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Evidence Snapshot

The efficacy of respirators and medical masks for healthcare workers to reduce transmission of COVID-19

An Evidence Snapshot brokered by the Sax Institute for the Australian Commission on Safety and Quality in Health Care.
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Introduction

This Evidence Snapshot was commissioned by the Australian Commission on Safety and Quality in Health Care and prepared by the Sax Institute. Note that it was completed within 5 days, so while a rigorous process for searching was followed it is possible that some peer reviewed or grey literature may have been missed.

Given the rapid increase in the number of health care workers contracting COVID-19 in Australia, actions to better manage the protection of health care staff and the prevention of transmission of COVID-19 are under consideration. The Commission is interested in the evidence on the comparative efficacy of respirators such as N95 and P2 masks, compared to surgical or medical masks, in reducing transmission of COVID-19 in hospitals and aged care settings. Current advice at national level in Australia is that health care workers wear personal protective equipment (PPE), which includes gloves, gowns, surgical masks and shields when dealing with potential or confirmed cases of COVID-19. Current recommendations in Australian jurisdictions and New Zealand are conflicting as indeed is the case internationally.

Recommendations in favour of medical masks for non-aerosol generating procedures may be based in part on evidence that is no longer current. The Commission is therefore also interested in the latest evidence on aerosol transmission and whether this should change the advice on the type of masks worn by health care workers. A second Evidence Snapshot reviews the most recent literature on aerosol transmission and the findings should be considered together.

Review question

What is the evidence of the efficacy of N95 masks compared to surgical or medical masks in reducing transmission of COVID-19 in hospitals and residential aged care facilities?

Methods

We searched PubMed; Google Scholar; collections of COVID-19 related research (Oxford University Centre for Evidence Based Medicine, CDC, Cochrane, ScienceDirect, Lancet, BMJ) as well as a grey literature search including jurisdictions and major international organisations from Australia, New Zealand, UK, US and Canada. We reviewed the title and abstracts of 779 peer reviewed papers. The searches were undertaken on 12 and 13 August 2020, and peer-reviewed and grey literature was sourced by 5 pm on 13 August. The included studies were reviewed by a content expert. We provide a summary of the included studies in Appendix 4 and full results in Appendix 3-6.

Summary of findings

We identified 14 peer reviewed papers that were published in 2020 in the context of the COVID-19 pandemic: 13 reviews and 1 peer reviewed commentary. **One systematic review and meta-analysis directly compared the effectiveness of respirators and medical or surgical masks n SARS COV 2 and COVID-19**. Three other systematic reviews found respirators were more effective than medical masks in reducing transmission of viral respiratory illnesses. The evidence overall is very limited and of low certainty.

The **best available evidence** is the WHO commissioned systematic review and meta-analysis of SARS, MERS and SARS-COV-2 by Chu et al 2020(1), which showed that N95 masks were 96% effective in reducing transmision and surgical masks 67% effective. This effect persisted after adjusting for aerosolisation.

Key messages

Peer reviewed literature

- This rapid evidence review identified 13 reviews and 1 commentary addressing the comparative effectiveness of respirators and medical masks. Of the thirteen reviews, 9 were systematic reviews(1-9), 3 were narrative reviews(10-12), and 1 was a scoping review(13). Eight reviews were specific to COVID-19(1-3, 5, 7, 9, 11, 12) and 5 studied viral respiratory illnesses(4, 6, 8, 10, 11), including coronavirus.
- Direct evidence on the effectiveness of respirators in the prevention of SARS-CoV-2 infection is low, with concerns about the generalizability of other virus models. **We found one systematic review and meta-analysis(1) and one peer reviewed commentary(14) that compared the effectiveness of respirators with medical masks in hospital settings** that were specific to COVID-19.
- Six reviews found N95 masks were more effective than medical masks in reducing transmission of COVID-19 or other viral respiratory illnesses(1, 3, 5, 6, 10-12), however only **four concluded that respirators should be worn by healthcare workers outside of** aerosol generating procedures (AGPs)(1, 5, 6, 12) and only 3 of these were systematic reviews(1, 5, 6).
- Three systematic reviews found both types of masks of equivalent effectiveness (particularly where both patient and health care worker wear surgical masks)(2-4) and 3 found the evidence insufficient or inconclusive(4, 10, 13). Overall the study quality was low.
- As noted above, the strongest evidence was from Chu et al(1), who found that **N95s offer greater protection from COVID-19 regardless of aerosolisation,** as the stronger association with N95 or similar respirators over other masks persisted when adjusted for AGPs. The authors note that the effects seen were large and probably clinically important.
- MacIntyre et al's review(6) found respirators were effective reducing transmission of coronaviruses and other transmissible respiratory viruses and supported the use of respirators continuously during a shift by healthcare workers; medical masks were found to be ineffective. Chou et al(3) found N95 masks more effective in preventing transmission of

SARS-CoV-1; Ma et al found that N95 masks offered the greatest protection against avian influenza(5).

