [mh "Respiratory Tract Infections"] OR (Influenza* OR parainfluenza OR "flu-like" OR H1N1 OR tuberculosis OR TB OR LTBI OR	311 - duplicates =201 unique items	36 - duplicates =26 unique items

Database	Strategy	Records 08/03/2022	Records 08/25/2023
	pneumo* OR "respiratory illness*" OR "respiratory infect*" OR "respiratory disorder*" OR "respiratory syndrome*" OR SARS* OR MERS* OR coronavir* OR "corona virus*" OR COVID* OR CoV OR CoV2 OR nCoV OR 2019nCoV OR "2019-nCoV" OR sneeze* OR cough* OR droplet* OR aerosol* OR air-borne OR (prevent* NEAR/5 transmi*) OR "infection control" OR nosocomial OR "healthcare associated infection*" OR "health care associated infection*" OR "hospital acquired infection*" OR "cross infection*" OR "infectious disease*"):ti,ab AND [mh "Health Personnel"] OR [mh "Health Facilities"] OR [mh "Occupational Health"] OR ("health worker*" OR "healthcare worker*" OR "health care worker*" OR "health personnel" OR "healthcare personnel" OR "health care personnel" OR hospital OR hospitals OR "health faclit*" OR "healthcare facilit*" OR "health care facilit*" OR "emergency department*" OR "emergency room*" OR "emergency service*" OR EMT* OR doctor* OR nurse* OR physician* OR provider* OR clinician* OR practitioner* OR "medical staff" OR "medical personnel"):ti,ab		
Scopus	TITLE-ABS-KEY(N95* OR KN95* OR FFP2 OR FFP3 OR FFP-2 OR FFP-3 OR KN100 OR KP95 OR KP100 OR PFF2 OR PFF3 OR R95 OR facemask* OR face-mask* OR "surgical mask*" OR "medical mask*" OR respirator OR respirators OR "respiratory protective device*") AND TITLE-ABS-KEY(Influenza* OR parainfluenza OR "flu-like" OR H1N1 OR tuberculosis OR TB OR LTBI OR pneumo* OR "respiratory illness*" OR "respiratory infect*" OR "respiratory disorder*" OR "respiratory syndrome*" OR SARS* OR MERS* OR coronavir* OR "corona virus*" OR COVID* OR CoV OR CoV2 OR nCoV OR 2019nCoV OR "2019-nCoV" OR sneeze* OR cough* OR droplet* OR aerosol* OR air-borne OR (prevent* W/5 transmi*) OR "infection control" OR nosocomial OR "healthcare associated infection*" OR "health care associated infection*" OR "hospital acquired infection*" OR "cross infection*" OR "infectious disease*") AND TITLE-ABS-KEY("health worker*" OR "healthcare worker*" OR "health care worker*" OR "health personnel" OR "healthcare personnel" OR "health care personnel" OR hospital OR hospitals OR "health faclit*" OR "healthcare facilit*" OR "health care facilit*" OR "emergency department*" OR "emergency room*" OR "emergency service*" OR EMT* OR doctor* OR nurse* OR physician* OR provider* OR clinician* OR practitioner* OR "medical staff" OR "medical personnel") AND NOT INDEX(medline)	974 - duplicates =406 unique items	432 - duplicates =274 unique items
Clinicaltrials.gov	N95 OR "surgical mask" OR "surgical mask" OR "filtering facepiece respirator"	115 - duplicates =96 unique items	72 - duplicates =274 unique items

B. Brief Summary of Findings

B.1. Brief Summary of Findings on the Effectiveness of N95 Respirators compared to Medical/ Surgical Masks

Table 2. Evidence Snapshot of the Effectiveness of N95 Respirators compared to Medical/ Surgical Masks (citations for study-specific biases in the footnotes can be found in Tables 7 & 8)

Outcome	Summary	Studies	Validity	Imprecision	Inconsistency	Indirectness	Confidence
Laboratory-confirmed viral respiratory infections (VRIs)	Evidence is heterogenous and inconsistent and results are inconclusive.	14 Studies[17, 19-22, 26-31, 33, 35, 36] (N = 17,925)	Serious concerns[a]	Serious concerns[b]	Serious concerns[c]	No concerns	Low confidence[d]
Novel laboratory confirmed VRIs	Evidence is heterogenous and inconsistent and results are inconclusive.	11 studies[17, 19-22, 26-30, 35] (N = 12,444)	Serious concerns[e]	Serious concerns[f]	Moderate concerns[c]	No concerns	Moderate confidence[g]
Seasonal laboratory confirmed VRIs	Evidence suggests no difference between N95 respirators and surgical masks. OR: 0.96 (95%CI: 0.88 – 1.04); I^2 = 17%	4 studies[29, 31, 33, 36] (N = 5,927)	Moderate concerns[h]	Serious concerns[i]	Moderate concerns[c]	No concerns	Moderate confidence[j]
Laboratory-confirmed bacterial infection and colonization	Evidence indicates N95 respirators are more effective than surgical masks. OR: 0.46 (95%CI: 0.34 – 0.62); I^2 = 0%	3 Studies[32, 33, 37] (N = 3,110)	Moderate concerns[k]	Serious concerns[l]	No concerns	No concerns	High confidence[m]

[a] All studies are at risk of confounding by eye protection use and patient mask use, 12 studies by coworker exposures, 10 studies by community exposures, and eight studies by healthcare tasks. Additionally, seven studies are retrospective and at risk of recall bias impacting results, and 11 studies either did not report on compliance or did not report compliance measured objectively.

[b] Four studies have small sample sizes and 12 studies report confidence intervals, eight of which include the null and eight are wide.

[c] Results are inconsistent for viral respiratory infections.

[d] Recall bias and confounding affect the confidence in these findings and the addition of new evidence may alter these findings.

[e] All studies are at risk of confounding by eye protection use, ten studies are at risk of confounding by patient mask use, eight by community exposures, and seven by coworker exposures and healthcare tasks. Additionally, nine studies are retrospective and at risk of recall bias impacting results.

[f] Four studies have a small sample, one does not report sample size, and ten studies report confidence intervals, seven of which are wide and include the null.

[g] Recall bias and confounding affect the confidence in these findings; however, the addition of new evidence is not expected to alter these findings.

[h] All studies are at risk of confounding by eye protection use, patient mask use, and coworker exposures, and one study is also at risk of confounding by community exposures and healthcare tasks. Two studies do not report compliance measured objectively.

[i] Three studies report confidence intervals, two of which include the null and two are wide.

[j] Confounding affects the confidence of these findings, and the addition of new evidence may alter these findings.

[k] All studies are at risk of confounding by patient mask use, eye protection use, and coworker and community exposures. Two studies are at risk of confounding by healthcare tasks, and no studies report on compliance or report compliance measured objectively, and one study is retrospective and at risk of recall bias impacting results. This study is also at risk for selection bias due to convenience sampling using a mailed questionnaire.

[l] Two studies report confidence intervals, both of which are wide and one includes the null.

[m] The addition of new evidence is not expected to alter these findings.

B.2 Brief Summary of Findings on Adverse Events among users of N95 Respirators compared to users of Medical/ Surgical Masks

Table 3. Evidence Snapshot for Physical Adverse Events from N95s or Medical/ Surgical Masks (citations can be found in

Outcome	Summary	Studies	Strength	Precision	Consistency	Directness	Confidence
Vital signs (including SpO_2 and heart rate)	The evidence is inconsistent and inconclusive on changes in SpO_2 and heart rate among N95 respirator users and surgical mask users (vitals are within normal range).	4 Studies[47, 55, 56, 61] (N = 323)	Serious concerns[n]	Serious concerns[o]	Serious concerns[p]	Moderate concerns[q]	Low confidence[r]
Headaches, difficulty breathing, and dizziness	The evidence indicates difficulty breathing, headaches, and dizziness are more frequent among N95 respirator users than surgical mask users.	12 studies[31, 50-56, 58-61] (N = 7,092)	Serious concerns[s]	Moderate concerns[t]	Moderate concerns[u]	No concerns	High confidence[v]
Skin issues	The evidence indicates skin barrier damage and itching is more frequent in N95 respirator users and no difference in pain between N95 respirator users and surgical mask users.	9 Studies[31, 46, 48, 49, 51, 53, 54, 57, 58] (N = 6,679)	Serious concerns[w]	Moderate concerns[x]	Moderate concerns[y]	No concerns	High confidence[v]

[n] One study was subject to sampling and recall bias and was subject to confounding by work site, three studies were subject to confounding by duration of mask use, and all four studies were subject to confounding by task, sex, age, and baseline fitness.

[o] Three studies reported small sample sizes.

[p] The results are inconsistent for SpO_2 and heart rate.

[q] One study was conducted in a healthcare facility with high heat and humidity due to no air conditioning during monsoon season.

[r] Small sample sizes and confounding affect the confidence in these findings, and the addition of new evidence will alter these findings.

[s] All studies were subject to recall bias and eleven studies were subject to sampling bias. Eight studies were subject to confounding by work site, and eight studies were subject to confounding by task, sex, age, baseline fitness, and duration of mask use.

[t] Three studies reported small sample sizes.

[u] Results are inconsistent for headache; however, the majority of studies suggest headaches are more frequent among N95s users.

[v] The addition of new evidence is not expected to alter these findings.

[w] All studies were subject to recall bias, and eight studies were subject to sampling bias. Five studies were subject to confounding by work site, eight studies were subject to confounding by task, sex, age, baseline fitness, and duration of mask use, and one study was subject to confounding by user errors.

[x] One study reported small sample size.

[y] Results are inconsistent for itching; however, the majority of studies suggest itching is more frequent in N95 users. Results are inconsistent for pain; however, the majority of studies suggest no difference.

Table 4. Evidence Snapshot for Psychological Adverse Events from N95s or Medical/ Surgical Masks

Outcome	Summary	Studies	Strength	Precision	Consistency	Directness	Confidence
Fatigue	The evidence suggests fatigue is more frequent in N95 respirator users than in surgical mask users.	3 Studies[50, 53, 61] (N = 413)	Serious concerns[z]	Moderate concerns[aa]	No concerns	No concerns	Moderate confidence[v]

Table 5. Evidence Snapshot for Occupational Adverse Events from N95s or Medical/ Surgical Masks

Outcome	Summary	Studies	Strength	Precision	Consistency	Directness	Confidence
Difficulty communicating	The evidence indicates difficulty communicating is more frequent in N95 respirator users than surgical mask users.	5 Studies[31, 45, 56, 58, 61] (N = 4,657)	Serious[bb]	Serious[cc]	Moderate[dd]	No concerns	High confidence[v]

[z] one study is subject to recall bias, two studies did not measure compliance to face masks, one study was subject to confounding by work site, and two studies were subject to confounding by task, by the pandemic, and work duration.

[aa] Two studies reported small sample sizes.

[bb] Three studies were subject to sampling bias, two studies were subject to recall bias, and one study was subject to reporting bias. The studies were subject to confounding by sex, age, sex, role, task, user errors, and duty of work.

[cc] Three studies reported a small sample size, and one study reported little to no events.

[dd] Results are inconsistent for difficulty talking; however, the majority of studies suggest difficulty talking is more frequent in N95 users.

B.3. Forest Plots for Meta-Analyses

Figure 2. Novel Laboratory-confirmed Viral Respiratory Infections

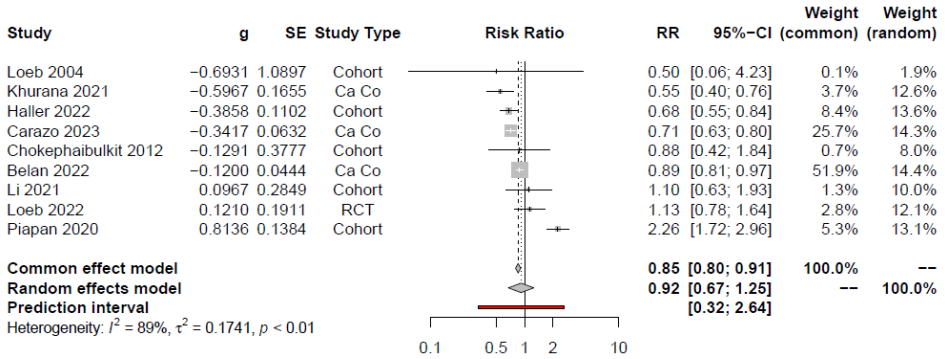


Figure 3. Seasonal Laboratory-confirmed Viral Respiratory Infections

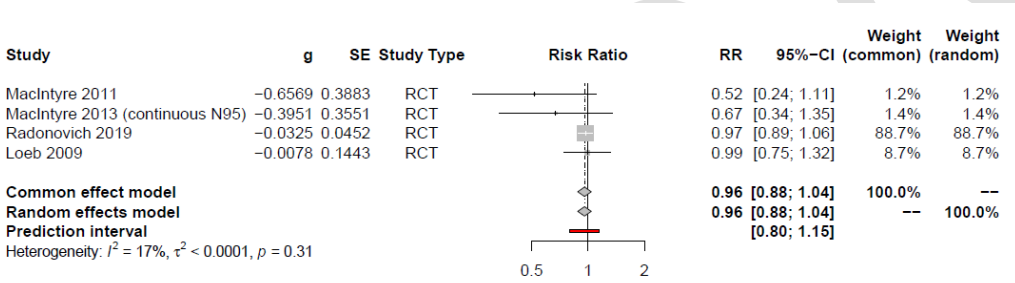


Figure 4. Laboratory-confirmed Bacterial Colonization

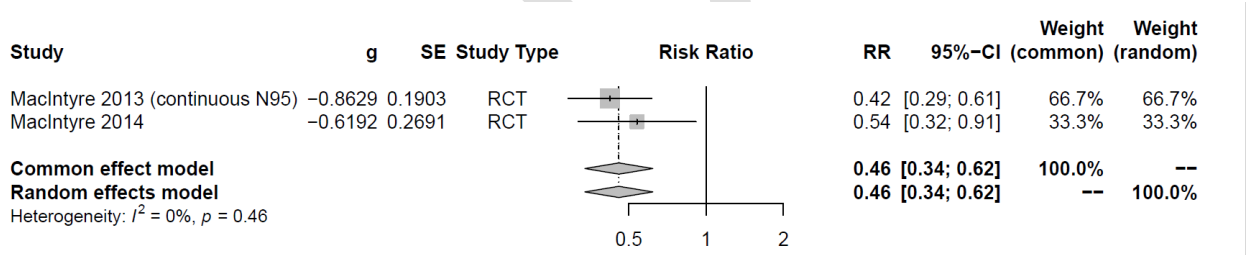
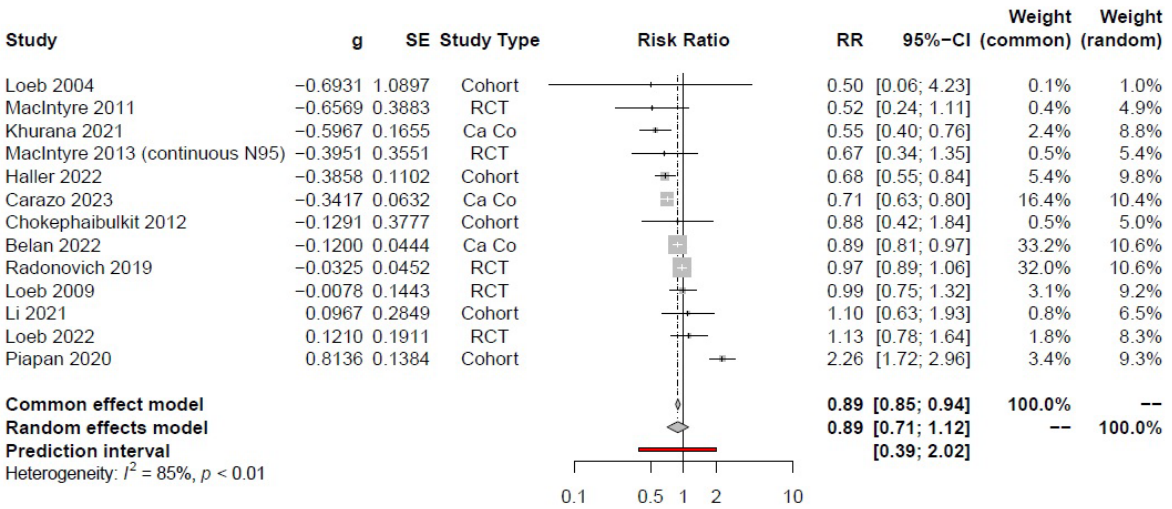


Figure 5. Preliminary Analysis: All Laboratory-confirmed Viral Respiratory Infections (including seasonal and pandemic)



B.3. Forest Plots for Sensitivity Analyses

Figure 6. Sensitivity Analysis A: Pandemic Laboratory-confirmed Viral Respiratory Infections Including Studies not Directly Comparing N95 Respirator Use with Medical/Surgical Mask Use

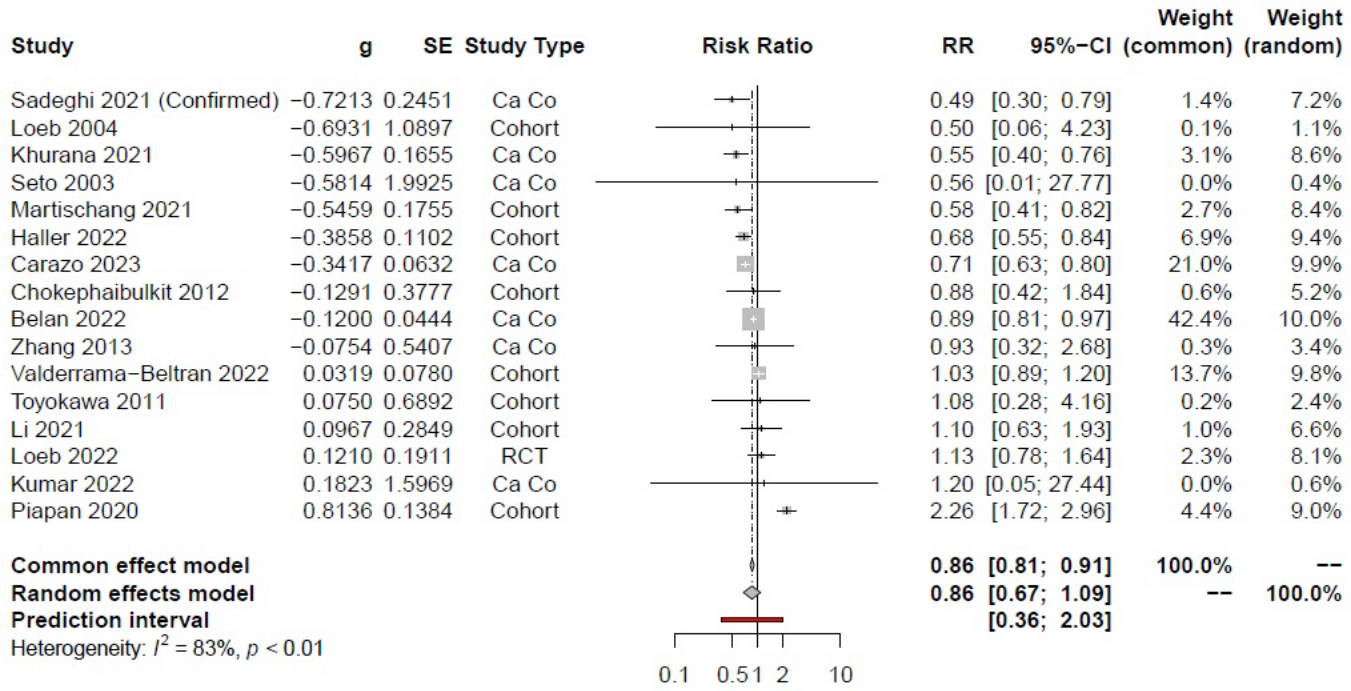


Figure 7. Sensitivity Analysis B: Seasonal Laboratory-confirmed Viral Respiratory Infections in studies reporting <25% of participants with coworker or community exposure

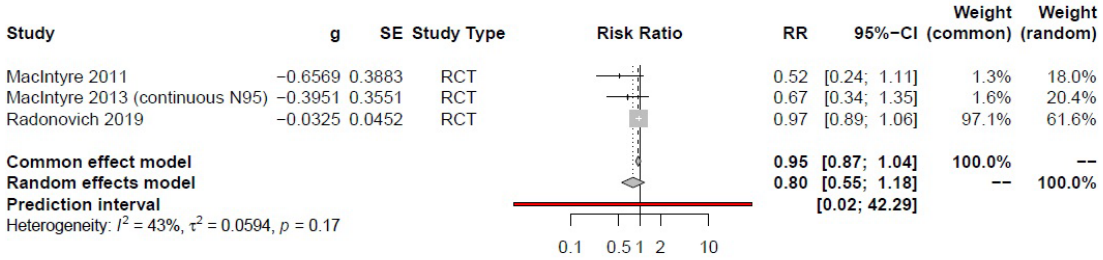
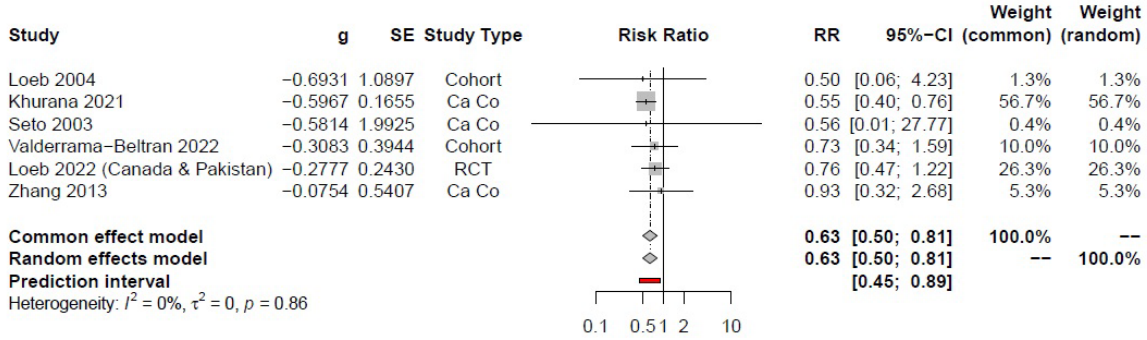


Figure 8. Sensitivity Analysis B: Novel Laboratory-confirmed Viral Respiratory Infections in studies reporting <25% of participants with coworker or community exposure



C. Narrative Evidence Synthesis and Extracted Data

C.1. Narrative Synthesis of the Effectiveness of N95 Respirators Compared with Medical/ Surgical Mask to Prevent Respiratory Illness Among Healthcare Personnel.

