

Abstract

Objective: To systematically assess the evidence comparing directly the effectiveness of surgical facemasks to respirators in the prevention of COVID-19 infection in Health care Workers (HCWs) providing non-Aerosol Generating Procedure (AGP) care to Covid-19 patients.

Methods: We performed a systematic review of literature databases. This was prospectively registered.

Results: We identified only one relevant study which reported no significant difference in COVID-19 infection rates amongst HCWs wearing surgical facemasks as compared to FFP2 respirators. That was observational with substantial methodological deficiencies.

Conclusions: There is lack of evidence to support the use of either fluid resistant surgical masks or FFP respirators when providing non-AGP care to Covid-19 patients. Until high quality evidence is available, and given that inadequate mask use may increase the risk of nosocomial infection amongst patients and HCWs, we recommend respirators for non-AGP care of Covid-19 patients.

Introduction

Appropriate facemask usage is vital to limit nosocomial infection with COVID-19 amongst healthcare workers (HCWs) and patients. In Scotland, HCWs and their families accounted for 1/6th of hospital cases of COVID-19¹. In the North West of England, up to 25% of COVID-19 infections were attributed to nosocomial spread². We recently highlighted the impact of lack of COVID-19 testing amongst patients and doctors and inadequate barrier nursing in the North West of England³. However, nosocomial infection is not inevitable and may be substantially reduced as shown by studies in Wuhan⁴ and the Heart Centre in Berlin⁵.

COVID-19 is transmitted through large and small respiratory droplets released by breathing, speaking, coughing or sneezing. Transmission occurs through exposed mucosae or through direct contact between infected surfaces. Large droplets do not travel far in air but smaller droplets (aerosols) are thought to travel further, remain suspended for longer and may also pass through face-coverings. Surgical masks have multiple layers and small pore sizes but prevent the passage of only large aerosol droplets and do not provide a tight seal around the wearer's mouth and nose. Filtering face piece (FFP) respirators filter small air particles, and range from FFP1 (filter 80% of small droplets), to FFP2 (filter 94%) and FFP3 (filter up to 99%). Similarly, N95 respirators filter 95% of airborne particles. Particulate respirators also provide a tight seal around the mouth and nose, limiting air leakage⁶.

Establishing the effectiveness of surgical facemasks compared to respirators when providing non-Aerosol Generating Procedure (AGP) care is vital. Given the large cost difference between standard surgical masks and respirators, unnecessary use of the latter could be considered a form of financial harm. However, equally, the use of standard surgical facemasks as opposed to respirators could confer increased risk for nosocomial infection and potential for harm from COVID-19.

The aim of this study was to systematically assess the evidence comparing directly surgical facemasks to respirators in the prevention of COVID-19 infection in HCWs providing non-

AGP care to Covid-19 patients.

Methods

We carried out a systematic literature search using the Cochrane methodology, registered prospectively with PROSPERO (regCRD42020222869). We searched Pubmed, EMBASE, CINAHL, CENTRAL (Cochrane Library), Lancet Covid-19 research centre, on 25/11/20 with no limits. Search keywords were 'sars-cov-2 'OR 'covid-19 'AND N95 or FFP or FFP1 or FFP2 or FFP3 or surgical masks or facemasks.

Inclusion Criteria

Population: HCWs caring for Covid-19 patients in a hospital setting, not involving AGPs.

Intervention: Surgical masks versus respirators.

Comparators: Use of surgical masks versus use of respirators.

Outcomes: Covid-19 infection based on PCR testing or clinical findings.

Type of study: RCTs, Cohort, Case series, Case-control.

Exclusion Criteria

Systematic reviews, meta-analysis, case reports, reviews, editorials, commentaries, personal opinions, and any study with less than 10 participants.

Two of the authors independently identified eligible studies. All duplicates were removed and all studies were screened for inclusion with any disagreement being settled by the lead author.

Data Extraction

Data was extracted by the 2 authors independently and the lead author settled any discrepancies.

Results

Of 7836 articles identified 629 were duplicates and 7176 failed to meet the inclusion criteria. 30 articles were excluded following full-text review leaving only one article for inclusion (Figure 1). In that study, Schmitz et al⁶ disseminated a questionnaire to emergency departments in the Netherlands exploring retrospectively their PPE use and staff infection rates. In 13 of 43 hospitals, FFP-2 or equivalent or higher level of protection respirators and eye protection were worn during all patient contacts (irrespective of AGP). These were compared to hospitals which used lower level PPE including surgical facemasks or FFP1 respirators for non-AGP care. Initial analysis showed that a higher level of PPE was associated with a higher infection rate. However, in multivariate analysis, adjusting for the hospital staff COVID-19 testing policy, the level of PPE use was not associated with COVID-19 infection rates.

Assessment of methodological quality

The methodological quality of the included study was assessed using the Methodological Index for Non-Randomised Studies (MINORS criteria) (Table 1).

Discussion

Understanding the level of PPE required when providing non-AGP care to Covid-19 patients is vital in limiting nosocomial spread of the infection. Although non-AGP care does not involve invasive airway interventions, Covid-19 patients may be symptomatic, actively coughing, and nursed in enclosed hospital ward bays. This systematic review has demonstrated a lack of evidence to support the use of either fluid resistant surgical masks or FFP respirators when providing non-AGP care to Covid-19 patients.

There is debate whether coughing and sneezing are aerosol generating. A recent systematic review identified 10 articles which classified coughing as aerosol generating, 5 as potentially aerosol generating and 3 as non-aerosol generating⁷. A study in 25 healthy volunteers showed that CPAP ventilation produced less aerosols than breathing, speaking and coughing, whilst coughing was associated with the highest aerosol emissions, 10 times that of breathing or speaking⁸. Public Health England (PHE) do not classify coughing or sneezing as aerosol generating and stipulated that non-AGP care requires minimal PPE (surgical masks) whilst AGP care requires full PPE with a FFP3 respirator. The CDC state the need for a N95 respirator (or equivalent), eye protection and a full body gown when dealing with confirmed or suspected COVID-19 positive patients. PHE PPE recommendations seem to be based on studies of influenza virus, rather than SARS-CoV-2. However, the American Society of Microbiology have highlighted key differences in the transmission of the two viruses; SARS-CoV-2 appears to remain on inanimate objects for longer and its reproductive rate (R) is higher (about 2.5 vs. 1.5 for influenza). The incubation period of SARS-CoV-2 is more variable (2 to 14 days)⁹.

Based on our findings, we conclude that there is limited evidence to support the use of either fluid resistant surgical masks or FFP respirators when providing non-AGP care to Covid-19 patients. The only article that met our inclusion criteria was observational and had substantial methodological deficiencies. Furthermore, we could only identify one registered randomised controlled trial protocol for a study in nurses, in Alberta, Canada who were to be randomised to medical masks or N95 respirators when providing care to patients with COVID-19 when undertaking non-AGP care¹⁰. However, the relevance of that trial may be limited as healthcare settings vary between countries and healthcare systems.

A considerable research effort has been placed on developing medical prophylactic and therapeutic interventions for COVID-19, yet the evidence base for non-pharmacological healthcare prevention strategies is limited. National policy should be dictated by evidence and this systematic review clearly highlights the complete lack of high quality studies in this area. The absence of evidence should not be concluded as absence of difference between the effectiveness of different masks and simply urges the need for high quality evidence.

Until that time, we would continue to argue for a cautious approach and recommend respirators for non-AGP care of Covid-19 patients.

References

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