- Two systematic reviews(2, 7) and the commentary(14) supported the use of respirators for aerosol generating procedures only, **due to the absence of clear scientific evidence for aerosol transmission** of SARS-CoV-2.
- One narrative review provided a risk adjusted strategy addressing various scenarios(12). This review (see Appendix 6) was the only study to refer to **residential type facilities such as nursing homes** and orphanages, and noted their vulnerability, with their greater potential for cluster outbreaks. This analysis proposed that 'workers' in residential facilities wear surgical masks or respirators and that 'others' wear disposable medical masks.

Understanding uncertainty related to the use of respirators

- Assumptions, limited evidence about transmission routes, factors associated with respirators, and the lack of data specific to the current pandemic, appear to influence recommendations in favour of medical masks over respirators.

(a) **Distance travelled by droplets**: Recommendations by some authors rely on the assumption that droplets do not travel more than 2 metres from the infected person. COVID-19 has been found in air conditioning and in air exhaust outlets, suggesting either that small virus-laden droplets are displaced by airflows that mimic aerosolisation, or that the droplets have indeed been aerosolised. One study identified particles expelled during speaking or singing as transmitting COVID-19.

(b) **Insufficient evidence that is specific to COVID-19**. Several studies indicated that caution must be applied to studies of the effectiveness of masks undertaken for other types of viral respiratory infections or influenza like illnesses, since their infectivity, composition and transmission routes cannot be assumed to be the same as SARS COV-2 or COVID-19.

(c) **Few studies made direct comparisons** between respirators and medical masks. For this review, we excluded studies which compared different types of respirators (see Appendix 5), and studies that compared N95s to no mask.

(d) Uncertainty about the comparative effectiveness of respirators may also be associated with poor fit and discomfort for the wearer with prolonged use and/or with poor compliance with protocols for donning and doffing PPE, resulting in contamination not directly associated with the use of respirators themselves.

Jurisdiction and country responses

- Current recommendations in Australia at the Commonwealth level are that the use respirators for healthcare workers (HCWs) is recommended only for aerosol generating procedures (AGPs). The same advice is provided in other states and territories except for Victoria and South Australia. Victoria advises that respirators are used in COVID-19 wards, when patients with suspected or confirmed COVID-19 are grouped or when AGPs are being performed. South Australia recommends that respirators are used when HCWs are in frequent contact with a patient with COVID-19, in intensive care units (ICU) and for AGPs.
- The World Health Organization along with New Zealand and the United Kingdom currently recommend that respirators should be reserved for AGPs.
- The Centres for Disease Control and Prevention (CDC) in the United States recommends the use of respirators for HCWs when working with COVID-19 patients, however where respirators are unavailable, a medical or surgical mask is an appropriate substitute.
- The European Centre for Disease Control recommends the use of medical masks for all HCWs in areas where there is high community transmission of COVID-19; when a HCW is

in contact with a patient with suspected of confirmed COVID-19 a respirator should be worn.

- Canada makes no recommendation on the use of respirators and surgical/medical masks, however respirators and medical/surgical masks should be reserved for HCWs (and not used by the public).

Appendices

Appendix 1: Included publications

Bartoszko, Jessica J.; Farooqi, Mohammed Abdul Malik; Alhazzani, Waleed; Loeb, Mark. Medical masks vs N95 respirators for preventing COVID-19 in healthcare workers: A systematic review and meta-analysis of randomized trials.

Bein B, Bachmann M, Huggett S, Wegermann P. SARS-CoV-2/COVID-19: Evidence-Based recommendations on diagnosis and therapy. Geburtshilfe und Frauenheilkunde. 2020 May;80(5):491.

Chu DK, Akl EA, Duda S, Solo K, Yaacoub S, Schünemann HJ, El-harakeh A, Bognanni A, Lotfi T, Loeb M, Hajizadeh A. Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis. The Lancet. 2020 Jun 1.

Chou, Roger; Dana, Tracy; Jungbauer, Rebecca; Weeks, Chandler; McDonagh, Marian S. Masks for Prevention of Respiratory Virus Infections, Including SARS-CoV-2, in Health Care and Community Settings: A Living Rapid Review.

Conly J, Seto WH, Pittet D, Holmes A, Chu M, Hunter PR. Use of medical face masks versus particulate respirators as a component of personal protective equipment for health care workers in the context of the COVID-19 pandemic. Antimicrobial Resistance & Infection Control. 2020 Dec;9(1):1-7.