Table 6. The Effectiveness of Medical/ Surgical Masks compared with N95 Respirators to Prevent Laboratory-confirmed Respiratory Illness among Healthcare Personnel

Outcome	Results
Laboratory-confirmed viral respiratory infections (VRIs)	The evidence from 14 studies[17, 19-22, 26-31, 33, 35, 36] (N = 17,925) is heterogenous and inconsistent on the effectiveness of surgical/medical masks compared to N95 respirators in preventing laboratory-confirmed VRIs among HCP. • Strength of Association: All studies are at risk of confounding by eye protection use and patient mask use, 12 studies[17, 19, 21, 22, 27-31, 33, 35, 36] by coworker exposures, 10 studies[17, 19-22, 27-30, 35] by community exposures, and eight studies[17, 19, 21, 22, 27, 29, 30, 35] by healthcare tasks. Additionally, seven studies[20, 21, 26-28, 30, 35] are retrospective and at risk of recall bias impacting results, and 11 studies[19-22, 26-28, 30, 31, 33, 35] either did not report on compliance or did not report compliance measured objectively. • Precision of Association: Four studies[19, 22, 27, 30] have small sample sizes and 12 studies[17, 19-22, 26, 28-31, 35, 36] report confidence intervals, eight[17, 20, 22, 26, 28-30, 36] of which include the null and eight[17, 20, 22, 28-31, 35] are wide. • Consistency of Association: Results are inconsistent. • Applicability of Association: The populations and settings were directly applicable to the question. One RCT, two cohort studies, and two case-control studies (N = 8,473) reported an increase in laboratory-confirmed VRIs among HCP using medical masks compared to HCP wearing N95s. • One cluster RCT[31] (N = 1,441) conducted in 15 tertiary hospitals in China reported a decrease in multiplex PCR-confirmed VRI among HCP assigned to wear N95s on every shift compared to HCP assigned to medical masks when adjusting for hospital level, high risk procedures, 2008 influenza vaccine status, and handwashing [aOR: 0.19 (95% CI: 0.05 to 0.67), p = sig]. However, there was no difference in multiplex PCR-confirmed influenza A and B among HCP assigned to wear N95s on every shift compared to HCP assigned to medical masks [aOR: 0.27 (95% CI: 0.06 to 1.17), p = NS]. This study was not powered to detect a difference in laboratory-confirmed viral respiratory infection, there were only eight cases of influenza during the study period, and the confidence interval was wide and included the null. Among HCPs assigned to wear N95s, no VRI cases occurred among those assigned to wear non-fit-tested respirators. Self-reported compliance was less than 80% but was similar across groups. • Two cohort studies[19, 26] (N = 3,443) reported a decrease in SARS-CoV-2 among HCP who reported using N95 respirators,[19, 26] KN95 respirators,[19] or KF94 respirators[19] when compared to HCP who reported using surgical masks. One study[26] was conducted in seven acute care institutions, one rehabilitation clinic, and three psychiatry clinics in Switzerland and the other[19] was conducted in a hospital in Indonesia. One study[26] reported adjusted results controlling for COVID-19 exposures, number of negative swabs, and HCP characteristics including PPE use, while the other[19] controlled for age, sex, presence of comorbidity, profession, contact with COVID-19 patients, place of contact, type of mask, wearing of mask during activities, and fruit and vegetable

Outcome	Results
	consumption. One study[26] compared HCP who reported mostly or only using FFP2 masks to HCP who reported mostly or only using surgical masks or reported equal use of FFP2 masks and surgical masks. The other study compared mask types worn by HCP when not treating COVID-19 patients. Mask use was self-reported by a questionnaire in both studies[19, 26] and collected prior to when follow-up serology was performed in one study[26] and monthly or when symptomatic in the other.[19] One study[19] had a small study size with few HCP who reported using surgical masks, and the other[26] reported a confidence interval that includes the null, decreasing confidence in these results. • Two case-control studies[21, 27] (N = 3,589) reported HCP with lab-confirmed SARS-CoV-2 were less likely to report using N95 respirators compared to HCP who tested negative. One study[21] was conducted in multiple healthcare facilities in Canada and one[27] at a tertiary care hospital in India. One study[27] does not report the variables on which the cases and controls were matched, while the other[21] did not report matching cases and controls. One study[21] reported results among high-risk HCP, which included nursing staff, patient-care assistants and physicians working in acute-care hospitals, long-term care facilities, or private residences for elderly. This study[21] reported adjusted results controlling for sex, age, born abroad, race and ethnicity, native language, type of employment, department, type of facility, health region, workplace and household exposures, infection prevention and control practices, and vaccination status. Mask use was self-reported through a questionnaire conducted after the disease was diagnosed in both studies and one study[27] had a small sample size, decreasing confidence in results. Four RCTs, three cohorts, and one case-control study (N = 9,271) reported no difference in laboratory-confirmed VRIs among HCP using N95s compared to surgical/medical masks. • Two cluster RCTs[33, 36] (N = 4,040) and two non-inferiority RCTs[17, 29] (N = 1,455) reported no difference in laboratory-confirmed SARS-CoV-2,[17] seasonal and pandemic influenza,[29, 36] syncytial virus,[29] metapneumovirus,[29] parainfluenza virus,[29] rhinovirus-enterovirus,[29] seasonal coronaviruses,[29] and respiratory illness[33, 36] among HCP assigned to wear fit-tested N95 respirators and HCP assigned to wear surgical or medical masks. A post-hoc per-protocol analysis[23] of one cluster RCT[36] reported no difference in laboratory-confirmed endemic coronaviruses, however results approached significance. The RCTs were conducted in U.S. health centers,[36] tertiary hospitals located in Canada[29] and China,[33] and healthcare facilities in Canada, Pakistan, Israel, and Egypt.[17] In one study,[36] self-reported compliance was similar across groups, however observed compliance was higher among HCP assigned to wear fit-tested N95s. In another study,[33] self-reported compliance was lowest for HCP assigned to wear N95s at all times, but highest for those assigned to wear N95s only during high-risk procedures. A subgroup analysis in one study[17] identified between country heterogeneity which correlated with different COVID-19 strains circulating during the study period. While HCP in Canada, Israel, and Pakistan were exposed to pre-Omicron strains, those in Egypt where results were near the null, were exposed to Omicron.[17] One study[33] was not powered to detect a difference in laboratory-confirmed viral infection. One non-inferiority RCT[29] had a preset noninferiority limit of -9% and the other[17] had a margin corresponding to a relative effect size of 2. Three studies[17, 29, 36] reported confidence intervals and two[17, 29] were wide, decreasing confidence in the results.

Outcome	Results
	• Three cohort studies[22, 28, 30] (N = 1,702) reported no difference in infection or no evidence of transmission of laboratory-confirmed SARS-CoV-2,[28] SARS,[30] and H1N1[22] among HCP using N95 or higher-level respirators compared to HCP wearing medical or surgical masks. Studies were conducted in an integrated managed case consortium in the U.S.,[28] a community hospital in Canada,[30] and in the emergency rooms, pediatric wards, adult wards, and ICUs of two public tertiary care hospitals in Thailand.[22] One study[28] reported adjusted results controlling for exposure status, presence of symptoms, presence of underlying health conditions, and work location in risk areas. Mask use was self-reported during structured interviews[28, 30] or an anonymous questionnaire that was not verified for accuracy.[22] In one study,[28] 91/95 (95.8%) of HCP who tested positive acquired COVID-19 outside of a known patient-exposure event. All three studies reported wide confidence intervals and two studies [22, 30] reported a small sample size, decreasing confidence in the results. • One case-control study[20] (N = 2,074) conducted in France reported no difference in the consistent use of N95 respirators versus surgical masks when comparing HCP cases with laboratory-confirmed SARS-CoV-2 to controls matched on 10-year age categories, sex, and residential region [aOR: 0.85 (95% CI: 0.55-1.29), p = NR)]. Mask usage in the 10 days preceding symptom onset or testing for asymptomatic cases and 10 days preceding questionnaire completion for controls was self-reported through online questionnaires. The study found that HCP were most likely infected during exposures outside of work, and reported a wide confidence interval that crosses the null, decreasing confidence in the results. One cohort study[35] (N = 181) reported a decrease in VRIs among HCP wearing medical masks compared to HCP wearing N95s. • One cohort study[35] (N = 181) conducted in public hospitals in Italy reported an increase in laboratory-confirmed SARS-CoV-2 among HCP who reported wearing FFP2 or FFP3 masks compared to surgical masks [aOR: 7.1 (95% CI: 3.0-16.7), p = NR]. Data were available for 144/178 (80.9%) HCP who were COVID-negative. The study identified four outbreak clusters occurring among HCP in various wards, including one which began with an HCP who acquired infection in the community and infected 87% of colleagues. Following checks it was found that PPE use was not appropriate during HCP meetings, which might have contributed to the spread among colleagues. The study included a small number of participants who wore FFP2 or FFP3 masks (n = 40) and reported a wide confidence interval, decreasing confidence in the result.
Laboratory-confirmed bacterial infection or colonization	The evidence from three studies[32, 33, 37] (N = 3,110) indicates N95s are more effective at preventing laboratory-confirmed bacterial colonization among HCP compared to surgical/medical masks. In two studies,[32, 33] bacterial colonization was identified by pharyngeal swabs among symptomatic HCP and included *S. pneumonia*, *Legionella*, *B. pertussis*, *Chlamydia*, *M. pneumonia*, or *H. influenzae* type B. The one study[37] reporting on *M. tuberculosis* infection used TST results to identify TST conversions among staff. • Strength of Association: All studies are at risk of confounding by patient mask use, eye protection use, and coworker and community exposures. Two studies[32, 37] are at risk of confounding by healthcare tasks, and no studies report on compliance or report compliance measured objectively. • Precision of Association: Two studies[32, 33] report confidence intervals, both of which are wide and one[33] includes the null. • Consistency of Association: The evidence is consistent.

Outcome	Results
	• Applicability of Association: The populations and settings were directly applicable to the question. Two RCTs and one before-after (N = 3,110) study reported an increase in laboratory-confirmed bacterial colonization among HCP using medical masks compared to HCP wearing N95s. • Two cluster RCTs[32, 33] (N = 3,110) reported a decrease in laboratory-confirmed bacterial colonization among HCP assigned to wear fit-tested[32, 33] and non-fit-tested[32] N95s compared to medical masks[32, 33] and surgical masks.[33] Both studies were conducted in hospitals in China and one[33] reported adjusted results controlling for age, H1N1 vaccination status, seasonal influenza vaccination status, hand washing, and HCP role. Both studies reported wide confidence intervals and one[33] includes the null. • One before-after study[37] (N = NR) conducted at a public hospital in Illinois, U.S. reported a decrease in TST conversion among staff following a policy change from HEPA, PAPR, and surgical masks to fit-tested N95 respirators in 1997 [January 1994: 98/2,221 (4.4%) vs. December 2002: 6/2,108 (0.3%), $p < 0.001$]. There was little data on how often PAPR respirators were used despite the switch to N95 respirators.

Table 7. The Effectiveness of Medical/ Surgical Masks compared with N95 Respirators to Prevent Novel and Seasonal Laboratory-confirmed Respiratory Illness among Healthcare Personnel

Outcome	Results
Laboratory-confirmed novel viral respiratory infections (VRIs)	The evidence from 11 studies [17, 19-22, 26-30, 35] (N = 12,444) is heterogenous and inconsistent on the effectiveness of surgical/medical masks compared to N95 respirators in preventing laboratory-confirmed novel viral respiratory infections among HCP. • Strength of Association: All studies are at risk of confounding by eye protection use, ten studies[17, 20-22, 26-30, 35] are at risk of confounding by patient mask use, eight[17, 20, 22, 27-30, 35] by community exposures, and seven by coworker exposures[17, 22, 27-30, 35] and healthcare tasks.[17, 21, 22, 27, 29, 30, 35] Additionally, nine studies[19-22, 26-28, 30, 35] are retrospective and at risk of recall bias impacting result. • Precision of Association: Four studies[19, 22, 27, 30] have a small sample size and ten studies[17, 19-22, 26, 28-30, 35] report confidence intervals, seven[17, 20, 22, 26, 28-30] of which are wide and include the null. • Consistency of Association: Results are inconsistent. • Applicability of Association: The populations and settings were directly applicable to the question. Two cohort studies and two case-control studies (N = 7,032) reported an increase in laboratory-confirmed novel VRIs among HCP using medical masks compared to HCP using N95s. • Two cohort studies[19, 26] (N = 3,443) reported a decrease in SARS-CoV-2 among HCP who reported using N95 respirators,[19, 26] KN95 respirators,[19] or KF94 respirators[19] when compared to HCP who reported using surgical masks. One study[26] was conducted in seven acute care institutions, one rehabilitation clinic, and three psychiatry clinics in Switzerland and the other[19] was conducted in a hospital in Indonesia. One study[26] reported adjusted results controlling for COVID-19 exposures, number of negative swabs,

Outcome	Results
	and HCP characteristics including PPE use, while the other[19] controlled for age, sex, presence of comorbidity, profession, contact with COVID-19 patients, place of contact, type of mask, wearing of mask during activities, and fruit and vegetable consumption. One study[26] compared HCP who reported mostly or only using FFP2 masks to HCP who reported mostly or only using surgical masks or reported equal use of FFP2 masks and surgical masks. The other study[19] compared mask types worn by HCP when not treating COVID-19 patients. Mask use was self-reported by a questionnaire in both studies[19, 26] and collected prior to when follow-up serology was performed in one study[26] and monthly or when symptomatic in the other[19] . One study[19] had a small study size with few HCP who reported using surgical masks, and the other[26] reported a confidence interval that includes the null, decreasing confidence in these results. • Two case-control studies[21, 27] (N = 3,589) reported HCP with laboratory-confirmed SARS-CoV-2 were less likely to report using N95 respirators compared to HCP who tested negative. One study[21] was conducted in multiple healthcare facilities in Canada and one[27] at a tertiary care hospital in India. One study[27] does not report the variables on which the cases and controls were matched, while the other[21] did not reported matching cases and controls. One study[21] reported results among high-risk HCP, which included nursing staff, patient-care assistants and physicians working in acute-care hospitals, long-term care facilities, or private residences for elderly. This study[21] reported adjusted results controlling for sex, age, born abroad, race and ethnicity, native language, type of employment, department, type of facility, health region, workplace and household exposures, infection prevention and control practices, and vaccination status. Mask use was self-reported through a questionnaire conducted after disease was diagnosed in both studies,[21, 27] and one study[27] had a small sample size, decreasing confidence in the findings. Two noninferiority RCTs, three cohort studies, and one case-control study reported (N = 5,231) no difference in laboratory-confirmed novel VRIs among HCP using N95s compared to surgical/medical masks. • Two noninferiority RCTs[17, 29] (N = 1,455) reported no difference in laboratory-confirmed SARS-CoV-2[17] or pandemic influenza strains[29] among HCP assigned to use fit-tested N95 respirators compared to HCP assigned to use medical or surgical masks. The RCTs were conducted in tertiary hospitals located in Canada[29] and healthcare facilities in Canada, Pakistan, Israel, and Egypt.[17] In one study,[17] HCP assigned to wear medical masks were more likely to self-report always wearing their assigned PPE compared to HCP assigned to wear N95s (p = NR). Both studies reported confidence intervals that were wide, deceasing confidence in the results. • Three cohort studies[22, 28, 30] (N = 1,702) reported no difference in infection or no evidence of transmission of laboratory-confirmed SARS-CoV-2,[28] SARS,[30] and H1N1[22] among HCP using N95 or higher-level respirators compared to HCP wearing medical or surgical masks. Studies were conducted in an integrated managed case consortium in the U.S.,[28] a community hospital in Canada,[30] and in the emergency rooms, pediatric wards, adult wards, and ICUs of two public tertiary care hospitals in Thailand.[22] One study[28] reported adjusted results controlling for exposure status, presence of symptoms, presence of underlying health conditions, and work location in risk areas. Mask use was self-reported during structured interviews[28, 30] or an anonymous questionnaire that was not verified for accuracy. In one study,[28] 91/95 (95.8%) of HCP who tested positive acquired COVID-19

Outcome	Results
	outside of a known patient-exposure event. All three studies reported wide confidence intervals and two studies reported a small sample size,[22, 30] decreasing confidence in the results. • One case-control study[20] (N = 2,074) conducted in France reported no difference in the consistent use of N95 respirators versus surgical masks when comparing HCP cases with laboratory-confirmed SARS-CoV-2 to controls matched on 10-year age categories, sex, and residential region [aOR: 0.85 (95% CI: 0.55-1.29), p = NR)]. Mask usage in the 10 days preceding symptom onset or testing for asymptomatic cases and 10 days preceding questionnaire completion for controls was self-reported through online questionnaires and the confidence interval is wide and crosses the null, decreasing confidence in the results. One cohort study[35] (N = 181) reported a decrease in laboratory confirmed novel VRIs among HCP using medical masks compared to HCP wearing N95s. • One cohort study[35] (N = 181)conducted in public hospitals in Italy reported an increase in laboratory-confirmed SARS-CoV-2 among HCP who reported wearing FFP2 or FFP3 masks compared to surgical masks [aOR: 7.1 (95% CI: 3.0-16.7), p = NR]. Data were available for 144/178 (80.9%) HCP who were COVID-negative. The study identified four outbreak clusters occurring among HCP in various wards, including one which began with one HCP who acquired infection in the community and infected 87% of colleagues. Following checks it was found that PPE use was not appropriate during HCP meetings, which might have contributed to the spread among colleagues. The study included a small number of participants who wore FFP2 or FFP3 masks (n = 40) and reported a wide confidence interval, decreasing confidence in the result.
Laboratory-confirmed seasonal viral respiratory infections (VRIs)	The evidence from four studies[29, 31, 33, 36] (N = 5,927) suggests there is no difference in the effectiveness of surgical/medical masks compared to N95 respirators in preventing laboratory confirmed seasonal VRIs among HCP. • Strength of Association: All studies are at risk of confounding by eye protection use, patient mask use, and coworker exposures, and one study[29] is also at risk of confounding by community exposures, and healthcare tasks. Two studies[31, 33] do not report compliance measured objectively. • Precision of Association: Three studies[29, 31, 36] report confidence intervals, two[29, 36] of which include the null and two[29, 31] are wide. • Consistency of Association: Results are inconsistent. • Applicability of Association: The populations and settings were directly applicable to the question. One RCT (N = 1,441) reported an increase in laboratory confirmed seasonal VRI among HCP using medical masks comparing to HCP using N95s. • One cluster RCT[31] (N = 1,441) conducted in 15 tertiary hospitals in China reported a decrease in multiplex PCR-confirmed VRI among HCP assigned to wear N95s on every shift compared to HCP assigned to medical masks when adjusting for hospital level, high risk procedures, 2008 influenza vaccine status, and handwashing [aOR: 0.19 (95% CI: 0.05 to 0.67), p = sig]. However, there was no difference in multiplex PCR-confirmed influenza A and B among HCP assigned to wear N95s on every shift compared to HCP assigned to medical masks [aOR: 0.27 (95% CI: 0.06 to 1.17), p = NS]. There were only eight cases of influenza during the

Outcome	Results
	study period and the confidence interval was wide and included the null. Among HCPs assigned to wear N95s, no VRI cases occurred among those assigned to wear non-fit-tested respirators. Self-reported compliance was less than 80% but was similar across groups. Three RCTs[29, 33, 36] (N = 4,486) reported no difference in laboratory confirmed seasonal VRIs among HCP using N95s compared to surgical/medical masks. • One cluster RCT[36] (N = 2,371) conducted in 137 health centers in the U.S. reported no difference in laboratory-detected respiratory infection [aIRR: 0.99 (95% CI: 0.89 to 1.09), p = NR], laboratory-confirmed respiratory illness [aOR: 0.96 (95% CI: 0.83-1.11), p = NR], or RT-PCR-confirmed influenza A or B [aOR: 1.18 (95% CI: 0.95 to 1.45), p = NR] among HCP assigned to wear N95 respirators when within six feet of patients with suspected or confirmed respiratory illness compared to HCP assigned to wear medical masks. The models adjusted for age, sex, race, number of household members younger than five years, occupational risk level, influenza vaccination status, proportion of daily exposures to others with respiratory illness, and self-reported adherence to hand hygiene. Laboratory-confirmed respiratory illness was defined laboratory-detected respiratory infection plus self-reported acute respiratory illness. A per-protocol analysis[23] reported no difference in laboratory-confirmed endemic coronaviruses among HCP who self-reported wearing N95 respirators compared to HCP who self-reported wearing medical masks when controlling for age, number of household members under five years of age, proportion of workdays with exposure to patients or coworkers with respiratory illness, occupation risk level, and whether AGPs were performed [aOR: 0.71 (95% CI: 0.49-1.03) p = NR]. The per-protocol[23] reported a wide confidence interval, decreasing confidence in the findings. Self-reported compliance was similar across groups, however observed compliance was higher among HCP assigned to wear N95s. • One cluster RCT[33] (N = 1,669) conducted in 19 tertiary hospitals in China reported no difference in laboratory-confirmed VRI among HCP assigned to wear fit-tested N95s compared to medical masks, regardless of whether HCP were instructed to wear N95s at all times [13/581 (2.2%) vs. 19/572 (3.3%), p = 0.44] or only during high-risk procedures [17/516 (3.3%) vs. 19/572 (3.3%), p = 0.99]. Self-reported compliance was lowest for HCP assigned to wear N95s at all times, highest for those assigned to wear N95s only during high-risk procedures; compliance was also low for those assigned to surgical/medical masks at all times (57% vs. 82% vs. 66%, p < 0.001). • One noninferiority RCT[29] (N = 446) conducted in eight Canadian tertiary care hospitals reported no difference in PCR-confirmed respiratory syncytial virus type B [RD: -0.47 (95% CI: -2.07 to 1.13), p > 0.99], metapneumovirus [RD: -0.46 (95% CI: -1.98 to 2.89), p > 0.99], parainfluenza virus 3 [RD: 0.48 (95% CI: -1.12 to 2.09), p = 0.62], rhinovirus-enterovirus [RD: 0.99 (95% CI: -2.87 to 4.85), p = 0.62], and coronaviruses OC43, 229E, NL63, and HKU1 [RD: 1.47 (95% CI: -2.68 to 5.62), p = 0.49] among unvaccinated nurses asked to use a fit-tested N95 respirator while caring for patients with febrile respiratory illnesses during the influenza season when compared to unvaccinated nurses asked use to surgical masks. There was also no difference in rise in serum titles for influenza strains A/Brisbane/10/2007 (H3N2) [RD: 3.52 (95% CI: -4.32 to 11.36), p = 0.38] and B/Florida/4/2006 [RD: 2.0 (95% CI: -3.0 to 7.17), p = 0.46]. While there was no difference in laboratory-confirmed influenza when limited to cases confirmed by

Outcome	Results
	RT-PCR, there were more cases of influenza A among the surgical masks group [RD: -1.88 (95% CI: -4.13 to 0.36), p = 0.22] but more influenza B among the N95 respirator group [RD: 0.96 (95% CI: -0.89 to 2.81), p = 0.37]. However, there were only six cases of RT-PCR confirmed influenza A and four cases of RT-PCR confirmed influenza B. The study reported wide confidence intervals, decreasing confidence in the results.

Table 8. The Effectiveness of Medical/ Surgical Masks compared with N95 Respirators to Prevent Influenza-like Illness, Acute Respiratory Illness, and Clinical Respiratory Illness among Healthcare Personnel

Outcome	Results
Influenza-like illness (ILI)	The evidence from four studies[29, 31, 33, 36] (N = 5,927) suggests there is no difference in the effectiveness of medical masks compared to N95 respirators in preventing ILI among HCP. Two studies[31, 33] defined ILI as a self-reported fever of at least 38°C with at least one respiratory symptom, one study[29] defined it as the presence of both a cough and temperature of at least 38°C, and one[36] defined ILI as a temperature of at least 37.8°C plus a cough and/or sore throat, with or without laboratory confirmation. • Strength of Association: All studies were at risk of confounding by eye protection, patient mask use, and coworker contact. One study[29] was also at risk of confounding by HCP task and community contact, and two studies[31, 33] did not report compliance measured objectively. • Precision of Association: Of the three studies[29, 31, 36] that reported confidence intervals, two[29, 31] are wide and all[29, 31, 36] include the null. • Consistency of Association: The evidence is consistent. • Applicability of Association: The populations and settings were directly applicable to the question. Four RCTs reported no difference in ILI among HCP using surgical/medical masks compared to HCP wearing N95s or normal practice. • Three cluster RCTs[31, 33, 36] and one noninferiority RCT[29] (N = 5,927) reported no difference in ILI among HCP assigned to wear fit-tested N95s compared to HCP assigned to wear medical or surgical masks. The RCTs were conducted in U.S. health centers[36] and tertiary hospitals located in Canada[29] and China .[31, 33] One study[33] reported no difference in ILI regardless of whether HCP wore N95s at all times or only during high-risk procedures. Self-reported compliance was similar across groups in two studies,[31, 36] however observed compliance was higher among HCP assigned to wear fit-tested N95s in one study.[36] All four studies reported a low number of ILI cases and three studies[29, 31, 36] reported confidence intervals, two[29, 31] of which were wide, decreasing confidence in the findings.
Acute Respiratory Illness (ARI)/Clinical	The evidence from four studies[17, 31, 33, 36] (N = 6,490) is inconclusive and inconsistent on the effectiveness of surgical/medical masks at preventing ARI or CRI among HCP compared to N95s. Two studies[31, 33] defined CRI was defined as two or more respiratory symptoms or one respiratory symptom and a systemic symptom. One study[36] defined ARI as at least one sign and two symptoms with or without laboratory confirmation, and one[17] defined ARI as fever and cough.

Outcome	Results
respiratory illness (CRI)	• Strength of Association: All studies were at risk of confounding by eye protection, patient mask use, and coworker contact and one study[17] was at risk of confounding by community contact. Two studies[31, 33] did not report compliance measured objectively. • Precision of Association: All studies reported confidence intervals, two[17, 31, 33, 36] are wide and two[17, 31] include the null. • Consistency of Association: The evidence is inconsistent. • Applicability of Association: The populations and settings were directly applicable to the question. Two RCTs (N = 3,110) suggested N95s are more effective at preventing CRIs among HCP compared to medical masks. • One cluster RCT[33] (N = 1,669) conducted in 19 tertiary hospitals in China reported a decrease in CRI among HCP assigned to wear fit-tested N95s compared to surgical/medical masks when adjusting for age, H1N1 vaccination status, seasonal influenza vaccination status, hand washing, and HCP role, regardless of whether HCP were instructed to wear N95s at all times [aHR: 0.39 (95% CI: 0.21 to 0.71), p = NR] or only during high-risk procedures [aHR: 0.70 (95% CI: 0.39 to 1.24), p = NR]. The study reported wide confidence intervals, one of which included the null, decreasing confidence in the results. • One cluster RCT[31] (N = 1,441) conducted in 15 tertiary hospitals in China reported a decrease in CRI among HCP assigned to wear N95s on every shift compared to HCP assigned to medical masks when adjusting for hospital level, high risk procedures, 2008 influenza vaccine status, and handwashing [aOR: 0.38 (95% CI: 0.17 to 0.86), p = sig]. When compared to HCP assigned to medical masks, there was a larger decrease in CRI among those assigned to non-fit-tested N95s [aOR: 0.48 (95% CI: 0.24 to 0.98), p = 0.045] than those assigned to fit-tested N95s [aOR: 0.76 (95% CI: 0.27 to 2.13), p = 60]. CRI was defined as self-reported two or more respiratory or one respiratory and a systemic symptom. This study reports wide confidence intervals, decreasing confidence in the findings. Two RCTs (N = 3,380) reported no difference in ARI among HCP using N95s compared to surgical/medical masks. • One cluster RCT[36] (N = 2,371) conducted in 137 health centers the U.S. reported no difference in ARI among HCP assigned to wear N95 respirators when within six feet of patients with suspected or confirmed respiratory illness compared to HCP assigned to wear medical masks when adjusting for age, sex, race, number of household members younger than five years, occupational risk level, influenza vaccination status, proportion of daily exposures to others with respiratory illness, and self-reported adherence to hand hygiene [aIRR: 0.99 (95% CI: 0.92 to 1.06), p = NR]. ARI was defined as the presence of at least one sign and two symptoms, regardless of laboratory confirmation. • One noninferiority RCT[17] (N = 1,009) conducted in 29 healthcare facilities located in Canada, Pakistan, Israel, and Egypt reported no difference in ARI among HCP assigned to use medical masks compared to fit-tested N95 respirators [HR: 0.89 (95% CI: 0.53-1.49), p = NR]. HCP assigned to wear medical masks were more likely to self-report always wearing their assigned PPE compared to N95 respirators (91.2% vs. 80.7%, p = NR). The study reported wide confidence intervals that include the null.

Outcome	Results
Self-reported respiratory infections	The evidence from four studies[25, 26, 34, 38] (N = 5,211) suggests N95s are more effective at preventing self-reported respiratory infections than medical/ surgical masks among HCP. • Strength of Association: Studies were at risk of confounding by HCP task,[25, 34] coworker[25, 34] and community[25, 34, 38] contact, eye protection,[26, 34] and patient mask use.[26, 34, 38] Additionally, all studies are retrospective and at risk of recall bias, and three[25, 26, 34, 38] are at risk of sampling bias, impacting results. None of the studies reported on compliance or reported compliance measured objectively. • Precision of Association: Two studies[25, 26] reported confidence intervals that include the null. • Consistency of Association: Results are inconsistent. • Applicability of Association: The populations and settings were directly applicable to the question. One cohort study[26] and one case-control study[38] (N = 4,029) reported an increase in self-reported respiratory infections among using medical masks compared to HCP wearing N95s. • One prospective cohort study[26] (N = 3,259) conducted in seven acute care institutions, one rehabilitation clinic, and three psychiatry clinics in Switzerland reported a decrease in self-reported SARS-CoV-2 infection among HCP who reported mostly or only using FFP2 masks compared to those who reported mostly or only using surgical masks or reported equal use of FFP2 masks and surgical masks when adjusting for COVID-19 exposures, the number of negative swabs, and HCP characteristics including PPE use [aHR: 0.8 (95% CI: 0.6-1.0), p = 0.052]. A follow-up study[24] providing an additional six months of data reported a decrease in self-reported infection or laboratory-confirmed seroconversion when adjusting for age, BMI, sex, pregnancy status, smoking status, presence of comorbidities, work-related factors (patient contact, FTE status, working in intensive care, visiting hospital canteen) and nonwork-related factors (vaccination, household contact, wearing mask outside work) [aOR 0.56 (95% CI: 0.43 – 0.74), p < 0.001]. Mask use was self-reported after diagnosis by a questionnaire prior to follow-up serology was performed and the comparator group included those who used FFP2 and surgical masks equally. In addition, the confidence intervals include the null, decreasing confidence in these results. • One case-control study[38] (N = 770) conducted in medical and medico-social establishments in France reported HCP with lab-confirmed SARS-CoV-2 were less likely to mainly wear respirators versus surgical masks when compared to HCP who tested negative after adjusting for age, sex, alcohol hand rub use before and after patient care, regular airing of patient/residents' rooms, and PPE use including mask, face shield or goggles, gown/plastic apron, gloves, protective hair cap, and protective overshoes [aOR: 0.39 (95% CI: 0.29-0.51), p = NR]. Cases and controls were matched by sector of activity and profession. Mask use during the 10 days prior to symptoms or testing if asymptomatic was self-reported through a questionnaire after the disease was diagnosed, decreasing confidence in the results. Two cross-sectional studies[25, 34] (N = 1,182) reported no difference in self-reported respiratory infections among HCP using medical or surgical masks compared to N95s or other respirators. • One cross-sectional study[25] (N = 801) conducted online reported no difference self-reported COVID-19 infection when comparing those who reported wearing a disposable respirator to those wearing a surgical mask during an encounter with a symptomatic

Outcome	Results
	patient when adjusting for asymptomatic patients not wearing masks, PPE worn during symptomatic encounter, and eye protection worn [aOR: 0.54 (95% CI: 0.2-1.3), p = 0.17]. HCP self-identified as clinicians, were recruited through social media, and self-reported mask use and COVID-19 infection. In addition, the confidence interval is wide and crosses the null, further reducing confidence in the results. • One cross-sectional study[34] (N = 381) conducted among HCP in tertiary sector healthcare services in Greece found no significant difference in self-reported SARS-CoV-2 among HCP who reported wearing FFP/(K)N95 respirators compared to those who reported wearing surgical or medical masks on a web-based questionnaire [9/82 (11.0%) vs. 28/243 (11.5%), p > 0.05]. HCP were randomly invited to participate through social media and self-reported mask use and SARS-CoV-2, reducing confidence in the results.

C.1. Narrative Synthesis of the Occurrence of Adverse Events Among Healthcare Personnel Using N95 Respirators Compared with Healthcare Personnel Using Medical/ Surgical Masks

Table 9. Association between Physical Adverse Events and Medical/ Surgical Masks compared with N95 Respirators

Outcome	Results
SpO_2	The evidence from four studies[47, 55, 56, 61] (N = 323) is inconclusive on changes in SpO_2 between HCP who wear N95s and those who wear masks, but levels remained within normal ranges (95-100%) among HCP wearing N95s and HCP wearing surgical masks. • Strength of Association: One study[61] was subject to sampling and recall bias and confounding by work site. Three studies[55, 56, 61] were subject to confounding by duration of mask use, and all four studies were subject to confounding by task, sex, age, and baseline fitness. • Precision of Association: Three studies[47, 56, 61] reported small sample sizes. • Consistency of Association: The evidence is inconsistent. • Applicability of Association: The setting of one study[55] was not direct due to extreme heat and humidity. Two studies[56, 61] (N = 144) conducted in air-conditioned facilities reported no difference in SpO_2 when comparing HCP wearing N95s to HCP wearing surgical masks for eight hours. • One RCT[61] (N = 68) conducted in a university hospital in Taiwan reported no difference in the adjusted least square means of SpO_2 for N95s and HCP wearing surgical masks from baseline to 8-hours and after adjusting for duty of work [adjusted difference of least-square means: 0.06mmHg (95% CI: -0.04 to 0.15), p = 0.24]. The study reported a significant increase in SpO_2 at four hours in the N95 respirator group (baseline: 96.59% vs. 4 hours: 96.97%, p = 0.03) however, this was still within the normal physiological range. HCP working in high-risk COVID-19 settings were assigned N95s and those working in low-risk settings were assigned surgical masks. All HCP followed masking rules set by the hospital. The sample size was small, limiting the confidence in these findings.

Outcome	Results
	• One cross-sectional study[56] (N = 76) conducted in a Nigerian hospital reported no difference in mean SpO_2 in N95 respirator or surgical mask users at the beginning [97.9 (SD: 0.8) vs. 98.1 (SD: 0.7), p = 0.38] or end of each eight hour shift [97.8 (SD: 0.8) vs. 98.1 (SD: 0.8), p = 0.11], and no difference in SpO_2 between groups after eight hours. Participants were assessed in the mask available to them and participants who removed masks before the end of the study period were excluded from the data analysis for noncompliance. The sample size was small, and tasks completed while wearing masks were not reported, limiting the confidence in these findings. Two studies[47, 55] (N = 179), one[55] of which was conducted in an un-airconditioned facility during monsoon season, reported a decrease in SpO_2 among HCP wearing N95s. • One cross-sectional study[55] (N = 128) conducted in an un-airconditioned Indian dental clinic during monsoon season reported a decrease in mean SpO_2 among N95 respirator wearers at one and two-hours of wear [baseline: 98.3 ± 0.97 vs. 60 mins: 96.13 ± 2.84 vs. 120 mins: 97.61 ± 1.99, p < 0.01]. There was no significant decrease in mean SpO_2 in the surgical mask group [baseline: 98.29 ± 1.36 vs. 60 mins: 98.14 ± 1.16 vs. 120 mins: 98.17 ± 1.04, p = 0.59]. The drop was statistically significant between the two groups at 60 minutes (p < 0.01) and at 120 minutes (p = 0.01), however all values were within normal SpO_2 ranges. Mask assignment was not described, and compliance was not measured. These results may have been confounded by the heat and humidity in a non-airconditioned facility during monsoon season. • One quasi-experimental study[47] (N = 51) conducted in a dental setting in Saudi Arabia reported a decrease in SpO_2 among N95 respirator wearers compared to surgical mask wearers after one, two, and three-hours of wear [baseline: 98.2 (SD 0.7) vs. 98.8 (SD 0.4), p = 0.12; 60 mins: 97.0 (SD 1.1) vs. 98.8 (SD 0.4), p < 0.01; 120 mins: 96.6 (SD 1.2) vs. 98.8 (SD 0.4), p < 0.01; 180 mins: 96.2 (SE 0.9) vs. 98.8 (SD 0.4), p < 0.01]. The sample size was small and compliance was not measured.
Heart Rate	Evidence from three studies[47, 55, 61] (N = 247) is inconclusive on differences in heart rate between surgical mask and N95 respirator users, but indicates heartrates remains within normal ranges (60 – 100 bpm) for both N95 respirator and mask wearers. • Strength of Association: One study[61] was subject to sampling and recall bias and was subject to confounding by work site, two studies[55, 61] were subject to confounding duration of mask use, and all three studies were subject to confounding by task, sex, age, and baseline fitness. • Precision of Association: Two studies[47, 61] reported small sample sizes. • Consistency of Association: The evidence is inconsistent. • Applicability of Association: The setting of one study[55] was not direct due to extreme heat and humidity. One study[47] (N = 51) suggested an increase in heart rate among HCP wearing N95s compared to HCP wearing surgical masks. • One quasi-experimental study[47] (M = 51) conducted in a dental setting in Saudi Arabia reported an increase in heart rate among N95 respirator wearers compared to surgical mask wearers at one, two, and three-hours of wear [baseline: 81.3 (SD 12.6) vs. 79.5 (SD 8.8), p = 0.9; 60 mins: 93.1 (SD 12.4) vs. 73.1 (SD 10.0), p < 0.01; 120 mins: 95.3 (SD 12.9) vs. 81.7 (SD 7.0), p < 0.01; 180 mins: 95.4 (SD 13.3) vs. 83.8 (SD 9.3), p < 0.01]. The sample size was small, and compliance was not measured. One study[55] (N = 128) suggested no difference in heart rate when comparing HCP wearing N95s or surgical masks. • One cross-sectional study[55] (N = 128) conducted in an un-airconditioned Indian dental clinic during monsoon season reported no difference in mean pulse rate among N95 respirator wearers at one and two-hours of wear [baseline: 85 ± 12.8

Outcome	Results
	vs. 60 mins: 83.25 ± 14.13 vs. 120 mins: 84.01 ± 14.57, p = 0.54]. There was no difference in mean pulse rate in the surgical mask group [baseline: 83.54 ± 11.83 vs. 60 mins: 84.97 ± 14.25 vs. 120 mins: 82.78 ± 11.42, p = 0.84]. There was no difference in pulse rate between HCP wearing N95s or surgical masks at baseline (p = 0.53), 60 minutes (p = 0.52) and at 120 minutes (p = 0.66). Mask assignment was not described, and compliance was not measured. These results may have been confounded by the heat and humidity in a non-airconditioned facility. One study[61] (N = 68) suggested a decrease in heart rate among HCP wearing N95s compared to HCP wearing surgical masks. • One RCT study[61] (N = 68) conducted in a Taiwanese tertiary care center measured heartrate before mask donning and after eight hours of continuous use for an N95 respirator group and a surgical mask group and reported a decrease in the adjusted difference of least square means heart rate among N95 respirator users at 8h (p = 0.0105) that was within normal range. HCP working in high-risk COVID-19 settings were assigned N95s and those working in low-risk settings were assigned surgical masks. All HCP followed masking rules set by the hospital. Sample size was small, baseline fitness and stress may have confounded results, limiting the confidence in these findings.
Headache	Evidence from ten studies[31, 50-53, 55, 58-61] (N = 5,926) indicates headaches are more frequent in N95 respirator users compared to surgical mask users. • Strength of Association: All studies were subject to recall bias, and 9 studies were subject to sampling bias.[50-53, 55, 58-61] Six studies[51, 52, 55, 58, 59, 61] were subject to confounding by work site, and six[31, 51, 55, 58, 59, 61] were subject to confounding by task, sex, age, baseline fitness, and duration of mask use. • Precision of Association: Two studies[53, 61] reported small sample sizes. • Consistency of Association: The evidence is inconsistent. • Applicability of Association: The populations and settings were directly applicable to the question. Seven studies[31, 50, 53, 55, 58, 59, 61] (N = 5,272) reported that headaches were more frequent in N95 respirator users than in surgical mask users. • Tasks performed while wearing masks were not known in these studies. Headache was self-reported in all studies and compliance was unclear in six studies.[50, 53, 55, 58, 59, 61] Additionally, the duration of mask use was unclear in two studies[50, 53] and sample size was small in two studies,[53, 61] limiting confidence in these findings. Two studies[51, 60] (N = 499) reported no association between N95 respirator or surgical mask use and new headaches among those who did and did not have prior headache disorders. • One cross-sectional study[60] (N = 383) conducted in a variety of Italian hospitals and clinics reported that type of mask was not associated with change in headache outcome compared to baseline (measured before lockdown) regardless of prior history of headaches following 6-10 hours of PPE use (p > 0.05). Mask usage was self-reported, and compliance was not measured. • One cross-sectional study[51] (N = 116) conducted in two Italian university hospitals reported mean scores for headaches were 2.4±0.3 for N95 respirator users and 2±3.5 for surgical mask users, (p = 0.2797) following eight or more hours of PPE use. Adverse events were measured using a questionnaire in which participants rated their experience with headaches on a

Outcome	Results
	scale of 0-10, 0 representing any disturbance and 10 representing complete alteration. Mask use was reported via questionnaire and compliance was not measured. One study[52] (N = 155) reported that headaches were more frequent in surgical mask users than in N95 respirator users. • One cross-sectional study[52] (N = 155) conducted in one Moroccan university hospital reported De novo headaches were reported by 47/148 (31.76%) N95 respirator users and 4/7 (57.14%) surgical mask users (p = 0.22), and aggravated headache was reported by 42/148 (28.38%) N95 respirator users and 3/7 (42.86%) surgical mask users, (p = 0.41). The assignment to group was not described, and compliance was not measured.
Difficulty breathing	The evidence from six studies[31, 53, 54, 56, 58, 61] (N = 5,761) indicates that wearing N95s is associated with difficulty breathing when compared to wearing surgical masks. • Strength of Association: All were subject to recall bias, and five studies were subject to sampling bias.[53, 54, 56, 58, 61] Three studies[54, 58, 61] were subject to confounding by work site, and five[31, 54, 56, 58, 61] were subject to confounding by task, sex, age, baseline fitness, and duration of mask use. • Precision of Association: Three studies[53, 56, 61] reported small sample sizes. • Consistency of Association: The evidence is consistent. • Applicability of Association: The populations and settings were direct. Six studies[31, 53, 54, 56, 58, 61] (N = 5,761) indicate a higher proportion of HCP experience difficulty breathing while wearing an N95 respirator compared to wearing a surgical mask. • Two RCTs,[31, 61] one quasi-experimental study,[53] and three cross-sectional studies[54, 56, 58] (N = 5,761) report an increase in difficulty breathing among N95 respirator users compared to surgical mask users. Difficulty breathing was heterogeneously assessed across studies and included shortness of breath and labored breathing. Tasks performed while wearing masks were not known, compliance was unclear in three studies,[53, 54, 58] the duration of mask use was unclear in three studies,[53, 54, 56] and the sample size was small in three studies,[53, 56, 61] limiting confidence in these findings.
Dizziness	Evidence from three studies[51, 53, 61] (N = 218) suggests dizziness is more frequent among N95 respirator users than surgical mask users. • Strength of Association: All were subject to sampling bias and recall bias, and two studies[51, 61] were subject to confounding by work site, task, sex, age, baseline fitness, and duration of mask use. • Precision of Association: Two studies[53, 61] reported small sample sizes. • Consistency of Association: The evidence is consistent. • Applicability of Association: The populations and settings were directly applicable to the question. Three studies reported[51, 53, 61] (N = 218) reported that dizziness was more frequent in N95 respirator users than surgical mask users. • One RCT study[61] (N = 68) conducted in a Taiwanese tertiary care center compared adverse events experienced by N95 respirator users to those experienced by surgical mask users after eight hours of continuous use and a higher frequency of dizziness was reported by N95 respirator users compared to surgical mask users [5/34 (14.7%) vs. 0/34 (0%), p = 0.027]. HCP