Godoy LR, Jones AE, Anderson TN, Fisher CL, Seeley KM, Beeson EA, Zane HK, Peterson JW, Sullivan PD. Facial protection for healthcare workers during pandemics: a scoping review. BMJ global health. 2020 May 1;5(5):e002553.

Ippolito M, Vitale F, Accurso G, Iozzo P, Gregoretti C, Giarratano A, Cortegiani A. Medical masks and Respirators for the Protection of Healthcare Workers from SARS-CoV-2 and other viruses. Pulmonology. 2020 Apr 27.

Long, Youlin; Hu, Tengyue; Liu, Liqin; Chen, Rui; Guo, Qiong; Yang, Liu; Cheng, Yifan; Huang, Jin; Du, Liang. Effectiveness of N95 respirators versus surgical masks against influenza: a systematic review and meta-analysis.

Ma, Qing-Xia; Shan, Hu; Zhang, Hong-Liang; Li, Gui-Mei; Yang, Rui-Mei; Chen, Ji-Ming. Potential utilities of mask-wearing and instant hand hygiene for fighting SARS-CoV-2

MacIntyre CR, Chughtai AA. A rapid systematic review of the efficacy of face masks and respirators against coronaviruses and other respiratory transmissible viruses for the community, healthcare workers and sick patients. International Journal of Nursing Studies. 2020 Apr 30:103629.

Ong SW, Coleman KK, Chia PY, Thoon KC, Pada S, Venkatachalam I, Fisher D, Tan YK, Tan BH, Ng OT, Ang BS. Transmission modes of severe acute respiratory syndrome coronavirus 2 and implications on infection control: a review. Singapore medical journal. 2020.

Ong, Sean Wei Xiang; Tan, Yian Kim; Chia, Po Ying; Lee, Tau Hong; Ng, Oon Tek; Wong, Michelle Su Yen; Marimuthu, Kalisvar. Air, surface environmental, and personal protective equipment contamination by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) from a symptomatic patient.

Radonovich, Lewis J; Simberkoff, Michael S; Bessesen, Mary T; Brown, Alexandria C; Cummings, Derek AT; Gaydos, Charlotte A; Los, Jenna G; Krosche, Amanda E; Gibert, Cynthia L; Gorse, Geoffrey J. N95 respirators vs medical masks for preventing influenza among health care personnel: a randomized clinical trial

Sommerstein R, Fux CA, Vuichard-Gysin D, Abbas M, Marschall J, Balmelli C, Troillet N, Harbarth S, Schlegel M, Widmer A. Risk of SARS-CoV-2 transmission by aerosols, the rational use of masks, and protection of healthcare workers from COVID-19. Antimicrobial Resistance & Infection Control. 2020 Dec;9(1):1-8.

Wang J, Pan L, Tang S, Ji JS, Shi X. Mask use during COVID-19: A risk adjusted strategy. Environmental Pollution. 2020 Jun 25:115099. Narrative Review

World Health Organization. (2020). Rational use of personal protective equipment (PPE) for coronavirus disease (COVID-19): interim guidance, 19 March 2020. World Health Organization. https://apps.who.int/iris/handle/10665/331498. License: CC BY-NC-SA 3.0 IGO

World Health Organization. Advice on the use of masks in the community, during home care, and in health care settings in the context of COVID-19: interim guidance, 19 March 2020. World Health Organization; 2020.

Appendix 2: Search strategy

Key concepts

Concept 1	Concept 2	Concept 3	Concept 4	Concept 5
Mask*	Coronavirus	Hospital	Infect*	Healthcare worker
Medical mask*	COVID*	ICU	Transm*	Care worker
N95	SARS COV-2	Emergency	Prevention	Doctor
P2	CoV	aged care		Nurse
Respirator				
Elastomeric				

Timeframe

- Last 12 months

Inclusion and exclusion criteria

We **included** combinations of the following key words: mask, surgical mask, medical mask, P2, N95, elastomeric, respirator, coronavirus, COVID, SARS CoV 2, transmission, infection, hospital, ICU, emergency, 'aged care', residential, facility*, health care worker, care worker, doctor, nurse. We included: systematic reviews, narrative reviews, and primary research. We also included peer reviewed commentaries. Agency and jurisdictional searches are listed in Appendix 7.

We **excluded** studies that compared different types of respirators, compared N95s to no-masks, use of masks in primary care and dental settings; studies that described the design of masks; studies focusing on supply and shortages; studies on extended use or re-use of masks, or on the decontamination or disposal of masks; studies on training, behaviour and protocol compliance. We excluded correspondence, new, letters, editorials and protocols.

We did not critically appraise the included studies and note that some studies may have been published before peer review was completed.