Outcome	Results
	working in high-risk COVID-19 settings were assigned N95s and those working in low-risk settings were assigned surgical masks. All HCP followed masking rules set by the hospital. Sample size was small, limiting the confidence in these findings. • One quasi-experimental study[53] (N = 34) in a Turkish tertiary care center reported a higher frequency of dizziness [8/34 (23.8%) vs. 2/34 (5.9%), p = 0.70] among HCP wearing N95s compared to surgical masks. HCP each wore a surgical mask or an N95 respirator for an unclear duration between one to four hours on one day and then wore the other mask type on another day. Compliance was not measured. The sample size is small, the duration of use is unclear for each group, and it is unclear what activities were performed during mask or N95 respirator use, reducing confidence in these findings. • One cross-sectional study[51] (N = 116) conducted in two Italian university hospitals reported higher mean scores for dizziness in the N95 respirator group compared to the surgical mask group [0.7±2.1 vs. 0.1±0.9, p = 0.02). HCP assessed adverse events following eight or more hours of PPE use using a questionnaire in which participants rated their experience with dizziness on a scale of 0-10, 0 representing any disturbance and 10 representing complete alteration. Mask use was reported via questionnaire and compliance was not measured.
Pain	Evidence from three studies[48, 51, 54] (N = 1,589) indicates no difference in pain between N95 respirator users and surgical mask users. • Strength of Association: All studies were subject to sampling bias, recall bias, and confounding by work site, task, sex, age, baseline fitness, and duration of mask use. • Precision of Association: No concerns with precision. • Consistency of Association: The evidence is inconsistent. • Applicability of Association: The populations and settings were directly applicable to the question. One cross-sectional study[51] (N = 116) reported pain was more frequent in N95 respirator users than in surgical mask users. • One cross-sectional study[51] (N = 116) conducted in two Italian university hospitals reported an increase in facial pain among HCP wearing N95s for eight or more hours compared to HCP wearing surgical masks when controlling for confounding factors that were not reported [2.9±2.8 vs. 1.6±2.8, p = 0.007]. Pain was measured using a questionnaire in which participants rated their experience with facial pain on a scale of 0-10, where 0 represents any disturbance and 10 represents complete alteration. Mask use was reported via questionnaire and compliance was not measured. Two cross-sectional studies[48, 54] (N = 1,473) reported no difference in frequency of facial or ear pain between N95 respirator users and surgical mask users. • One cross-sectional study[54] (N = 1,090) conducted in 12 hospitals in China reported no difference in face pain between HCP who reported using N95 respirators and HCP who reported using surgical masks [34.56% vs. 37.53%, p = 0.503]. Face pain was reported via an online survey and compliance was not measured. • One cross-sectional study[48] (N = 383) conducted in three hospitals in Pakistan reported no difference in indentation and ear pain between HCP who reported using N95 respirator and those who reported using surgical masks [52.6% vs. 51.9%, p = 0.885]. Indentation and ear pain was reported via face-to-face or telephonic interviews and compliance was not measured.

Outcome	Results
Skin Barrier Damage	Evidence from five studies[46, 48, 49, 54, 57] (N = 2,036) suggests a higher frequency of skin barrier damage in N95 respirator users compared with surgical mask users. • Strength of Association: All studies were subject to sampling bias, recall bias, and confounding by task, sex, age, baseline fitness, and duration of mask use. Three studies[48, 54, 57] were subject to confounding by work site. • Precision of Association: No concerns with precision. • Consistency of Association: The evidence is consistent. • Applicability of Association: The populations and settings were directly applicable to the question. Five cross-sectional studies[46, 48, 49, 54, 57] (N = 2,036) reported that skin barrier damage was more frequent in N95 respirator users than in surgical mask users • Two cross-sectional studies[49, 57] (N = 407) reported increased odds of lesions among N95 respirator users compared with surgical mask users following unknown durations of PPE use. The studies were conducted in the main isolation center for COVID-19 in Barbados[49] and a Korean university hospital.[57] Mask usage was measured via questionnaire and compliance was not measured in both studies. Both studies reported confidence intervals that were wide, deceasing confidence in the results. • Three cross-sectional studies[46, 48, 54] (N = 1,629) reported that skin barrier damage was more frequent in N95 respirator users compared to surgical mask users. In all three studies, mask usage was self-reported and compliance was not assessed. Prior skin sensitivities, sex, age, and duration of use may have confounded these results.
Itching	Evidence from five studies [31, 48, 51, 53, 58] (N = 5,026) suggests itching and rashes is more frequent in N95 respirator users than in surgical mask users. • Strength of Association: All studies were subject to recall bias, four studies were subject to sampling bias,[48, 51, 58] four studies[31, 48, 51, 58] were subject to confounding by work site, task, sex, age, baseline fitness, and duration of mask use, and one[58] was subject to confounding by user errors. • Precision of Association: One study[53] reported small sample size. • Consistency of Association: The evidence is inconsistent. • Applicability of Association: The populations and settings were directly applicable to the question. Evidence from four studies[31, 48, 51, 53] (N = 1,974) suggests no difference in frequency of itching between N95 respirator users and surgical mask users. • One cluster RCT,[31] two cross-sectional studies,[48, 51] and one quasi-experimental study[53] reported no difference in the frequency of itching or rashes between N95 respirator users and surgical mask users. Mask compliance was not assessed in three studies,[48, 51, 53] rash and itching was self-reported in all studies, and one study[48] had a small sample size. Evidence from one cross-sectional study[58] (N = 3,052) suggests that itching was more frequent in N95 respirator users than in surgical mask users.

Outcome	Results
	• One study[58] (N = 3,052) conducted in Portuguese healthcare organizations reported more frequent skin rash or itching with the use of N95 respirators compared to surgical masks [37.5% vs. 19.4%, p < 0.001]. Tasks performed while wearing masks were not known, rash and itching was self-reported, and compliance was unclear.

Table 10. Association between Psychological Adverse Events and Medical/ Surgical Masks compared with N95 Respirators

Outcome	Results
Fatigue	Evidence from three studies[50, 53, 61] (N = 413) suggests fatigue is more frequent in N95 respirator users than in surgical mask users. • Strength of Association: Two studies[50, 53] did not measure compliance to face masks, one study[61] was subject to confounding by work site, and two studies[50, 53] were subject to confounding by task, by the pandemic, and work duration. • Precision of Association: Two studies[53, 61] reported small sample sizes. • Consistency of Association: The evidence is consistent. • Applicability of Association: The populations and settings were directly applicable to the question. Three studies[50, 53, 61] (N = 413) reported data suggesting fatigue and drowsiness were more frequent in N95 respirator users than surgical mask users. • One RCT study[61] (N = 68) conducted in a Taiwanese tertiary care center found that fatigue was reported by more N95 respirator users than surgical mask users after eight hours of continuous use [9/34 (26.5%) vs. 0/34 (0%), p = 0.001]. HCP working in high-risk COVID-19 settings were assigned N95s and those working in low-risk settings were assigned surgical masks, and all HCP followed masking rules set by the hospital. Sample size was small, limiting the confidence in these findings. • One quasi-experimental study[53] (N = 34) in a Turkish tertiary care center reported a higher prevalence of fatigue [21/34 (61.8%) vs. 5/34 (17.6%), p < 0.001] and drowsiness [16/24 (47.1%) vs. 2/34 (5.9%), p = 0.001] among HCP wearing N95s compared to HCP wearing surgical masks. HCP wore a surgical mask or an N95 respirator for an unclear duration between one to four hours on one day and then wore the other mask type on another day, and it is unclear what activities were performed while wearing either a surgical mask or N95 respirator, decreasing confidence in the results. In addition, compliance was not measured, and the sample size is small. • One cross-sectional study[50] (N = 311) conducted in one Turkish hospital reported that HCP who used filtering facepiece respirators regularly scored a mean 8.59±5.48 while HCP who used surgical masks regularly scored a mean 6.04±4.41, (p <

Outcome	Results
	0.001) on fatigue when using the Epworth sleepiness scale. The sum of each score ranges from zero to twenty-four, with scores higher than ten indicating excessive daytime sleepiness. Mask assignment was not described, and compliance was not measured.

Table 11. Association between Occupational Adverse Events and Medical/ Surgical Masks compared with N95 Respirators

Outcome	Results
Difficulty talking	The evidence from five studies[31, 45, 56, 58, 61] (N = 4,657) suggests difficulty talking is more frequent in N95 respirator users than surgical mask users. • Strength of Association: Three studies[56, 58, 61] were subject to sampling bias, two studies[31, 58] were subject to recall bias, and one[56] was subject to reporting bias. The studies were subject to confounding by sex, age, role, task, user errors,[58] and duty of work.[61] • Precision of Association: Three studies[45, 56, 61] reported a small sample size, and one study[61] reported little to no events. • Consistency of Association: The evidence is inconsistent. • Applicability of Association: The populations and settings were directly applicable to the question. One study[56] (N = 76) reported no difference in difficulty talking among surgical mask or N95 respirator users. • One cross-sectional study[56] (N = 76) conducted in a Nigerian hospital reported difficulty talking was reported by 13/28 (46.4%) N95 respirator users and 23/48 (47.9%) surgical mask users (p = 0.9). Participants were assessed in the mask available to them and participants who removed masks before the end of the study period were excluded from the data analysis for noncompliance. The sample size was small, and tasks were unknown, limiting the confidence in these findings. Four studies[31, 45, 58, 61] (N = 4,581) reported that difficulty talking was more frequent in N95 respirator users than in surgical mask users. • Two RCTs,[31, 61] one quasi-experimental study,[45] and one cross-sectional study[58] reported a higher frequency of difficulty communicating among N95 respirator users compared to surgical mask users. One quasi-experimental study[45] (N = 20) reported that speech intelligibility of nurses from a human speaker wearing a N95 respirator was approximately 10% lower than when using surgical mask in presence of background noise levels (p < 0.01). Mask usage was self-reported in one study,[58] the sample size was small in two studies,[45, 61] and difficulty talking was self-reported in three studies.[31, 58, 61]

C.2. Extracted Evidence Relevant to the Comparison of N95 Respirators with Medical/ Surgical Masks among Healthcare Personnel

Table 12. Extracted Studies Reporting the Association between Respiratory Illness and Medical/ Surgical Masks compared with N95 Respirators

Study	Population and setting	Intervention	Definitions	Results
Author: Anshory[19] **Year:** 2022 **Data extractor:** DOS **Reviewer:** CNS **Study design:** Cohort **Study objective:** To assess the several risk factors associated with the incidence of vaccine breakthrough in HCP who were already fully vaccinated. **IVA:** • Recall bias • Potential confounding (eye protection) • Small sample size, small cell size for mask type	**Population:** N = 184 HCP **Setting:** Hospital **Location:** Indonesia **Study dates:** January – September 2021 **Matching:** None **Inclusion criteria:** Doctors or nurses who worked in the hospital, were 18-59 years old, and received two intramuscular injections of COVID-19 vaccine within the interval of 14 days, with each injection containing 3 µg/doses or equal to 600 SU inactivated SARS-CoV-2 virus. **Exclusion criteria:** HCP who were pregnant or breastfeeding, had an unstable condition due to some comorbidities (e.g., flare or uncontrolled autoimmune disease, history of anaphylactic reaction due to vaccination, asthma attack, unstable heart failure, or acute complications of diabetes), have a severe liver or renal impairment, or previously recovered from COVID-19 in less	**N95 respirator Intervention group:** n = 82 HCP • **Type of Mask:** N95 • **Mask compliance:** NR **KN95 respirator Intervention group:** n = 50 HCP • **Type of Mask:** KN95 • **Mask compliance:** NR **KF94 respirator Intervention group:** n = 6 HCP • **Type of Mask:** KF94 • **Mask compliance:** NR **Control group:** n = 13 HCP • **Type of Mask:** Surgical mask • **Mask compliance:** NR **Exposure assignment or ascertainment:** Self-reported type of mask worn when not treating COVID-19 patients via electronic-based questionnaire administered monthly or when symptomatic **Standard preventive measures:** HCP attending COVID-19 wards wore PPE according to hospital's WHO and CDC guidelines.	**Outcome definitions:** *COVID-19 infection:* Positive results of SARS-CoV-2 from respiratory specimen by RT-PCR; cases were classified as having asymptomatic, mild, moderate, severe, or critical illness according to NIH *Mask compliance:* Self-reported wearing mask during activities when not handling COVID-19 patients; answers were categorized into often (always complied every day without being absent), sometimes (absent from complying at least one day in a week), and never (did not comply at all) **Case ascertainment:** HCP who reported clinical symptoms of COVID-19 via electronic-based questionnaire underwent testing the day of reporting. Clinical symptoms of suspected COVID-19 included: fever (body temperature recorded above 38°C or subjective fever), nausea, cough (dry or productive), shortness of breath, chest pain or tension, fatigue or malaise, sore throat, headache, nasal discharge, constipation, muscle pain, nausea or vomiting, diarrhea, stomach pain, smell or taste changes, loss of appetite, as well as red or bruised toes or legs. All participants who did not have any COVID-19 symptoms also underwent testing at the end of the month each month.	**Respiratory infection outcomes:** *aRR1: Adjusted relative risk; model includes age, sex, presence of comorbidity, profession, contact with COVID-19 patients, place of contact, type of mask, wearing of mask during activities, and fruit and vegetable consumption* *aRR2: Adjusted relative risk; model includes profession, contact with COVID-19 patients, place of contact, type of mask, wearing of mask during activities, and fruit and vegetable consumption* *aRR3: Adjusted relative risk; model includes age, sex, and presence of comorbidity* *RR: Relative risk* *COVID-19 infection (surgical mask is reference group):* N95 respirator • aRR1: 0.05 (95% CI: 0.01 – 0.45), p = 0.007 • aRR2: 0.06 (95% CI: 0.01 – 0.49), p = 0.009 • aRR3: 0.25 (95% CI: 0.07 – 0.87), p = 0.029 • RR: 0.29 (95% CI: 0.09 – 0.97), p = 0.044 KN95 respirator • aRR1: 0.06 (95% CI: 0.01 – 0.51), p = 0.011 • aRR2: 0.06 (95% CI: 0.01 – 0.51), p = 0.10 • aRR3: 0.27 (95% CI: 0.07 – 0.97), p = 0.045 • RR: 0.28 (95% CI: 0.08 – 0.99), p = 0.048 KF94 respirator • aRR3: 0.14 (95% CI: 0.01 – 1.60), p = 0.114 • RR: 0.17 (95% CI: 0.02 – 1.91), p = 0.151 **Other related outcomes:** *Mask compliance, n/N (%):* • Often: 116/184 (63%) • Sometimes: 51/184 (27.7%) • Never: 17/184 (9.2%) **Adverse events:** NR **Cost information:** NR

Study	Population and setting	Intervention	Definitions	Results
	than three months before undergoing vaccination.		**Sampling methods:** Pharyngeal swabs **Diagnostic tests:** RT-PCR **Comments:** None	
Author: Belan[20] **Year:** 2022 **Data extractor:** MC/JH **Reviewer:** DOS **Study design:** Matched case-control **Study objective:** To identify occupational and non-occupational exposures, and PPE use associated with COVID-19 risk for HCP working in primary care, long-term care facilities (LTCFs) or hospitals. **IVA:** • Recall bias • Potential confounding (eye protection, patient mask use, community contact) • Compliance not reported	**Population:** N = 2,074 HCP **Setting:** Healthcare sector: hospitals, LTCFs, and primary care facilities **Location:** France **Study dates:** April 10 – July 9, 2021 **Matching:** 1:1 matching for 10-year age categories, sex and residential region **Inclusion criteria:** Cases: HCP contacted by the French National Health Insurance with confirmed COVID-19 who responded to email within a week after notification of positive test and selected 'healthcare worker or working within health field' in questionnaire. Controls: HCP contacted by IPSOS and members of 24 professional societies who identified as HCP and reported no	**Cases:** n = 1,080 Laboratory-confirmed COVID-19 who identified as 'healthcare worker or working within health field' • **Type of Mask:** Surgical facemask (n = 331) or N95 respirator (n = 749) • **Mask compliance:** NR **Controls:** n = 994 Participants declaring to be HCP and reporting no previous symptoms or positive test • **Type of Mask:** Surgical facemask (n = 253) or N95 respirator (n = 741) • **Mask compliance:** NR **Case ascertainment:** All laboratory-confirmed cases (either nasopharyngeal RT-PCR or antigenic test) of COVID-19 were compiled by French National Health Insurance. **Standard preventive measures:** NR	**Exposure definitions:** *Consistent mask use:* Self-reported consistent use of N95 respirator or surgical face mask among HCP who cared for COVID-19 patients during past 10 days **Exposure ascertainment:** Online questionnaires on HCP exposures and PPE use over the 10-day period preceding symptom onset for cases (or testing if asymptomatic) and the 10-day period preceding questionnaire completion for controls **Comments:** None	**Respiratory infection outcomes:** *aOR: Adjusted odds ratio; model includes age, sex, COVID-19 immunization status, smoking status, healthcare sector, HCP professional category, COVID-19 exposure, mask type, wearing of gloves, wearing of eye protection, wearing of gown, wearing of apron, and status on caring for COVID-19 patients* *OR: Odds ratio* *Consistent mask use (N95 respirator compared to surgical facemask as reference):* • aOR: 0.85 (95% CI: 0.55-1.29) • OR: 0.64 (95% CI: 0.50-0.83) N95 respirator, n/N (%): • Cases: 749/1,080 (68.8%) • Controls: 741/994 (74.2%) Surgical masks, n/N (%): • Cases: 331/1,080 (30%) • Controls: 253/994 (25%) **Other related outcomes:** NR **Adverse events:** NR **Cost information:** NR

Study	Population and setting	Intervention	Definitions	Results
	previous symptoms or positive COVID-19 test. **Exclusion criteria:** Individuals with missing data in questionnaire.			
Author: Carazo[21] **Year:** 2022 **Data extractor:** ECS **Reviewer:** DOS **Study design:** Case-control **Study objective:** To evaluate (1) the demographic and employment characteristics of HCWs associated with COVID-19 and (2) the association between the risk of infection and various exposures or IPC measures among patient-facing HCP. **IVA:** • Recall bias • Potential confounding (HCP task, eye protection, patient mask use) • Compliance not reported	**Population:** N = 3,408 HCP **Setting:** Multiple healthcare facilities **Location:** Canada **Study dates:** November 2020– July 2021 **Matching:** 1:1 ratio was chosen balancing statistical power and logistic constrains for additional recruitment. During the peaks of the second pandemic wave (epi-weeks 2020-47 to 2021-05) and the third wave (epi-weeks 2021-14 to 2021-19), 750 controls per week were randomly sampled, whereas 550 controls were sampled in weeks with low case incidence (epi-weeks 2021-06 to 2021-13 and epi-weeks 2021-20 and 2021-21). Cases & and controls censored after inclusion so that each HCW participated only once. **Inclusion criteria:** HCP who were tested for SARS-CoV-2 infection by	**Cases:** n = 2,046 HCP High-risk HCP who tested positive for SARS CoV-2 infection the first time by PCR • **Type of mask:** N95 respirator or medical mask • **Mask compliance:** NR **Controls:** n = 1,362 HCP High-risk HCP who tested negative for SARS CoV-2 by PCR • **Type of mask:** N95 respirator or medical mask • **Mask compliance:** NR **Case ascertainment:** Data extracted from provincial laboratory COVID-19 database that contains records of all PCR testing in province. Study sample extracted from PCR results that occurred November 2020 and February 2021. **Standard preventive measures:** Recommendations for PPE use evolved during the study period. From mid-February 2021 onward, N95 respirator use was required for any contact with confirmed COVID-19 patients. From the end of March onward, N95 respirator use was required for any contact with suspected COVID-19 patients.	**Exposure definitions:** *Type of mask used during non-AGMP contact with COVID-19 patients:* Self-reported via questionnaire, and categorized as use of N95 respirators always or most of the time; or the use of medical masks when caring for COVID-19 patients during non-AGMPs *Household exposure to COVID-19:* Self-reported via questionnaire *Workplace exposure to COVID-19:* Self-reported via questionnaire **Exposure ascertainment:** HCPs were contacted by phone between December 3, 2020 – July 31, 2021, and were invited to complete a self-administered online (or by phone if preferred) questionnaire **Comments:** None	**Respiratory infection outcomes:** *aOR: Adjusted odds ratio; model includes sex, age, born abroad, race/ethnicity, native language, type of employment, department, type of facility, health region and all other presented exposures, IPC practices, and vaccination status.* *OR: Odds ratio* *Type of mask used during non-AGMP contact with COVID-19 patients (N95 respirator always or most of the time vs. medical mask as reference):* • aOR: 0.7 (95% CI: 0.5 – 0.9) • OR: 0.7 (95% CI: 0.5 – 0.9) N95 respirator always or most of the time, n/N (%): • Cases: 127/2,046 (9.3%) • Controls: 116/ 1,362 (19.8%) Medical mask, n/N (%): • Cases: 1,154/2,046 (84.5%) • Controls: 415/1.362 (70.7%) **Other related outcomes:** *Household exposure to COVID 19, n/N (%):* • aOR: 7.8 (95%CI: 5.2 – 11.8), p = NR • OR: 3.3 (95% CI: 2.3 – 4.7), p = NR • Cases: 176/2,046 (8.6%) • Controls: 38/1.362 (2.8%) *Workplace exposure to COVID 19, n/n (%):* • aOR: 2.7 (95% CI: 2.2 – 3.3), p = NR • OR: 2.6 (95% CI: 2.3 – 3.1), p = NR • Cases: 1,365 /2,046 (66.7%) • Controls: 587/1.362 (43.1%)

Study	Population and setting	Intervention	Definitions	Results
	PCR between November 15, 2020 – May 29, 2021, had worked in any facility of Québec province during the 2 weeks prior to testing, and spoke French or English. Nursing staff, patient-care assistants and physicians working in acute-care hospitals, long-term care facilities, or private residences for elderly were considered high-risk caregivers. **Exclusion criteria**: Not being an HCP, not having a positive PCR test if a case, having a positive PCR test is a control, working from home, not having worked during the 14 days prior to testing, and other reasons.			*Workplace exposure to COVID 19 coworkers, n/N (%):* • aOR: 2.2 (95% CI: 1.8 – 2.7), p = NR • OR: 3.3 (95% CI: 2.8 – 3.9), p = NR • Cases: 1,170 /2,046 (57.2%) • Controls: 475/1.362 (34.9%) **Adverse events:** NR **Cost information:** NR
Author: Chokephaibulkit[22] **Year:** 2012 **Data extractor:** DOS **Reviewer:** CNS **Study design:** Cohort **Study objective:** To understand the magnitude of acquisition of infections among	**Population:** N = 256 HCP **Setting:** 3 ERs, 4 pediatric wards, 3 adult wards, and 3 ICUs at 2 public tertiary care hospitals **Location:** Thailand **Study dates:** October 1 – 19, 2009 **Matching:** NR	**Intervention group:** n = 142 HCP • **Type of Mask:** N95 respirator • **Mask compliance:** NR **Control group:** n = 78 HCP • **Type of Mask:** Surgical mask • **Mask compliance:** NR **Exposure assignment or ascertainment:** Mask type used when caring for patients with suspected/confirmed 2009 H1N1 collected via anonymous self-administered questionnaire with no verification of accuracy of responses	**Outcome definitions:** *2009 H1N1 infection:* Hemo-agglutination titer ≥40 defined as seropositive and a marker of acquiring recent infection assuming that none of the HCP had been infected with the 2009 H1N1 virus prior to the outbreak and that pre-existing HI antibody to 2009 H1N1 was uncommon *Adherence to mask use:* Self-reported adherence during exposure events when in contact with patients with suspected 2009 H1N1 infection	**Respiratory infection outcomes:** *OR: Odds ratio* *2009 H1N1 infection, n/N (%):* • OR: 1.2 (95% CI: 0.4 – 2.9), p = 0.73 • N95 respirator: 16/142 (11.3%) • Surgical mask: 10/78 (12.8%) **Other related outcomes:** *Adherence to mask use:* 73.8% **Adverse events:** NR **Cost information:** NR

Study	Population and setting	Intervention	Definitions	Results
HCP in relation to self-reported infection control practices and the risk factors associated with infection during the outbreak. **IVA score:** 17 (high) • Recall bias • Sampling bias • Compliance not reported • Potential confounding (HCP task, eye protection, patient mask use, coworker contact, community contact)	**Inclusion criteria:** Frontline HCP who worked during the peak of the 2009 H1N1 outbreak (June – August 2009) on wards that cared for patients with influenza and at emergency rooms. **Exclusion criteria:** NR	**Standard preventive measures:** Wards were classified as isolation wards (1-3 patients in a room, PPE practice for airborne and contact precautions when entering patients' room), semi-open ward (share up to 12 patients in a room, PPE practice of airborne and contact precaution when entering patients' area), and open ward or emergency room (large ward up to 24 beds or walk-in patients, PPE practice for contact and droplet precaution as needed)	**Case ascertainment:** Single assessment of HI titer following self-administered questionnaire **Sampling methods:** Blood draw **Diagnostic tests:** HI assay **Comments:** None	
Author: Cummings[23] **Year:** 2021 **Data extractor:** MC **Reviewer:** DOS/CNS **Study design:** Per protocol analysis of a cluster RCT **Study objective:** To assess the association of worker characteristics, occupational roles and behaviors, and participation in procedures with the risk of endemic	**Population:** N = 4,689 HCP seasons **Setting:** 137 outpatient sites at 7 U.S. health systems **Location:** The United States **Study dates:** 2011 – 2016 **Matching:** None **Inclusion criteria:** HCP ≥ 18 years old that were full-time employees with direct patient care for ≥24 hours per week and worked ≥75% of working hours at the	**Intervention group:** n = 2,243 Infection control practices included HCP to wear N95 respirators when positioned within 6 feet of patients with signs or symptoms of respiratory illness, to follow study site health system policies reflecting Centers for Disease Control and Prevention (CDC) guidance • **Type of Mask:** N95 respirator • **Mask compliance:** NR **Control group:** n = 2,446 Infection control practices included HCP to wear medical masks when positioned within 6 feet of patients with signs or symptoms of respiratory illness, to follow study site health system policies reflecting Centers for Disease Control and Prevention (CDC) guidance	**Outcome definitions:** *Laboratory-confirmed CoV:* Endemic coronaviruses that circulate widely in humans (strains HKU1, OC43, NL63, 229E, and HKU1) **Case ascertainment:** Participants reported symptoms weekly and underwent anterior nasal and pharyngeal swabbing when ill with signs or symptoms of respiratory illness and twice at randomly selected times when asymptomatic during each respiratory virus season for 4 consecutive years **Sampling methods:** Swabs of anterior nasal and pharyngeal	**Respiratory infection outcomes:** *aOR: Adjusted odds ratio* *OR: Univariate odds ratio* *Laboratory-confirmed CoV:* • aOR: 0.71 (95% CI: 0.49-1.03) • OR: 0.74 (95% CI: 0.52-1.06) • Intervention: 172/2,243 (7.7%) • Control: 215/2,446 (8.8%) **Other related outcomes:** NR **Adverse events:** NR **Cost information:** NR

Study	Population and setting	Intervention	Definitions	Results
coronavirus infection among HCP who participated in the Respiratory Protection Effectiveness Clinical Trial (ResPECT), a cluster randomized trial to assess personal protective equipment to prevent respiratory infections and illness conducted from 2011 to 2016. **IVA:** • Recall bias • Potential confounding (eye protection, patient mask use) • Compliance not reported **Related to:** Radonovich 2019	study site, and self-identified as routinely positioned within six feet of patients (Radonovich 2019). **Exclusion criteria:** Cluster size below a preestablished threshold of 2, medical conditions precluding safe participation, or anatomic features that could interfere with respirator fit, such as facial hair or third-trimester pregnancy (Radonovich 2019).	• **Type of Mask:** Medical mask • **Mask compliance:** NR **Exposure assignment or ascertainment:** Self-reported adherence to PPE weekly, which was measured as "always," "sometimes," "never," and "did not recall." **Standard preventive measures:** Hand hygiene	**Diagnostic tests:** Multiplex reverse-transcription polymerase chain reaction **Comments:** None	
Author: Dorr[24] **Year:** 2022 **Data extractor:** DOS **Reviewer:** CNS **Study design:** Cohort **Study objective:** To analyze the SARS-CoV-2 risk for HCP depending on	**Population:** N = 2,919 HCP **Setting:** 7 healthcare networks **Location:** Switzerland **Study dates:** September 2020 – September 2021 **Matching:** None	**Intervention group:** n = 638 HCP N95 respirator only • **Type of Mask:** N95 respirator • **Mask compliance:** NR **Control group:** n = 2,281 HCP Surgical mask only or mixed mask use • **Type of Mask:** Surgical mask, N95 • **Mask compliance:** NR **Exposure assignment or ascertainment:** HCP indicated which mask type they had used in contact (if	**Outcome definitions:** *SARS-CoV-2 infection:* Self-reported positive nasopharyngeal swab and/or anti-nucleocapsid seroconversion from baseline *Mask use outside work:* Self-reported always wearing a mask outside of work **Case ascertainment:** Weekly follow-up evaluations where HCP indicated results of symptom-based swabs; HCP screened for anti-nucleocapsid antibodies in	**Respiratory infection outcomes:** *aOR: Adjusted odds ratio; generalized mixed-effects model using healthcare networks as random effect adjusts for a priori-defined covariables* *OR: Odds ratio* *SARS-CoV-2 infection, n/N (%):* • aOR: 0.56 (95% CI: 0.43 – 0.74), p < 0.001 • OR: 0.57 (95% CI: 0.45 – 0.73), p < 0.001 • Always N95 respirator: 132/638 (20.7%) • Surgical/mixed masks: 617/2,281 (27.0%)

Study	Population and setting	Intervention	Definitions	Results
cumulative exposure to patients with COVID-19 and assess whether this risk can be modulated by the use of respirator compared with surgical masks. **IVA score:** 18 (moderate) • Recall bias • Sampling bias • Compliance not reported • Potential confounding (HCP task, eye protection, patient mask use, coworker contact) **Related to:** Haller 2022[26]	**Inclusion criteria:** Volunteer HCP aged ≥18 years old **Exclusion criteria:** None	any) with patients with COVID-19 in the last 12 months outside of AGPs **Standard preventive measures:** NR	January and September 2021. Accuracy of self-reported tests was verified using a subgroup of HCP from the largest participating institution; all self-reported positive tests and a random sample of negative test results were cross-checked with database from division of occupational health. **Sampling methods:** Nasopharyngeal swabs **Diagnostic tests:** PCR or rapid antigen test **Comments:** None	*SARS-CoV-2 infection among HCP exposed to patients, %:* • OR: 0.49 (95% CI: 0.39 – 0.61), p = NR • Always N95 respirator: 21% • Surgical/mixed masks: 35% **Other related outcomes:** *Mask use outside work:* • aOR: 1.33 (95% CI: 0.91 – 1.93), p = 0.14 • OR: 1.25 (95% CI: 0.93 – 1.68), p = 0.15 • Always wearing mask outside work: 69/231 (29.9%) • Surgical/mixed masks: 680/2,688 (25.3%) **Adverse events:** NR **Cost information:** NR
Author: Haas[25] **Year:** 2021 **Data extractor:** DOS **Reviewer:** CNS **Study design:** Cross-sectional **Study objective:** To determine if certain PPE types are associated with a risk of self-reported COVID-19 infection in clinicians.	**Population:** N = 801 **Setting:** NR **Location:** NR **Study dates:** June 15 – July 9, 2020 **Inclusion criteria:** Self-identifying clinicians recruited using social media posts on clinician groups soliciting participation in a brief survey. Electronic informed consent was obtained.	**Intervention group:** n = NR Disposable respirator worn during an encounter with a symptomatic patient • **Type of Mask:** Disposable N95 respirator • **Mask compliance:** NR **Control group:** n = NR Surgical mask worn during an encounter with a symptomatic patient • **Type of Mask:** Standard surgical mask • **Mask compliance:** NR **Exposure assignment or ascertainment:** Self-reported **Standard preventive measures:** NR	**Outcome definitions:** *COVID-19:* Self-reported COVID-19 infection **Case ascertainment:** Survey **Sampling methods:** None **Diagnostic tests:** None **Comments:** None	**Respiratory infection outcomes:** *aOR: Adjusted odds ratio; model includes asymptomatic patients do not wear masks, PPE worn during symptomatic encounter, and eye protection worn* *OR: Odds ratio* *COVID-19 (surgical mask ref):* Disposable respirator • aOR: 0.54 (95% CI: 0.2-1.3), p = 0.17 • OR: 0.51 (95% CI: 0.2-1.2), p = 0.12 • Intervention: 31/490 (6.3%) • Control: 7/69 (10.1%) **Other related outcomes:** NR **Adverse events:** NR **Cost information:** NR

Study	Population and setting	Intervention	Definitions	Results
IVA: • Recall bias • Sampling bias (online questionnaire) • Potential confounding (HCP task, coworker contact, community contact) • Compliance not reported	**Exclusion criteria:** NR			
Author: Haller[26] **Year:** 2022 **Data extractor:** DCB **Reviewer:** DOS **Study design:** Prospective cohort **Study objective:** To assess the effectiveness of FFP2 compared to surgical masks regarding SARS-CoV-2 protection for HCP involved in patient care. **IVA:** • Recall bias • Sampling bias • Compliance not reported • Potential confounding (eye protection, patient mask use)	**Population:** N = 3,259 **Setting:** Seven acute care institutions, one rehabilitation clinic, and three psychiatry clinics in four cantons **Location:** Switzerland **Study dates:** June 22, 2020 – March 9, 2021 **Matching:** NA **Inclusion criteria:** HCP over 16 years of age in the four study cantons who agreed to participate and had patient contact. **Exclusion criteria:** NR	**Intervention group:** n = 716 • HCP who reported "Mostly use of FFP2" or "Use of FFP2 only" when asked about mask type outside of AGP during COVID-19 patient contact. • **Type of Mask:** FFP2 • **Mask compliance:** NR **Control group:** n = 2,543 HCP who reported "Use of surgical mask only," "Mostly use of surgical mask," or "Equal use of both mask types" when asked about mask type outside of AGP during COVID-19 patient contact. • **Type of Mask:** Surgical • **Mask compliance:** NR **Exposure assignment or ascertainment:** Questionnaire **Standard preventive measures:** During the study period, a national policy required residents including HCP to wear at least a surgical mask at work. The Swiss National Centre for Infection Prevention suggested the use of a respirator mask only while performing aerosol generating	**Outcome definitions:** *Self-reported SARS-CoV-2 infection:* Time to first self-reported positive nasopharyngeal swab test results via online questionnaire. HCP reported results in weekly questionaries. *SARS-CoV-2 serologic conversion:* Baseline (June – August 2020) and follow-up (January – February 2021) serologies were performed. HCP with positive serology at baseline were excluded from this analysis. **Case ascertainment:** Participants received weekly text messages and emails with a link to a questionnaire where they indicated results of nasopharyngeal swabs (polymerase chain reaction or laboratory confirmed rapid antigen tests) for SARS-CoV-2. To verify that self-reported test results were accurate and complete, researchers cross-checked all reported positive test and a random sample of negative	**Respiratory infection outcomes:** *aHR: Adjusted hazard ratio; cox regression model included COVID-19 exposures, number of negative swabs, HCP characteristics including PPE use* *HR: Hazard ratio; log rank test* *aOR: Adjusted odds ratio; multivariable analysis included HCP characteristics including PPE use* *OR: Odds ratio* *Self-reported SARS-CoV-2 infection:* • aHR: 0.8 (95% CI: 0.6-1.0), p = 0.052) • HR: 0.8 (95% CI: 0.6–1.0) p = 0.06 • Intervention: 81/716 (11%) • Control: 352/2,543 (14%) *SARS-CoV-2 serologic conversion:* • aOR: 0.7 (95% CI: 0.5-1.0), p = 0.053 • OR: 0.6 (95%CI 0.5–0.8) p < 0.001 • Intervention: 85/658 (12.9%) • Control: 429/2,258 (18.9%) **Other related outcomes:** NR **Adverse events:** NR **Cost information:** NR

Study	Population and setting	Intervention	Definitions	Results
		procedures on confirmed or suspected COVID-19 patients.	test results with the database of the division of occupational health for a subgroup of HCP from the largest participating institution. **Sampling methods:** Nasopharyngeal swab **Diagnostic tests:** PCR, rapid antigen test, and electro-chemiluminescence immunoassay **Comments:** None	
Author: Khurana[27] **Year:** 2021 **Data extractor:** MC/CNS **Reviewer:** DOS **Study design:** Case-control **Study objective:** To look at the infection rate, efficacy and usage of masks, prophylactic measures being used by the healthcare workers and the various factors associated with a positive COVID-19 result, which may help in formulating better strategies to help prevent contracting	**Population:** N = 181 **Setting:** Tertiary care hospital **Location:** India **Study dates:** April – May 2020 **Matching:** A matched cohort of healthcare workers who tested negative was taken as the control group **Inclusion criteria:** Cases: HCP who tested positive for COVID-19. Controls: Matched cohort of HCP who tested negative for COVID-19. **Exclusion criteria:** NR	**Cases:** n = 94 RT-PCR confirmed SARS-CoV-2 • **Type of Mask:** N95 respirator or 3-ply mask • **Mask compliance:** NR **Controls:** n = 87 Negative RT-PCR for SARS-CoV2 • **Type of Mask:** N95 respirator or 3-Ply mask • **Mask compliance:** NR **Case ascertainment:** Evaluation of health records **Standard preventive measures:** NR	**Exposure definitions:** *Mask use:* Self-reported use of N95 respirator or 3-ply mask was present in survey *Minimum level of protection:* Self-reported N95 or 3-ply mask use as a minimum level of protection among HCP **Exposure assignment or ascertainment:** Self-reported responses to a questionnaire-based survey were recorded via by telephone, text, or in-person **Sampling methods:** NR **Diagnostic tests:** RT-PCR **Comments:** Demographics of included HCP does not equal total number of HCP in each mask group, participants may have been double counted due to self-report.	**Respiratory infection outcomes:** *N95* respirator *use:* • Cases: 62/94 (66.0%) • Controls: 77/87 (88.5%) • p < 0.001 *3-ply mask use:* • Cases: 62/94 (66.0%) • Controls: 34/87 (39.1%) • p < 0.001 *Minimum level of protection (3-plu mask vs. N95* respirator *as reference):* • Cases: 60/89 (67.4%) • Controls: 30/80 (37.5%) • Adjusted p < 0.001 **Other related outcomes:** NR **Adverse events:** NR **Cost information:** NR

Study	Population and setting	Intervention	Definitions	Results
infection at the workplace. **IVA:** • Recall bias • Compliance not reported • Potential confounding (eye protection, patient mask use, HCP task, coworker contact, community contact) • Small sample size				
Author: Li[28] **Year:** 2021 **Data extractor:** DCB **Reviewer:** DOS **Study design:** Retrospective cohort **Study objective:** To describe the mask usage of HCP in a single service area and their SARS-CoV-2 infection status. **IVA:** • Recall bias • Observed compliance not reported • Potential confounding (eye protection, patient mask use,	**Population:** N = 1,414 **Setting:** Single service area of an integrated managed care consortium **Location:** California, U.S. **Study dates:** March 13 – August 3, 2020 **Matching:** NA **Inclusion criteria:** All HCP who underwent COVID-19 testing by PCR during the study period. **Exclusion criteria:** NR	**Intervention group:** n = 302 • **Type of Mask:** N95 or higher-level respirator • **Mask compliance:** NR **Control group:** n = 724 • **Type of Mask:** Medical mask (i.e., surgical or procedural mask) • **Mask compliance:** NR **Exposure assignment or ascertainment:** Mask use ascertained through structured interviews **Standard preventive measures:** Masking protocols for HCP caring for patients with confirmed or suspected COVID-19 consist of medical masks when performing non-aerosolizing, routine patient care and respirator masks for patient care in areas with high risk of aerosolizing events, identified as emergency, urgent care, and designated COVID-19 medical and surgical units and intensive care units. Patient care not related to COVID-19 and non-patient care did not require	**Outcome definitions:** *Laboratory-confirmed SARS-CoV-2:* A positive PCR result **Case ascertainment:** HCPs were identified for testing either through exposure to a patient with COVID-19 or symptomatology of potential COVID-19 as defined by CDC criteria. Testing protocol for exposure HCP was initiated on the day when exposure was identified, then again 5 to 7 days after exposure, and finally at day 14 after exposure. A symptomatic HCP was tested on the first day of reported symptoms. **Sampling methods:** NR **Diagnostic tests:** PCR **Comments:** None	**Respiratory infection outcomes:** *aOR: Adjusted odds ratio; model adjusted for HCP exposure status, presence of symptoms, presence of underlying health conditions, and work location in risk-areas* *OR: Odds ratio* *Laboratory-confirmed SARS-CoV-2:* • aOR: 1.23 (95% CI: 0.66-2.29) • OR: 1.11 (95% CI: 0.61-2.00) • N95: 17/302 (5.6%) • Medical mask: 37/724 (5.1%) • p = 0.51 **Other related outcomes:** *Self-reported compliance:* • No mask: 388/1,414 (27.4%) **Adverse events:** NR **Cost information:** NR

Study	Population and setting	Intervention	Definitions	Results
coworker contact, community contact)		any PPE until universal masking was implemented.		
Author: Loeb[30] **Year:** 2004 **Data extractor:** MC **Reviewer:** DOS **Study design:** Retrospective cohort study **Study objective:** To determine risk factors for SARS among nurses who worked in two critical care units in a hospital. **IVA:** • Recall bias • Compliance not reported • Potential confounding (eye protection, patient mask use, HCP task, coworker contact, community contact) • Small sample size	**Population:** N = 32 **Setting:** Community hospital **Location:** Canada **Study dates:** March 7 – April 3, 2003 **Matching:** None **Inclusion criteria:** Nurses who worked one or more shifts in the ICU from March 8-13 or March 17-21 when a SARS patient was in the unit, or who worked one or more shifts from March 14-16 in the coronary care unit. **Exclusion criteria:** Nurses who did not enter a SARS patient's room at least once.	**Intervention group:** n = 16 Consistent use of N95 respirator • **Type of Mask:** N95 • **Mask compliance:** NR **Control group:** n = 4 Consistent use of surgical mask • **Type of Mask:** Surgical mask • **Mask compliance:** NR **Exposure assignment or ascertainment:** Standardized data collection form to record duration, frequency, and types of PPE used when caring for SARS patients. Information from charts was then used to interview nurses about specific care provided during shifts. Information provided by nurses was corroborated whenever possible by data from charts. **Standard preventive measures:** NR	**Outcome definitions:** *Laboratory-confirmed SARS:* SARS confirmed by serology **Case ascertainment:** Nurses that met probable or suspected SARS definitions were tested for antibodies against SARS-associated coronavirus by immunofluorescence. Suspected cases were described as fever (>38° C), cough or breathing difficulty, and ≥1 of the following exposures during the 10 days before onset of symptoms: close contact with a person with suspected or probable SARS, recent travel to an area with recent local SARS transmission outside Canada, recent travel or visit to an identified setting in Canada where SARS exposure might have occurred. Probable cases were described as suspected SARS cases with radiographic evidence of infiltrates consistent with pneumonia or respiratory distress syndrome or a suspected SARS case with autopsy findings consistent with pathologic features of respiratory distress syndrome without identifiable cause. **Sampling methods:** NR **Diagnostic tests:** Immunofluorescence antibody tests	**Respiratory infection outcomes:** *RR: Relative risk* *Laboratory-confirmed SARS:* • RR 0.5 (95% CI: 0.06 - 4.23), p = 0.51 • Intervention: 2/16 (13%) • Control: 1/4 (25.0%) **Other related outcomes:** NR **Adverse events:** NR **Cost information:** NR

Study	Population and setting	Intervention	Definitions	Results
			Comments: None	
Author: Loeb[29] **Year:** 2009 **Data extractor:** CNS **Reviewer:** MC **Study design:** Noninferiority RCT **Study objective:** To compare the surgical mask with the N95 respirator in protecting health care workers against influenza. **IVA:** • Potential confounding (eye protection, patient mask use, HCP task, coworker contact, community contact)	**Population:** N = 446 **Setting:** EDs, medical units, and pediatric units of eight tertiary care hospitals **Location:** Canada **Study dates:** September 23, 2008 – April 23, 2009 **Matching:** None **Inclusion criteria:** Nurses expected to work full-time (>37 hours per week) on the study units during the 2008-2009 influenza season who had current fit-test certification and provided written informed consent. **Exclusion criteria:** Nurses who could not pass a fit test or withdrew prior to follow-up.	**Intervention group:** n = 221 Nurses were asked to begin using N95 respirator when caring for patients with febrile respiratory illness at the beginning of the influenza season, which was defined as 2 or more consecutive isolations of influenza per week in each study region, and during aerosol-generating procedures as long as tuberculosis was not suspected • **Type of Mask:** Fit-tested N95 respirator • **Mask compliance:** Medical and pediatric study units were contacted daily by telephone to assess whether any patients admitted to the unit in droplet precautions for influenza or febrile respiratory illness. If there were cases and if the primary nurse was enrolled in the study, a trained auditor stood a short distance from the patient isolation room to remain inconspicuous but within distance to accurately record the audit. Auditors were asked to remain on the unit until they recorded the type of protective equipment worn by the nurse prior to entering the isolation room. The auditor assessed compliance for one room entry per observation and full compliance in the room was not assessed. **Control group:** n = 225 Nurses were asked to begin using surgical masks when caring for patients with febrile respiratory illness at the beginning of the influenza season, which was defined	**Outcome definitions:** *Laboratory-confirmed influenza:* Detection of viral RNA using RT-PCR from nasopharyngeal and flocked nasal specimens or at least a 4-fold rise in serum antibodies to circulating influenza strain antigens (A/Brisbane/ 59/2007(H1N1), A/Brisbane/10/2007(H3N2), and B/Florida/4/2006). Calculated for unvaccinated nurses only. *Laboratory-confirmed influenza A:* Serological infection was defined by detection of 4-fold or greater increase in influenza-specific hemagglutinin inhibition assay titer between baseline and convalescent serum samples. Calculated for unvaccinated nurses only. *Laboratory-confirmed influenza B:* Serological infection was defined by detection of 4-fold or greater increase in influenza-specific hemagglutinin inhibition assay titer between baseline and convalescent serum samples. Calculated for unvaccinated nurses only. *Laboratory-confirmed influenza A/Brisbane/59/2007 (H1N1):* Serological infection was defined by detection of 4-fold or greater increase in influenza-specific hemagglutinin inhibition assay titer between baseline and convalescent serum samples	**Respiratory infection outcomes:** *RD: Absolute risk difference* *Laboratory-confirmed influenza:* • RD: -0.73 (95% CI: -8.8-7.3), p = 0.86 • Intervention: 48/210 (22.9%) • Control: 50/212 (23.6%) *Laboratory-confirmed influenza A:* • RD: -1.88 (95% CI: -4.13-0.36), p = 0.22 • Intervention: 1/210 (0.5%) • Control: 5/212 (2.4%) *Laboratory-confirmed influenza B:* • RD: 0.96 (95% CI: -0.89-2.81), p = 0.37 • Intervention: 3/210 (1.4%) • Control: 1/212 (0.5%) *Laboratory-confirmed influenza A/Brisbane/59/2007 (H1N1):* • RD: -1.79 (95% CI: -7.73-4.15), p = 0.55 • Intervention: 21/210 (10.0%) • Control: 25/212 (11.8%) *Laboratory-confirmed influenza A/Brisbane/10/2007 (H3N2):* • RD: 3.52 (95% CI: -4.32-11.36), p = 0.38 • Intervention: 49/210 (23.3%) • Control: 42/212 (19.8%) *Laboratory-confirmed influenza B/Florida/4/2006:* • RD: 2.0 (95% CI: -3.0-7.17), p = 0.46 • Intervention: 19/210 (9.0%) • Control: 15/212 (7.1%) *Laboratory-confirmed influenza A/TN/1560/09 (H1N1):* • RD: 3.89 (95% CI: -1.82-9.59), p = 0.18 • Intervention: 25/210 (11.9%) • Control: 17/212 (8.0%) *Laboratory-confirmed RSV:*

Study	Population and setting	Intervention	Definitions	Results
		as 2 or more consecutive isolations of influenza per week in each study region, and during aerosol-generating procedures as long as tuberculosis was not suspected • **Type of Mask:** Surgical mask • **Mask compliance:** Medical and pediatric study units were contacted daily by telephone to assess whether any patients admitted to the unit in droplet precautions for influenza or febrile respiratory illness. If there were cases and if the primary nurse was enrolled in the study, a trained auditor stood a short distance from the patient isolation room to remain inconspicuous but within distance to accurately record the audit. Auditors were asked to remain on the unit until they recorded the type of protective equipment worn by the nurse prior to entering the isolation room. The auditor assessed compliance for one room entry per observation and full compliance in the room was not assessed. **Exposure assignment or ascertainment:** Randomization was performed centrally by an independent clinical trials coordinating group such that investigators were blind to the randomization procedure and group assignment was stratified by center in permuted blocks of 4 participants. **Standard preventive measures:** Gloves and gowns when entering the room of a patient with febrile respiratory illness	*Laboratory-confirmed influenza A/Brisbane/10/2007 (H3N2):* Serological infection was defined by detection of 4-fold or greater increase in influenza-specific hemagglutinin inhibition assay titer between baseline and convalescent serum samples *Laboratory-confirmed influenza B/Florida/4/2006:* Serological infection was defined by detection of 4-fold or greater increase in influenza-specific hemagglutinin inhibition assay titer between baseline and convalescent serum samples *Laboratory-confirmed influenza A/TN/1560/09 (H1N1):* Serological infection was defined by detection of 4-fold or greater increase in influenza-specific hemagglutinin inhibition assay titer between baseline and convalescent serum samples *Laboratory-confirmed respiratory syncytial virus (RSV):* Type B confirmed by RT-PCR *Laboratory-confirmed metapneumovirus:* Confirmed by RT-PCR *Laboratory-confirmed parainfluenza virus:* Parainfluenza 3 confirmed by RT-PCR *Laboratory-confirmed rhinovirus-enterovirus:* Confirmed by RT-PCR	• RD: -0.47 (95% CI: -2.07-1.13), p > 0.99 • Intervention: 1/210 (0.5%) • Control: 2/212 (0.9%) *Laboratory-confirmed metapneumovirus:* • RD: -0.46 (95% CI: -1.98-2.89), p > 0.99 • Intervention: 3/210 (1.4%) • Control: 4/212 (1.9%) *Laboratory-confirmed parainfluenza virus:* • RD: 0.48 (95% CI: -1.12-2.09), p = 0.62 • Intervention: 2/210 (1.0%) • Control: 1/212 (0.5%) *Laboratory-confirmed rhinovirus-enterovirus:* • RD: 0.99 (95% CI: -2.87-4.85), p = 0.62 • Intervention: 10/210 (4.8%) • Control: 8/212 (3.8%) *Laboratory-confirmed coronavirus:* • RD: 1.47 (95% CI: -2.68-5.62), p = 0.49 • Intervention: 12/210 (5.7%) • Control: 9/212 (4.3%) *ILI:* • RD: -3.29 (95% CI: -6.31-0.28), p = 0.06 • Intervention: 2/210 (1.0%) • Control: 9/212 (4.2%) **Other related outcomes:** *Mask compliance:* • Intervention: 6/7 (85.7%) • Control: 11/11 (100%) Based on the prespecified definition, the lower CI for the difference in effectiveness of the surgical mask and N95 respirator was within −9% and the statistical criterion of noninferiority was met. Thus, surgical masks appeared to be no worse, within a pre-specified margin, than N95 respirators in preventing influenza. **Adverse events:** NR

Study	Population and setting	Intervention	Definitions	Results
			Laboratory-confirmed coronavirus: Coronaviruses OC43, 229E, NL63, and HKU1 confirmed by RT-PCR *Influenza-like illness (ILI):* Presence of both cough and temperature ≥38°C **Case ascertainment:** All participants were assessed for signs and symptoms of influenza twice weekly using web-based questionnaires. If a new symptom was reported, the study nurse was notified and a flocked nasal specimen was obtained by the participants. HCP were asked to self-swab if fever (≥38°C), cough, nasal congestion, sore throat, headache, sinus problems, muscle aches, fatigue, earache, ear infection, or chills were present. Blood specimens for serology were obtained prior to enrollment and at the end of the follow-up period. Serological infection was defined by detection of 4-fold or greater increase in influenza-specific hemagglutinin inhibition assay titer between baseline and convalescent serum samples. Serology includes nurses who did not receive the trivalent 2008-2009 influenza vaccine. **Sampling methods:** Flocked nasal swab, nasopharyngeal swab, blood **Diagnostic tests:** Hemagglutinin inhibition assays, RT-PCR (xTAG Respiratory Virus Panel test)	**Cost information:** NR

Study	Population and setting	Intervention	Definitions	Results
			Comments: The study was stopped on April 23, 2009 due to the 2009 influenza A (H1N1) pandemic when the Ontario Ministry of Health and Long-Term Care recommended N95 respirators for all health care workers taking care of patients with febrile respiratory illness.	
Author: Loeb[17] **Year:** 2022 **Data extractor:** DOS **Reviewer:** CNS **Study design:** RCT **Study objective:** To assess whether medical masks were noninferior to N95 respirators for protection against COVID-19 among unvaccinated HCP providing routine care to patients with suspected or confirmed COVID-19. **IVA:** • Potential confounding (eye protection, patient mask use, HCP task, coworker contact, community contact)	**Population:** N = 1009 **Setting:** 29 health care facilities (27 acute care hospitals and 2 long-term care facilities) **Location:** Canada, Pakistan, Israel, and Egypt **Study dates:** May 4, 2020 – March 29, 2022 **Matching:** None **Inclusion criteria:** HCP who provided direct care to patients with suspected or confirmed COVID-19 in specialized COVID-19 units and in emergency departments, medical units, pediatric units, and long-term care facilities. HCP were required to spend ≥60% of their time doing clinical work. **Exclusion criteria:** HCP who provided care in ICUs. HCP who did not have a valid fit test	**Intervention group:** n = 500 HCP were instructed to use the medical mask when providing routine care to patients with COVID-19 or suspected COVID-19 for 10 weeks, which aligned with the current policy in their setting. HCP were could also use the N95 respirator at any time based on a point-of-care risk assessment. Participants were asked to discard the medical mask if it became soiled or damaged or if breathing through the device became difficult. If the institutional policy was for extended use and masks were not typically removed after a patient encounter, the extended use procedure was to be followed. • **Type of Mask:** ASTM International certified medical mask • **Mask compliance:** *Self-reported adherence:* Measured using weekly self-reporting for all participants *Audited adherence:* Conducted when feasible, audits were done at 3 hospitals in Pakistan and 6 in Egypt where 20% of shifts were randomly selected and trial participants were observed **Control group:** n = 509 HCP were instructed to use a fit-tested NIOSH-approved N95	**Outcome definitions:** *Laboratory-confirmed SARS-CoV-2:* COVID-19 confirmed by RT-PCR in symptomatic participants or seroconversion *PCR-confirmed SARS-CoV-2:* COVID-19 confirmed by RT-PCR *Seroconversion:* A change from negative spike IgG and nucleocapsid IgG antibodies at baseline to positive nucleocapsid IgG antibody at follow-up *Acute respiratory illness:* Fever and cough *Lower respiratory infection or pneumonia:* ND *Adverse events:* Included discomfort, skin irritation, and headaches **Case ascertainment:** Assessed for signs and symptoms of COVID-19 through twice-weekly automated text messages. Care-administered nasopharyngeal swab was obtained if at least one sign or symptom was present (fever (≥38°C), cough, or shortness of breath), or if at least two symptoms were present	**Respiratory infection outcomes:** *HR: Hazard ratio; Cox proportional hazards model stratifying by health care facility* *Laboratory-confirmed SARS-CoV-2:* • HR: 1.08 (95% CI: 0.75-1.55), p = NR • Intervention: 72/497 (14.5%) • Control: 69/507 (13.6%) *Laboratory-confirmed SARS-CoV-2 subgroup analysis, HR:* • Canada: 3.31 (95% CI: 0.87-12.62), p = NR • Israel: 1.00 (95% CI: 0.24-4.08), p = NR • Pakistan: 1.91 (95% CI: 0.52-6.93), p = NR • Egypt: 0.88 (95% CI: 0.75-1.55), p = NR *PCR-confirmed SARS-CoV-2:* • HR: 1.14 (95% CI: 0.77-1.69), p = NR • Intervention: 52/497 (10.46%) • Control: 47/507 (9.27%) *PCR-confirmed SARS-CoV-2 subgroup analysis, HR:* • Canada: 2.83 (95% CI: 0.75-10.72), p = NR • Israel: 1.54 (95% CI: 0.43-5.49), p = NR • Pakistan: 1.50 (95% CI: 0.25-8.98), p = NR • Egypt: 0.95 (95% CI: 0.60-1.50), p = NR *Seroconversion:* • HR: 0.88 (95% CI: 0.43-1.81), p = NR • Intervention: 20/185 (10.8%0 • Control: 22/185 (11.9%) *Acute respiratory illness:* • HR: 0.89 (95% CI: 0.53-1.49), p = NR

Study	Population and setting	Intervention	Definitions	Results
	within the past 24 months or could not pass a fit test, had ≥1 high-risk comorbidities for COVID-19 (hypertension, cardiac disease, pulmonary disease, chronic kidney disease, diabetes, chronic liver disease, actively treated cancer, or immunosuppression due to illness or medications), had a previous laboratory-confirmed clinical diagnosis of COVID-19 at the time of enrollment, or had received ≥1 dose of a COVID-19 vaccine with greater than 50% efficacy for the circulating strain.	respirator when providing routine care to patients with COVID-19 or suspected COVID-19 for 10 weeks. Participants were asked to discard the N95 respirator if it became soiled or damaged or if breathing through the device became difficult. If the institutional policy was for extended use and masks were not typically removed after a patient encounter, the extended use procedure was to be followed. • **Type of Mask:** NIOSH-approved, fit-tested N95 respirator • **Mask compliance:** *Self-reported adherence:* Measured using weekly self-reporting for all participants *Audited adherence:* Conducted when feasible, audits were done at 3 hospitals in Pakistan and 6 in Egypt where 20% of shifts were randomly selected and trial participants were observed **Exposure assignment or ascertainment:** Participants were randomly assigned 1:1 to either medical masks or N95 respirators. Randomization was stratified by site in permuted blocks of 4 and performed centrally by a study statistician who generated the sequence using a computerized random number generator. **Standard preventive measures:** *Standard precautions:* Eye protection, gowns, and gloves were worn when caring for patients with suspected or confirmed COVID-19. Existing policy at each site was to use medical masks while providing routine care to	(fatigue, myalgia, headache, dizziness, expectoration, sore throat, diarrhea, nausea, vomiting, abdominal pain, runny nose, altered taste or smell, conjunctivitis, or painful swallowing). **Sampling methods:** Nasopharyngeal swab and sera samples **Diagnostic tests:** RT-PCR and serology testing for spike IgG and nucleocapsid IgG antibodies **Comments:** Pre-Omicron exposure occurred in Canada, Israel, and Pakistan, whereas Omicron exposure occurred in Egypt.	• Intervention: 27/497 (5.4%) • Control: 31/507 (6.1%) *Lower respiratory infection or pneumonia:* • HR: 1.02 (95% CI: 0.21-5.04), p = NR • Intervention: 3/497 (0.6%) • Control: 3/507 (0.6%) There were 2 HCP in medical mask group and 1 in N95 respirator group were where hospitalized for COVID-19. Additionally, there were 2 HCP in medical mask group and 1 in N95 respirator group who could not be safely isolated at home and were hospitalized for isolation. There were no ICU admissions and no deaths. **Other related outcomes:** *Self-reported adherence:* Intervention: • Always: 91.2% • Sometimes: 6.5% • Never: 1.1% • Do not recall: 1.1% Control: • Always: 80.7% • Sometimes: 13.7% • Never: 4.3% • Do not recall: 1.3% *Audited adherence (adherent/observations):* • Intervention: 116/118 (98.3%) • Control: 113/117 (96.6%) • p = NR **Adverse events:** *Any adverse events:* • Intervention: 47/434 (10.8%) • Control: 59/435 (13.6%) • p = NR *Discomfort:* • Intervention: 20/434 (4.6%) • Control: 42/435 (9.7%) • p = NR

Study	Population and setting	Intervention	Definitions	Results
		patients with confirmed or suspected COVID-19. *Universal masking:* Each site required masks to be used when in the health care facility for all activities, whether patient related or not, including in workrooms, meetings, and treating persons that were not suspected or known to be positive for COVID-19. *PPE use during AGPs:* HCP were required to use N95 respirators for aerosol-generating medical procedures.		*Skin irritation:* • Intervention: 22/434 (5.1%) • Control: 25/435 (5.8%) • p = NR *Headaches:* • Intervention: 20/434 (4.6%) • Control: 29/435 (6.7%) • p = NR **Cost information:** NR
Author: MacIntyre[31] **Year:** 2011 **Data extractor:** DOS **Reviewer:** DCB **Study design:** Cluster RCT **Study objective:** To determine the efficacy of medical masks compared to fit-tested and non-fit-tested N95 respirators in HCP in the prevention of disease because of influenza and other respiratory viruses. **IVA:** • Observed compliance not reported • Possible confounding due	**Population:** N = 1441 **Setting:** 15 tertiary hospitals **Location:** China **Study dates:** December 1, 2008 – January 15, 2009 **Inclusion criteria:** HCP aged ≥18 years from emergency departments and respiratory wards of included hospitals. **Exclusion criteria:** HCP who were unable or refused to consent, had beards, long mustaches or long facial hair stubble, had a current respiratory illness, rhinitis and/or allergy, and who worked part-time.	**Intervention group (N95 fit-tested):** n = 461 HCP wore respirator on every shift for four consecutive weeks after being shown when to wear it and undergoing fit-testing procedure according to the manufacturers' instructions. HCP were supplied two N95 respirators daily and were asked to store it in a paper bag every time they removed it (for toilet breaks, tea/lunch breaks and at the end of every shift) and place the bagged respirator in their locker. • **Type of Mask:** N95 fit-tested respirator (3M flat-fold N95 respirator, 9132) • **Mask compliance:** *Observed compliance:* Head ward nurse recorded daily observed compliance on structured form *Self-reported compliance:* Wearing ≥80% during working hours on follow-up **Intervention group (N95 non-fit-tested respirator):** n = 488 HCP wore respirator on every shift for four consecutive weeks after being	**Outcome definitions:** *Laboratory-confirmed influenza:* Detection of influenza viruses A and B by multiplex PCR *Laboratory-confirmed viral respiratory infection (VRI):* Detection of adenoviruses, human metapneumovirus, coronavirus 229E/NL63, parainfluenza viruses 1, 2, and 3, influenza viruses A and B, respiratory syncytial virus A and B, rhinovirus A/B, and coronavirus OC43/HKU1 by multiplex PCR *Influenza-like illness (ILI):* Self-reported fever ≥38°C plus one respiratory symptom (i.e., cough, runny nose, etc.) *Clinical respiratory illness (CRI):* Self-reported two or more respiratory or one respiratory symptom and a systemic symptom	**Respiratory infection outcomes:** *aOR1: Adjusted odds ratio; multivariable random effect logistic regression model adjusting for hospital level, high risk procedures, flu-vaccine 2008, and handwashing* *aOR2: Adjusted odds ratio; random effect logistic model accounting for clustering* *Laboratory-confirmed influenza:* All N95 respirators (fit-tested and non-fit-tested) • aOR1: 0.27 (95% CI: 0.06-1.17), p = not significant • aOR2: 0.31 (95% CI: 0.07 - 1.32), p = 0.113 • N95: 3/949 (0.3%) • Medical mask: 5/492 (1.0%) N95 fit-tested respirator • aOR2: 0.64 (95% CI: 0.15-2.68), p = 0.54 • N95 fit-tested respirator: 3/461 (0.7%) • Medical mask: 5/492 (1.0%) N95 non-fit-tested respirator • N95 non-fit-tested respirator: 0/488 (0%) • Medical mask: 5/492 (1.0%) *Laboratory-confirmed VRI:* All N95 respirators (fit-tested and non-fit-tested) • aOR1: 0.19 (95% CI: 0.05-0.67), p = significant

Study	Population and setting	Intervention	Definitions	Results
to continuous self-reported compliance analyzed as dichotomous variable • Potential confounding (eye protection, patient mask use, coworker contact) **Related to:** MacIntyre 2014[32]		shown when to wear it and how to fit it correctly. HCP were supplied two N95 respirators daily and were asked to store it in a paper bag every time they removed it (for toilet breaks, tea/lunch breaks and at the end of every shift) and place the bagged respirator in their locker. • **Type of Mask:** N95 non-fit-tested respirator (3M flat-fold N95 respirator, 9132) • **Mask compliance:** *Observed compliance:* Head ward nurse recorded daily observed compliance on structured form *Self-reported compliance:* Wearing ≥80% during working hours on follow-up **Control group:** n = 492 HCP wore mask on every shift for four consecutive weeks after being shown when to wear it and how to fit it correctly. HCP were supplied three masks daily and were asked to store it in a paper bag every time they removed it (for toilet breaks, tea/lunch breaks and at the end of every shift) and place the bagged respirator in their locker. • **Type of Mask:** Medical mask (3M medical mask, 1820) • **Mask compliance:** *Observed compliance:* Head ward nurse recorded daily observed compliance on structured form *Self-reported compliance:* Wearing ≥80% during working hours on follow-up **Exposure assignment or ascertainment:** Hospitals were randomized using a secure	**Case ascertainment:** HCP were contacted daily to identify incident cases of respiratory infection. At each ward, head nurse actively followed-up all HCP and identified incident cases. District CDC staff members also undertook daily monitoring of sites. If participants were symptomatic, swabs were collected. **Sampling methods:** Swabs of both tonsils and the posterior pharyngeal wall **Diagnostic tests:** Multiplex PCR **Comments:** None	• aOR2: 0.54 (95% CI 0.21 - 1.36), p = 0.19 • N95: 13/949 (1.4%) • Medical mask: 13/492 (2.6%) N95 fit-tested respirator • aOR2: 0.69 (95% CI: 0.24-2.03), p = 0.50 • N95 fit-tested: 8/461 (1.7%) • Medical mask: 13/492 (2.6%) N95 non-fit-tested respirator • aOR2: 0.39 (95% CI: 0.12-1.22), p = 0.11 • N95 non-fit-tested respirator: 5/488 (1%) • Medical mask: 13/492 (2.6%) *ILI:* All N95 respirators (fit-tested and non-fit-tested) • aOR1: 0.58 (95% CI: 0.10-3.47), p = not significant N95 fit-tested respirator • aOR2: 0.35 (95% CI: 0.04-3.42), p = 0.37 • N95 fit-tested respirator: 1/461 (0.2%) • Medical mask: 3/492 (0.6%) N95 non-fit-tested respirator • aOR2: 0.67 (95% CI: 0.11-4.03), p = 0.66 • N95 non-fit-tested respirator: 2/488 (0.4%) • Medical mask: 3/492 (0.6%) *CRI:* All N95 respirators (fit-tested and non-fit-tested) • aOR1: 0.38 (95% CI: 0.17-0.86), p = significant N95 fit-tested respirator • aOR2: 0.76 (95% CI: 0.27-2.13), p = 0.60 • N95 fit-tested respirator: 21/461 (4.6%) • Medical mask: 33/492 (6.7%) N95 non-fit-tested respirator • aOR2: 0.48 (95% CI: 0.24-0.98), p = 0.045 • N95 non-fit-tested respirator: 16/488 (3.3%) • Medical mask: 33/492 (6.7%) **Other related outcomes:**

Study	Population and setting	Intervention	Definitions	Results
		computerized randomization program. **Standard preventive measures:** All participants were instructed on the important of hand hygiene prior to/after the removal of medical masks and respirators.		*Self-reported compliance:* • N95 fit-tested respirator: 74% (95% CI: 70%-78%) • N95 non-fit-tested respirator: 68% (95% CI: 64%-73%) • Medical mask: 76% (95% CI: 72%-79%) **Adverse events:** *Fit-testing failure:* • N95 fit-tested respirator: 5/461 (1.08%) *Headaches:* • All N95 respirators: 94/701 (13.4%) • Medical mask: 11/281 (3.9%) • p < 0.01 *Skin rash:* • All N95 respirators: 35/701 (5.0%) • Medical mask: 13/281 (4.6%) • p = 0.81 *Difficult breathing:* • All N95 respirators: 136/701 (19.4%) • Medical mask: 35/281 (12.5%) • p = 0.01 *Allergies:* • All N95 respirators: 50/701 (7.1%) • Medical mask: 26/281 (9.3%) • p = 0.26 *Pressure on nose:* • All N95 respirators: 366/701 (52.2%) • Medical mask: 31/281 (11.0%) • p < 0.01 *Uncomfortable:* • All N95 respirators: 395/943 (41.9%) • Medical mask: 48/491 (9.8%) • p < 0.01 *Patient felt uncomfortable:* • All N95 respirators: 17/943 (1.8%) • Medical mask: 1/491 (0.2%)

Study	Population and setting	Intervention	Definitions	Results
				• p = 0.01 *Trouble communicating with the patient:* • All N95 respirators: 62/775 (8.0%) • Medical mask: 9/303 (3.0%) • p < 0.01 **Cost information:** NR
Author: MacIntyre[33] **Year:** 2013 **Data extractor:** DOS **Reviewer:** DCB **Study design:** Cluster RCT **Study objective:** To determine the efficacy of three different options for the use of masks and respirators in HCP working in high-risk hospital wards, in the prevention of respiratory infections. **IVA:** • Observed compliance not reported • Potential confounding (eye protection, patient mask use, coworker contact)	**Population:** N = 1669 **Setting:** 68 emergency department and respiratory wards of 19 tertiary hospitals **Location:** China **Study dates:** December 28, 2009 – February 7, 2010 **Inclusion criteria:** Any nurse or doctor ≥18 who worked full-time in the emergency or respiratory wards eligible. **Exclusion criteria:** HCP who were unable or refused to consent, had beards, long moustaches, or long facial hair stubble, had a current respiratory illness, rhinitis, and/or had an allergy.	**Intervention group (N95):** n = 581 Participants wore the respirator at all times on every shift after being shown how to fit and wear it. Participants were supplied daily with two N95 respirators and underwent a fit test procedure according to the manufacturer's instructions. • **Type of Mask:** Fit-tested N95 respirator (N95 Particulate Respirator, 1860) • **Mask compliance:** Monitored adherence using previously validated self-reporting mechanism **Intervention group (Targeted N95):** n = 516 Participants wore the respirator while doing high-risk procedures on every shift after being shown how to fit and wear it. Participants were supplied daily with two N95 respirators and underwent a fit test procedure according to the manufacturer's instructions. • **Type of Mask:** Fit-tested N95 respirator (N95 Particulate Respirator, 1860) • **Mask compliance:** Monitored adherence using previously validated self-reporting mechanism **Control group:** n = 572	**Outcome definitions:** *Laboratory-confirmed viral respiratory infection (VRI):* Symptomatic subjects with detection of adenoviruses; human metapneumovirus; coronaviruses 229E/NL63 and OC43/HKU1; parainfluenza viruses 1, 2, and 3; influenza viruses A and B; respiratory syncytial viruses A and B; or rhinoviruses A/B *Laboratory-confirmed bacterial colonization:* Symptomatic subjects with detection of *Streptococcus pneumoniae*, legionella, *Bordetella pertussis*, chlamydia, *Mycoplasma pneumoniae*, or *Hemophilus influenzae* type B *Influenza-like illness (ILI):* Self-reported fever (38°C) plus one respiratory symptom *Clinical respiratory illness (CRI):* Self-reported two or more respiratory symptoms or one respiratory symptom and a systemic symptom **Case ascertainment:** Participants received a thermometer and diary cards to record development of symptoms and	**Respiratory infection outcomes:** *aHR: Adjusted hazard ratio; multivariable Cox proportional hazards model includes N95* respirator *or targeted N95* respirator *group, age, A(H1N1)pdm09 vaccination, seasonal influenza vaccination, hand washing, and staff (doctor)* *Laboratory-confirmed VRI:* N95 respirator • N95 respirator: 13/581 (2.2%) • Medical mask: 19/572 (3.3%) • p = 0.44 Targeted N95 respirator • Targeted N95 respirator: 17/516 (3.3%) • Medical mask: 19/572 (3.3%) • p = 0.99 *Laboratory-confirmed bacterial colonization:* N95 • aHR: 0.40 (95% CI: 0.21-0.73), p = NR • N95 respirator: 52/581 (9.0%) • Medical mask: 120/572 (21.0%) • p = 0.02 Targeted N95 respirator • aHR: 0.70 (95% CI: 0.40-1.24), p = NR • Targeted N95 respirator: 75/516 (14.5%) • Medical mask: 120/572 (21.0%) • p = 0.25 *ILI:* N95 • N95: 6/581 (1.0%) • Medical mask: 4/572 (0.7%)

Study	Population and setting	Intervention	Definitions	Results
		Participants wore the mask at all times on every shift after being shown how to fit and wear it. Participants were supplied daily with three masks. • **Type of Mask:** Medical/surgical mask (3M Standard Tie-On Surgical Mask 1817) • **Mask compliance:** Monitored adherence using previously validated self-reporting mechanism **Exposure assignment or ascertainment:** Wards were randomized to intervention groups using a secure computerized randomization program. **Standard preventive measures:** NR	were contacted daily to identify incidence cases of respiratory infection. Anyone with a single respiratory symptom or fever was tested for viral or bacterial outcomes. Asymptomatic subjects were not tested. **Sampling methods:** Both tonsillar areas and the posterior pharyngeal wall **Diagnostic tests:** NAT using commercial multiplex PCR **Comments:** None	• p = 0.54 Targeted N95 • Targeted N95: 2/516 (0.4%) • Medical mask: 4/572 (0.7%) • p = 0.49 *CRI:* N95 • aHR: 0.39 (95% CI: 0.21-0.71), p = NR • N95 respirator: 42/581 (7.2%) • Medical mask: 98/572 (17.1%) • p = 0.28 Targeted N95 • aHR: 0.70 (95% CI: 0.39-1.24), p = NR • Targeted N95 respirator: 61/516 (11.8%) • Medical mask: 98/572 (17.1%) • p = 0.024 *Laboratory-confirmed VRI or bacterial colonization:* N95 respirator • N95: 52/581 (9.0%) • Medical mask: 123/572 (21.5%) • p = 0.016 Targeted N95 respirator • Targeted N95 respirator: 77/516 (14.9%) • Medical mask: 123/572 (21.5%) • p = 0.25 *Coinfection laboratory confirmed VRI and bacterial colonization:* • N95 respirator: 13/581 (2.2%) • Targeted N95 respirator: 15/516 (2.9%) • Medical mask: 14/572 (2.5%) • p = 0.773 *Coinfection ≥2 laboratory-confirmed viruses:* • N95 respirator: 6/581 (1.0%) • Targeted N95 respirator: 5/516 (1.0%) • Medical mask: 8/572 (1.4%)

Study	Population and setting	Intervention	Definitions	Results
				• p = 0.766 *Coinfection ≥2 laboratory-confirmed bacteria:* • N95 respirator: 30/581 (5.2%) • Targeted N95 respirator: 40/516 (7.8%) • Medical mask: 6/4572 (11.2%) • p < 0.001 **Other related outcomes:** *Self-reported compliance:* • N95 respirator: 333/581 (57%) • Targeted N95 respirator: 422/516 (82%) • Medical mask: 380/572 (66%) • p < 0.001 *Fit test failure:* • N95 and Targeted N95 respirator: 28/1,086 (2.6%) **Adverse events:** *Comfort (no problems reported):* • N95 respirator: 217/574 (38%) • Targeted N95 respirator: 317/512 (62%) • Medical mask: 297/571 (52%) • p < 0.001 **Cost information:** NR
Author: MacIntyre[32] **Year:** 2014 **Data extractor:** DOS **Reviewer:** DCB **Study design:** Cluster RCT **Study objective:** To determine the efficacy of respiratory protection in preventing bacterial	**Population:** N = 1441 **Setting:** 15 hospitals **Location:** China **Study dates:** December 1, 2008 – January 15, 2009 **Inclusion criteria:** Nurses or doctors who worked full time in the emergency or respiratory wards at participating hospitals.	**Intervention group:** n = 949 HCP wore respirator on every shift (8-12 hours) for four consecutive weeks and were shown how to wear and fit it correctly. HCP were supplied with two respirators daily and were asked to store the respirator in a paper bag every time they removed it (for toilet breaks, tea/lunch breaks and at the end of every shift) and place in their locker. HCP randomized to the fitted N95 respirator arm underwent a fit testing procedure according to the manufacturers' instructions.	**Outcome definitions:** *Laboratory-confirmed bacterial colonization:* Symptomatic subjects with PCR-confirmed colonization of the respiratory tract with *S. pneumonia*, *Legionella*, *B. pertussis*, *Chlamydia*, *M. pneumonia*, or *H. influenzae* type B *Laboratory-confirmed viral infection or bacterial colonization:* Laboratory-confirmed bacterial colonization or NAT-confirmed respiratory infection with adenoviruses,	**Respiratory infection outcomes:** *RR: Relative risk* *Laboratory-confirmed bacterial colonization:* • RR: 46.2 (95% CI: 8.8-68.2), p = 0.02 • N95: 27/949 (2.8%) • Medical: 26/492 (5.3%) *Laboratory-confirmed bacterial colonization or viral infection:* • RR: 49.8 (95% CI: 18.7-69.0), p = 0.004 • N95: 31/949 (3.3%) • Medical: 32/492 (6.3%) *Co-infection with ≥2 bacteria:* • RR: 48.2 (95% CI: 0-74.4), p = 0.064

Study	Population and setting	Intervention	Definitions	Results
colonization and co-infections or co-colonization in HCPs. **IVA:** • Observed compliance not reported • Potential confounding (eye protection, patient mask use, HCP task, coworker contact, community contact) **Related to:** MacIntyre 2011[31]	**Exclusion criteria:** HCP who were unable or refused to consent, had beards, long mustaches or long facial hair stubble, or had a current respiratory illness, rhinitis and/or allergy.	• **Type of Mask:** Fit-tested and non-fit-tested N95 respirator (3M flat-fold N95 respirator, 9132) • **Mask compliance:** Validated diary cards were provided to record self-reported daily mask/respirator usage **Control group:** n = 492 HCP wore mask on every shift (8-12 hours) for four consecutive weeks and were shown how to wear and fit it correctly. HCP were supplied with three masks daily and were asked to store the mask in a paper bag every time they removed it (for toilet breaks, tea/lunch breaks and at the end of every shift) and place in their locker. • **Type of Mask:** Medical mask (3M medical mask, 1820) • **Mask compliance:** Validated diary cards were provided to record self-reported daily mask/respirator usage **Exposure assignment or ascertainment:** A secure computerized randomization program was used to randomize the hospitals to each intervention. **Standard preventive measures:** All HCP were instructed on the importance of hand hygiene prior to/after the removal of medical masks and respirators.	human metapneumovirus, coronavirus 229E/NL63 and OC43/HKU1, parainfluenza viruses 1, 2, and 3, influenza viruses A and B, respiratory syncytial viruses A and B, or rhinovirus A/B *Co-infection with virus and bacteria:* Co-infection with a PCR-confirmed viral infection and bacterial colonization **Case ascertainment:** HCP were contacted daily to actively identify incidence cases of clinical respiratory illness, which was defined as at least two respiratory symptoms (cough, sneezing, runny nose, shortness of breath, sore throat) or one respiratory symptom and one systemic symptom (including fever, headache, and lethargy). HCP with respiratory symptoms had two pharyngeal swabs collected by a trained nurse or doctor. **Sampling methods:** Two pharyngeal swabs **Diagnostic tests:** Multiplex PCR **Comments:** None	• N95: 16/949 (1.7%) • Medical: 15/492 (3.1%) *Co-infection with virus and bacteria:* • RR: 33.3 (95% CI: 0-75.0), p = 0.415 • N95: 9/949 (1.0%) • Medical: 7/492 (1.4%) *Co-infection ≥ viruses:* • RR: 72.3 (95% CI: 0-96.0), p = 0.05 • N95: 2/949 (0.1%) • Medical: 5/492 (1.0%) **Other related outcomes:** NR **Adverse events:** NR **Cost information:** None
Author: Mouliou[34] **Year:** 2022 **Data extractor:** CNS	**Population:** N = 381 **Setting:** Tertiary sector healthcare services **Location:** Greece	**Intervention group:** n = 82 • **Type of Mask:** FFP/(K)N95 • **Mask compliance:** NR **Control group:** n = 243	**Outcome definitions:** *SARS-CoV-2:* ND **Case ascertainment:** Self-reported	**Respiratory infection outcomes:** *SARS-CoV-2:* n = 37 • Intervention: 9/82 (11.0%) • Control: 28/243 (11.5%)

Study	Population and setting	Intervention	Definitions	Results
Reviewer: MC **Study design:** Cross-sectional **Study objective:** To present the mask type preferences amongst tertiary sector services and to monitor SARS-CoV-2 transmissibility in the wearing of specific mask types. **IVA:** • Recall bias • Sampling bias (online questionnaire) • Compliance not reported • Potential confounding (eye protection, patient mask use, HCP task, coworker contact, community contact)	**Study dates:** November 18 – 27, 2021 **Matching:** NA **Inclusion criteria:** Participants in the tertiary sector services were randomly invited to participate in the survey through social media shares in profiles and Facebook teams, and informed consent was obtained from all subjects. **Exclusion criteria:** Participants aged under 18 and over 75.	• **Type of Mask:** Medical/surgical mask • **Mask compliance:** NR **Exposure ascertainment:** Self-reported mask type and mask use on a web-based questionnaire **Standard preventive measures:** State mandated social distancing and mask use policies were implemented	**Sampling methods:** NR **Diagnostic tests:** NR **Comments:** None	• No significant difference at the 0.05 level **Other related outcomes:** NR **Adverse events:** NR **Cost information:** NR
Author: Piapan[35] **Year:** 2020 **Data extractor:** DOS **Reviewer:** CNS **Study design:** Cohort	**Population:** N = 181 **Setting:** Public hospitals **Location:** Italy **Study dates:** March 1 – April 6, 2020 **Matching:** None **Inclusion criteria:** HCP who reported contact	**Intervention group:** n = 40 • **Type of Mask:** FFP2-3 mask • **Mask compliance:** NR **Control group:** n = 141 • **Type of Mask:** Surgical mask • **Mask compliance:** NR **Exposure assignment or ascertainment:** Self-reported PPE use **Standard preventive measures:** In the case of symptom onset, HCP were	**Outcome definitions:** *Laboratory-confirmed SARS-CoV-2:* Cycle threshold value below 40 interpreted as positive for SARS-CoV-2 RNA **Case ascertainment:** HCP were interviewed daily to verify health status, had to monitor and report their body temperature twice daily, and were tested every 3 days after close contact and after 13 days for casual contact.	**Respiratory infection outcomes:** *aOR: Adjusted odds ratio; model includes sex* *Laboratory-confirmed SARS-CoV-2:* • aOR: 7.1 (95% CI: 3.0-16.7), p = NR • Intervention: 32/40 (80.0%) • Control: 50/141 (35.5%) **Other related outcomes:** Following checks it was found that the use of PPE was not appropriate during HCP meetings which

Study	Population and setting	Intervention	Definitions	Results
Study objective: To verify symptom onset among HCP. **IVA:** • Recall bias • Compliance not reported • Potential confounding (eye protection, patient mask use, HCP task, coworker contact, community contact)	with patients with COVID-19 during study period. **Exclusion criteria:** NR	tested immediately, stopped working, and remained home with active daily monitoring by telephone.	Symptomatic HCP were tested immediately. **Sampling methods:** Nasopharyngeal and oropharyngeal swabs **Diagnostic tests:** RT-PCR **Comments:** Data was only available for 144 COVID-19 negative workers.	might have contributed to the spread of COVID-19 among colleagues **Adverse events:** NR **Cost information:** NR
Author: Radonovich[36] **Year:** 2019 **Data extractor:** CNS **Reviewer:** DOS/Team **Study design:** Cluster RCT **Study objective:** To compare the effectiveness of N95 respirators vs medical masks worn by HCP in clinical practice for prevention of workplace-acquired influenza and other viral respiratory infections in geographically diverse, high-	**Population:** N = 2371 HCP N = 5180 HCP-seasons **Setting:** 137 outpatient medical centers, including primary care facilities, dental clinics, adult and pediatric clinics, dialysis units, urgent care facilities and emergency departments, and emergency transport services, at seven health systems **Location:** US **Study dates:** September 2011 – June 28, 2016 **Matching:** Within each medical center for each study year, pairs of clusters were matched by the number of participants, health	**Intervention group:** n = 2512 HCP-seasons Participants were instructed to wear N95 respirators during the 12-week intervention period. Participants were instructed to put on a new N95 respirator whenever they were positioned within 6 feet of patients with suspected or confirmed respiratory illness. Participants were reminded to adhere to N95s and hand hygiene instructions by signage posted at study sites, email, and by study personnel in person. • **Type of Mask:** N95 respirators (3M Corporation 1860, 1860S, 1870; Kimberly Clark Technol Fluidshield PFR95-270, PFR95-274) • **Mask compliance:** *Mask compliance on daily surveys:* Adherence to N95s were reported daily by participants as "always," "sometimes," "never," or "did not recall" *Observed mask compliance:* Study personnel observed participants'	**Outcome definitions:** *Laboratory-confirmed influenza:* Detection of influenza A or B virus by RT-PCR in an upper respiratory specimen collected within 7 days of symptom onset or from a randomly obtained swab from an asymptomatic participant, or influenza seroconversion (at least a 4-fold rise in hemagglutination inhibition antibody titers to influenza A or B virus between preseason and postseason serological samples deemed not attributable to vaccination). *Acute respiratory illness:* The presence of at least one sign (coryza, fever (>37.8°C), lymphadenopathy, and tachypnea) and two symptoms (arthralgias/ myalgias/body aches, chills, cough, diarrhea, dyspnea, fatigue, headache, malaise, other gastrointestinal symptoms, sore throat, sputum production, sweats, and	**Respiratory infection outcomes:** *aOR: Adjusted odds ratio; logistic regression; model included age, sex, race, number of household members younger than 5 years, occupation risk level (defined as low, medium, or high), binary season-specific influenza vaccination status, the proportion of daily exposures to others with respiratory illness, categorical self-reported adherence to hand hygiene, and intervention group assignment* *aIRR: Adjusted incidence rate ratio; Poisson regression; model included age, sex, race, number of household members younger than 5 years, occupation risk level (defined as low, medium, or high), binary season-specific influenza vaccination status, the proportion of daily exposures to others with respiratory illness, categorical self-reported adherence to hand hygiene, and intervention group assignment* *Laboratory-confirmed influenza:* • aOR: 1.18 (95% CI: 0.95-1.45), p = NR • Intervention: 207/2512 (8.2%) • Control: 193/2668 (7.2%) *Acute respiratory illness:* • aIRR: 0.99 (95% CI: 0.92-1.06), p = NR

Study	Population and setting	Intervention	Definitions	Results
exposure, outpatient settings. **IVA:** • Potential confounding (eye protection, patient mask use, coworker contact)	services delivered, patient population served, and additional personal protective equipment within each medical center. **Inclusion criteria:** HCP ≥ 18 years old that were full-time employees with direct patient care for ≥24 hours per week and worked ≥75% of working hours at the study site, and self-identified as routinely positioned within six feet of patients. **Exclusion criteria:** Cluster size below a preestablished threshold of 2, medical conditions precluding safe participation, or anatomic features that could interfere with respirator fit, such as facial hair or third-trimester pregnancy.	mask-wearing behaviors as they entered and exited patient care rooms by conducting random, unannounced, inconspicuous visits **Control group:** n = 2668 HCP-seasons Participants were instructed to wear medical masks during the 12-week intervention period. Participants were instructed to put on a new medical mask whenever they were positioned within 6 feet of patients with suspected or confirmed respiratory illness. Participants were reminded to adhere to protective device and hand hygiene instructions by signage posted at study sites, email, and by study personnel in person. • **Type of Mask:** Medical masks (Precept 15320 and Kimberly Clark Technol Fluidshield 47107) • **Mask compliance:** *Mask compliance on daily surveys:* Adherence to medical masks were reported daily by participants as "always," "sometimes," "never," or "did not recall." *Observed mask compliance:* Study personnel observed participants' mask-wearing behaviors as they entered and exited patient care rooms by conducting random, unannounced, inconspicuous visits. **Exposure assignment or ascertainment:** One cluster was randomly assigned to the medical mask group and one to the N95 respirator group. All HCP in a cluster worked in the same outpatient setting. Constrained randomization was used using computer-generated random sequences of group assignments. Each HCP had an equal probability of being assigned to the	vomiting/nausea) with or without laboratory confirmation *Laboratory-detected respiratory infection:* Detection of a respiratory pathogen by PCR or serological evidence of infection with a respiratory pathogen during the study surveillance period *Laboratory-confirmed respiratory illness:* Self-reported acute respiratory illness plus the presence of at least one PCR-confirmed viral pathogen in a specimen collected from the upper respiratory tract within seven days of the reported symptoms and/or at least a 4-fold rise from preintervention to post-intervention serum antibody titers to influenza A or B virus *Influenza like illness (ILI):* Temperature of at least 100°F (37.8°C) plus cough and/or a sore throat, with or without laboratory confirmation **Case ascertainment:** Samples were collected from symptomatic HCP or two times randomly during the intervention period. Participants kept diaries that included signs and symptoms of respiratory illness, annual influenza vaccination status, and exposure to household and community members with respiratory illness. Participants also recorded their participation in aerosol-generating procedures and exposure to patients,	• Intervention: 1556/2512 (61.9%) • Control: 1711/2668 (64.1%) *Laboratory-detected respiratory infection:* • aIRR: 0.99 (95% CI: 0.89-1.09), p = NR • Intervention: 679/2512 (27.0%) • Control: 745/2668 (27.9%) *Laboratory-confirmed respiratory illness:* • aOR: 0.96 (95% CI: 0.83-1.11), p = NR • Intervention: 371/2512 (14.8%) • Control: 417/2668 (15.6%) *ILI:* • aIRR: 0.86 (95% CI: 0.68-1.10), p = NR • Intervention: 128/2512 (5.1%) • Control: 166/2668 (6.2%) **Other related outcomes:** *Mask compliance on daily surveys:* "Always" • Intervention: 14,566/22,330 (65.2%) • Control: 15,186/23,315 (65.1%) "Sometimes" • Intervention: 5,407/22,330 (24.2%) • Control: 5,853/23,315 (25.1%) "Never" • Intervention: 2,272/22,330 (10.2%) • Control: 2,207/23,315 (9.5%) "Do not recall" • Intervention: 85 (0.4%) • Control: 69/23,315 (0.3%) *Observed mask compliance:* • Intervention: 40.6% • Control: 33.5% • p = 0.02 **Adverse events:** Nineteen participants reported skin irritation or worsening acne during years 3 and 4 at one study site in the N95 respirator group. **Cost information:** NR

Study	Population and setting	Intervention	Definitions	Results
		intervention or control group and allowed participants to switch group between seasons. **Standard preventive measures:** Infection control practices included hand hygiene	coworkers, or both with respiratory illness daily. **Sampling methods:** Swabs of the anterior nares and oropharynx were collected within 24 hours of self-reported symptoms and again if signs or symptoms persisted beyond seven days. Samples were self-obtained if the symptomatic HCP was not at work. Two random swabs were obtained from all participants during each 12 week intervention period. Each year, paired serum samples from all HCP were assayed for influenza hemagglutinin levels before and after peak viral respiratory season. **Diagnostic tests:** RT-PCR **Comments:** None	
Author: Welbel[37] **Year:** 2009 **Data extractor:** CNS **Reviewer:** DCB **Study design:** Before-after **Study objective:** To assess the potential benefits of more aggressive use of fit testing by evaluating the relative impact of fit testing and other infection control measures on	**Population:** N = NR **Setting:** Public hospital **Location:** IL, US **Study dates:** 1990-2002 **Matching:** NA **Inclusion criteria:** HCP (new hires, existing HCP with prior negative TSTs, or HCP requiring postexposure testing) screened for TB. **Exclusion criteria:** HCP previously TST positive.	**Intervention group:** n = NR Fit-tested N95 respirators were introduced September 1997 for new and current HCP, eliminating HEPA masks. • **Type of Mask:** N95 • **Mask compliance:** NR **Control group:** n = NR Personnel wore surgical masks when entering a TB isolation room until 1995 when HEPA masks became available however, HCP rarely donned the HEPA masks. PAPRs were supplied to HCP who could not use HEPA masks. • **Type of Mask:** Surgical masks/HEPA masks/PAPRs • **Mask compliance:** NR	**Outcome definitions:** *TB:* HCP with a positive TST result for *mycobacterium* TB **Case ascertainment:** Employee Health Service records identified results of all HCP-TSTs. TSTs were placed annually or semiannually. A two-step TST program was applied for new hires where an initial negative TST result (less than 10mm of induration) resulted in a confirmation test one week later. If the second test was positive, it was considered a boosted reaction. Contact investigations of patients who were not appropriately isolated included identifying all HCP with potential exposure so that they	**Respiratory infection outcomes:** *TB TST conversion overall* • January 1994: 98/2,221 (4.4%) • December 2002: 6/2,108 (0.3%) • $p < 0.001$ *TB TST conversion from January 1994-September 1997* • $p < 0.001$ *TB TST conversion after N95 respirator introduction (October 1997-December 2002):* • $p = 0.14$ **Other related outcomes:** NR **Adverse events:** NR **Cost information:** NR

Study	Population and setting	Intervention	Definitions	Results
development of latent tuberculosis (TB) infection, as measured by rates of tuberculin skin test (TST) conversions in HCP in a large inner-city public hospital. **IVA:** • Compliance not reported • Potential confounding (eye protection, patient mask use, HCP task, coworker contact, community contact)		**Exposure assignment or ascertainment:** Hospital policy introduced the N95 respirator with qualitative fit testing to replace HEPA, PAPR, and surgical masks in 1997 **Standard preventive measures:** Administrative IPC measures included initiating a "roving team" to place and read TSTs, use of radiometric susceptibility testing of all TB isolates, creating a multidisciplinary TB subcommittee, revising policies based on CDC guidelines for isolation requirements for patients, choosing a dedicated nurse epidemiologist to coordinate TB infection control activities, confirming a TST program by a risk assessment, instituting a hospital-based directly observed TB therapy program, having a dedicated TB respiratory technician, following-up with every patient with a positive TB culture, flagging TB patients on the ED computer system, creating a two-step TST program, and extensively educating ED providers to improve recognition of new TB patients. Engineering IPC measures included converting isolation rooms to negative pressure (≥6 air changes per hour), installing UV lights in isolation rooms and select corridors, checking isolation rooms for negative pressure daily, placing two high-efficiency particulate air filtration units in ED exam rooms, and having a one-time evaluation of ventilation systems serving high-risk areas (isolation rooms, pharmacy, ED, acute care waiting rooms) by outside consultants.	could undergo skin testing soon after the exposure and 12 weeks later. **Sampling methods:** NA **Diagnostic tests:** 5-tuberculin unit purified protein derivative intradermal skin test (TST) **Comments:** None	
Author: Wilson[38]	**Population:**	**Cases:** n = 154	**Exposure definitions:**	**Respiratory infection outcomes:**

Study	Population and setting	Intervention	Definitions	Results
Year: 2022 **Data extractor:** MC/CNS **Reviewer:** DOS **Study design:** Matched case-control **Study objective:** To investigate sociodemographic factors, behavioral factors and professional practice associated with the risk of COVID-19 infection in HCP, and to describe the circumstances of infection declared by the respondents, and the protective measures applied by healthcare professionals working in clinical areas, as well as during contacts with other colleagues. **IVA:** • Recall bias • Compliance not reported • Potential confounding (patient mask use, community contact)	N = 770 HCP **Setting:** Numerous medical and medico-social establishments **Location:** France **Study dates:** September 1, 2020 – June 30, 2021 **Matching:** Cases and controls were matched by sector of activity (health establishment or medico-social establishment) and by profession, with 4 controls for 1 case. **Inclusion criteria:** Healthcare personnel (medical and paramedical professionals, as well as personnel from laboratories, hospital pharmacies and administration) working in health establishments (hospitals, clinics, rehabilitation and recuperation care facilities and establishments specializing in psychiatry), nursing homes and establishments for handicapped children and adults in Normandy, France, that	HCP who declared having a COVID-19 infection (confirmed by a positive SARS-CoV-2 PCR or antigenic test) which they reported as having been acquired in the workplace • **Type of Mask:** Surgical mask or respirator • **Mask compliance:** NR **Controls:** n = 616 HCP who declared no known history of COVID-19 infection over study period and declared no modifications of the PPE measure they applied since September 2020 • **Type of Mask:** Surgical mask or respirator • **Mask compliance:** NR **Case ascertainment:** Self-reported COVID-19 infection with date of infection was collected via online questionnaire and confirmed by a positive SARS-CoV-2 PCR or antigenic test **Standard preventive measures:** NR	*Type of mask used:* Self-reported mainly using surgical masks or mainly using respirators **Exposure ascertainment:** Self-reported mask use during the ten days preceding infection symptoms was collected via online questionnaire **Comments:** None	*aOR: Adjusted odds ratio; model includes age, sex, hand rubbing with alcohol based handrub before and after patient care, wearing of mask, wearing of face shield or protective goggles, wearing of gown/plastic apron, wearing of gloves, wearing of protective hair cap, wearing of protective overshoes, and regular airing of patient/residents' rooms* *OR: Odds ratio* *Type of mask used among HCP caring for COVID-19 patients (mainly using respirators compared to mainly using surgical masks as reference):* • aOR: 0.39 (95% CI: 0.29-0.51) • OR: 0.38 (95% CI: 0.29-0.46) Mainly respirators, n/N (%): • Cases: 13/70 (18.6%) • Controls: 77/280 (27.5%) Mainly surgical masks, n/N (%): • Cases: 22/70 (31.4%) • Controls: 55/280 (19.6%) **Other related outcomes:** *Type of mask used among HCP caring for non-COVID-19 patients (mainly using respirators compared to mainly using surgical masks as reference):* • aOR: 1.84 (95% CI: 1.06-3.37) • OR: 2.36 (95% CI: 1.45-4.00) Mainly respirators, n/N (%): • Cases: 5/84 (6.0%) • Controls: 13/336 (3.9%) Mainly surgical masks, n/N (%): • Cases: 60/84 (71.4%) • Controls: 245/336 (72.9%) **Adverse events:** NR **Cost information:** NR

Study	Population and setting	Intervention	Definitions	Results
	gave written agreement. **Exclusion criteria:** NR			

C.4. Sensitivity Analysis A: Detailed Review of Studies Not Meeting Inclusion Criteria

Table 13. Detailed Review of Potentially Relevant Studies Not Meeting Inclusion Criteria and Rationale for Exclusion

Included Study	Retrieved From	Intervention	Comparator	Outcome	Exclusion Criteria	Additional Notes
Aghili 2022[70]	• Boulos 2023[68]	Surgical mask	Cloth or no mask	SARS-CoV-2	Irrelevant	Conducted in patient population; no comparator of interest
Alraddadi 2016[71]	• Li 2021[4] • Chou 2020[72]	N95 respirator during direct patient contact	Medical mask during direct patient contact	MERS-CoV seropositive	No direct comparison between N95 respirator and surgical/medical mask	The reported use of medical mask and N95 respirator were not mutually exclusive
Burke 2020[73]	Li 2021[4]	N95 respirator	Face mask only	SARS-CoV-2 secondary attack rate among HCP	No outcome of interest	N95 is "ill fitting" and thus doesn't meet inclusion
Caputo 2006[74]	Chou 2020[72]	N95 respirator	Surgical mask	SARS-CoV-1	Irrelevant	Patients undergoing AGPs
Collatuzzo 2022[75]	CDC Systematic Review	FFP2/FFP3 mask	Surgical mask	Percentage of effective contacts (contact that precedes positive test)	No direct comparison between N95 respirator and surgical/medical mask	Reported use of N95 Respirators and Surgical Masks was not mutually exclusive
Guo 2020[76]	CDC Systematic Review	1) Usage of N95 respirator 2) Wearing respirators or masks all of the time	1) No usage of N95 respirator 2) Not wearing respirators or masks all of the time	COVID-19 morbidity	No comparator	Either reports on respirators vs. no respirators or collapses masks and respirators together vs. none

Included Study	Retrieved From	Intervention	Comparator	Outcome	Exclusion Criteria	Additional Notes
Hall 2014[77]	Li 2021[4]	N95 respirator	Surgical mask	MERS-CoV	No outcome of interest	Mask & N95 respirator use are not mutually exclusive
Kim 2020[78]	Sami 2023[69]			SARS-CoV-2	Irrelevant	Conducted in patient population
Kim 2016[79]	CDC Systematic Review	N95 respirator (n =1)	Surgical masks (n = 6)	MERS-CoV	No direct comparison between N95 respirator and surgical/medical mask	No direct comparison
Kumar 2020[39]	Boulos 2023[68]	N95 respirator	Surgical mask	SARS-CoV-2	No direct comparison between N95 respirator and surgical/medical mask	Contains data that could be extracted for use despite no direct comparison
Lau 2004[80]	CDC Systematic Review	N95 respirator during direct patient contact with SARS patients or during direct contact with patients in general	No N95 respirator	SARS-CoV-1	No comparator	N95 vs no N95 respirator
Lentz 2021[81]	CDC Systematic Review	Respirator during AGPs + Respirator during Non-AGPs	Medical mask during AGPs + Medical mask during Non-AGPs	SARS-CoV-2	No direct comparison between N95 respirator and surgical/medical mask	Table 3 reports ORs for different mask types and combinations
Liu 2009[82]	CDC Systematic Review	Wearing N95 respirator	1) Wearing 12-layer cotton surgical mask 2) Wearing 16-layer cotton surgical mask	SARS-CoV-1	No direct comparison between N95 respirator and surgical/medical mask	Use of N95 respirator & Surgical mask were not mutually exclusive: "286/477 wore multiple layers of mask"
MacIntyre 2009[83]	Jefferson 2023[2]			Respiratory Viruses	Irrelevant	Conducted in households
Martischang 2022[40]	CDC Systematic Review	Use of respirator (FFP2/N95) in case of contact with COVID-19-positive patients	Use of surgical mask in case of contact with COVID-19-positive patients	SARS-CoV-2 seroconversion	No direct comparison between N95 respirator and surgical/medical mask	Contains data that could be extracted for use despite no direct comparison

Included Study	Retrieved From	Intervention	Comparator	Outcome	Exclusion Criteria	Additional Notes
Mastan 2021[84]	CDC Systematic Review	FFP3 respirator	Fluid resistant surgical masks	Outbreak of COVID-19 amongst staff or patients (unit level)	No outcome of interest	Survey data of hospitals
Raboud 2010[85]	Chou 2020[72]	N95 respirator or equivalent	Surgical mask	SARS-CoV-1	Irrelevant	Patients undergoing AGPs
Rodriguez-Lopez 2021 [86]	CDC Systematic Review	Always use high-performance filtering facepiece	Not always use high-performance filtering mask or use another mask	SARS-CoV-2	No comparator	"Always use" compared to "not always used"
Sadeghi 2020[41]	CDC Systematic Review	N95 respirator used before entering place with suspected or confirmed COVID-19 patient	Surgical mask used before entering place with suspected or confirmed COVID-19 patient	SARS-CoV-2	No direct comparison between N95 respirator and surgical/medical mask	Contains data that could be extracted for use despite no direct comparison
Scales 2003[87]	Li 2021[66]	Gown, gloves, and N95 respirator	Gown, gloves, and surgical mask	SARS-CoV-2	No comparator	No HCP wore N95s during routine care, only AGP
Sertcelik 2022[88]	CDC Systematic Review	Participant wearing a respirator during close contact	Participant wearing medical mask during close contact	SARS-CoV-2	No direct comparison between N95 respirator and surgical/medical mask	Not all mask & N95 respirator exposures were individual and mutually exclusive
Seto 2003[42]	• Li J, 2021[66] • Collins 2021[1]	N95	Surgical mask	SARS-CoV-1	No direct comparison between N95 respirator and surgical/medical mask	Contains data that could be extracted for use despite no direct comparison
Shah 2022s[89]	CDC Systematic Review	Respirator	Surgical face mask	SARS-CoV-2	No outcome of interest	Using surgical face mask instead of respirator during AGP

Included Study	Retrieved From	Intervention	Comparator	Outcome	Exclusion Criteria	Additional Notes
Sims 2021[90]	CDC Systematic Review	PAPR/N95	Surgical/other	SARS-CoV-2 seropositivity	No direct comparison	Collapses PAPR and N95 respirators together (they are separate in appendix but only for CoV positives. - no extractable data)
Toyokawa 2011[43]	CDC Systematic Review	N95 respirator in emergency department	Surgical mask in emergency department	Seropositive HI antibody against pandemic A/H1N1pdm virus	No direct comparison between N95 respirator and surgical/medical mask	Contains data that could be extracted for use despite no direct comparison
Wang 2021[91]	Li 2021[66]	Level 2 protection: disposable hat, medical protective mask (N95 respirator or higher standard), goggles (anti-fog) or protective mask (anti-fog), medical protective clothing or white coats covered by medical protective clothing, disposable gloves, and disposable shoe covers	1) Inadequate protection, which is not defined OR 2) Level 1 protection: white coat, disposable hat, disposable isolation clothing, disposable gloves, and disposable surgical mask (replace every 4 hours or when wet or contaminated)	SARS-CoV-2	No outcome of interest	Examined suites of PPE compared to "inadequate protection"
Wang 2020[92]	CDC Systematic Review	N95	No medical mask	Confirmed or suspected SARS-CoV-2 infection	No comparator	comparator is "no medical mask"
Zhang 2013[44]	CDC Systematic Review	N95	Medical mask	Pandemic H1N1 2009	No direct comparison between N95 respirator and surgical/medical mask	Contains data that could be extracted for use despite no direct comparison

D. Internal Validity Assessment (IVA) Signaling Prompts

- Study Design
    - Design appropriate to research question
    - Well described population
    - Well described setting
    - Well described intervention/ exposure
    - Well described control/ comparator
    - Well described outcome
    - Clear timeline of exposures/ interventions and outcomes
- Selection Bias: Sampling
    - Randomization appropriately performed
    - Allocation adequately concealed
    - Population sampling appropriate to study design
- Selection Bias: Attrition
    - Attrition not significantly different between groups
    - Attrition <10-15% of population
    - Attrition appropriately analyzed
- Information Bias: Measurement and Misclassification
    - Measure of intervention/ exposure is valid
    - Measure of outcome is valid
    - Fidelity to intervention is measured
    - Fidelity to intervention is valid
    - Prospective study
    - Adequately powered to detect result
    - Outcome assessor blinded
- Information Bias: Performance and Detection
    - Study participant blinded
    - Investigator/ data analyst blinded
    - Data collection methods described in sufficient detail
    - Data collection methods appropriate
    - Sufficient follow up to detect outcome
- Information Bias: Analytic

    - Appropriate statistical analyses for collected data
    - Appropriate statistical analyses are conducted correctly
    - Confidence interval is narrow
- Confounding
    - Potential confounders identified
    - Adjustment for confounders in study design phase
    - Adjustment for confounders in data analysis phase
    - All pre-specified outcomes are adequately reported
- Other Sources of Bias (including historical events, etc.)
    - No other sources of bias
- Conflict of Interest (COI)
    - Funding sources disclosed and no obvious conflict of interest

E. Table of Acronyms

Acronym	Expansion
AGP	Aerosol-generating procedures
ARI	Acute respiratory illness
CDC	Centers for Disease Control and Prevention
CI	Confidence interval
CO_2	Carbon dioxide
COI	Conflict of interest
COVID-19	Coronavirus Disease 2019
CRI	Clinical respiratory illness
ED	Emergency department
FFP	Filtering face piece
GRADE	Grading of Recommendations Assessment, Development and Evaluation
HCP	Healthcare personnel
HEPA	High-efficiency particulate air
HICPAC	Healthcare Infection Control Practices Advisory Committee
HR	Hazard ratio
I^2	Measure of heterogeneity in meta-analyses
ICU	Intensive care unit
ILI	Infection prevention and control
IPC	Infection prevention and control
IPSOS	Multinational market research and consulting firm
IRR	Incidence rate ratio
IVA	Internal validity assessment
LTCF	Long-term care facility
N95	N95 respirator
NA	Not applicable
NAT	Nucleic acid testing
ND	Not defined
NIOSH	National Institute for Occupational Safety and Health
NR	Not reported
NS	Not significant
NSAID	Nonsteroidal anti-inflammatory drug

Acronym	Expansion
OR	Odds ratio
PAPR	Powered air purifying respirator
pCO_2	Partial pressure of carbon dioxide
PCR	Polymerase Chain Reaction
PPE	Personal protective equipment
RCT	Randomized controlled trial
RD	Absolute risk difference
RNA	Ribonucleic acid
RR	Relative risk
RSV	Respiratory syncytial virus
RT-PCR	Reverse transcriptase polymerase chain reaction
SARS	Severe acute respiratory syndrome
SD	Standard deviation
SpO_2	Saturation of peripheral oxygen (pulse oximetry)
TB	Tuberculosis
TBP	Transmission-based precautions
TST	Tuberculin skin test
US	United State of America
UV	Ultraviolet
VRI	Viral respiratory infection

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