Sources

1. PubMed
    - ((((((((((COVID*[Title/Abstract]) OR (CoV[Title/Abstract])) OR (SARS COV-2[Title/Abstract])) AND (hospital[Title/Abstract])) OR (Intensive care[Title/Abstract])) OR (emergency[Title/Abstract])) OR ('aged care'[Title/Abstract])) OR (residential[Title/Abstract])) OR (facilit*[Title/Abstract])) AND (infection[Title/Abstract])) OR (transmission[Title/Abstract]) OR prevention
    - Limited to articles published from 13 August 2019 to 13 August 2020
    - Excluded editorials, news, correspondence, letters

2. Cochrane Collaboration: COVID Special Collection

    Infection control and prevention measures
    - Keywords: respiratory and transmission
    - Limited to articles published from 13 August 2019 to 13 August 2020

3. Lancet COVID Collection
    - Keywords: COVID, transmission, infection
    - Limited to articles published from 13 August 2019 to 13 August 2020

4. BMJ COVID Collection
    - Keywords: COVID, transmission, infection
    - Limited to articles published from 13 August 2019 to 13 August 2020

5. ScienceDirect COVID Collection:
    - Keywords: COVID, transmission, infection
    - Selected review articles, mini review, and research articles limited to 2020

6. Google Scholar
    - Keywords: COVID, transmission, infection
    - First 6 pages of 10 articles per page

7. Centre for Evidence-based Medicine (Oxford)
    - Keywords: PPE and Prevention
    - Limited to articles published from 13 August 2019 to 13 August 2020

Appendix 3 Search results

A **Database**	B **Results**	C **Excluded after title & abstract screening**	D **Full text review**	E **Excluded after full text review**	F **FINAL INCLUDED**
	n=	n=	n=	n=	n=
1 PubMed	374	367	7	2	**5**
2 Cochrane COVID	14	12	2	2	**0**
3 Lancet COVID	3	3	0	0	**0**
4 BMJ COVID	94	94	0	0	**0**
5 Science direct COVID	143	141	2	1	**1**
6 Google Scholar	142	130	11	3	8
7 CEBM	9	7	2	2	0
TOTAL	779	755	24	10	***Total n=14***

Appendix 4: Summary table of included studies

	First author	Review type	COVID 19 specific?	Viral respiratory infections	Findings	N95 Y/N
1	Bartoszko	SR		x	Medical masks and N95 respirators offer similar protection	No
2	Chou	SR		x	Insufficient evidence for SARS-CoV-2. Yes for SARS-CoV-1	No
3	Chu	SR	x		N95 has greater protection regardless of aerosolisation	Yes
4	Long	SR		x	No significant difference between N95 respirators and medical masks	No
5	Ma	SR		x	N95 greatest protection against avian influenza	Yes
6	MacIntyre	SR		x	Respirators more effective in health care settings	Yes
7	Ong Tr	SR	x		No conclusion can be drawn	Unsure
8	Radonovich	SR		x	No significant difference	No
9	Sommerstein	SR	x		Insufficient direct evidence that respirators more effective	No
10	Godoy	Scoping	x		N95 more effective in laboratory. Conflicting in inpatients	Unsure
11	Bein	Narrative	x		Prefer N95, but medical masks on patient and HCW should be fine	No
12	Ippolito	Narrative	x		P95 more effective, but Long found no significant difference	No
13	Wang	Narrative	x		Risk adjusted strategy and compliance improvement needed	Yes
14	Conly	Commentary	x			No

Appendix 5: Descriptors of different kinds of respirator masks (Ippolito et al)

Table 1 Characteristics of surgical masks and respirators.

Name or Respirator class EU-OSHA [a]	Fit-test [b]	Splash protection [c]	Type of protection	Filter performance [d]	Inward leakage [e]	Equivalent classes [f]	Notes
Medical mask	Not needed	Type IIR	Droplets	Variable	Variable	NA	Loose-fitting; not protective for inhalation
FFP1	Needed	Type IIR	Droplets and airborne particles	≥ 80%	< 22%	NA	Expiration valve version available*
FFP2	Needed	Type IIR	Droplets and airborne particles	≥ 94%	< 8%	N95/P95/R95	Expiration valve version available*
FFP3	Needed	Type IIR	Droplets and airborne particles	≥ 99%	< 2%	N100/N99/P100/ P99/R100/R99	Expiration valve version available*
Elastomeric respirator	Needed	Provided	Droplets and airborne particles	Interchangeable filters	Interchangeable filters	NA	Re-usable; expensive; half or full face
PAPR	Usually not needed	Provided	Droplets and airborne particles	Interchangeable filters	Interchangeable filters	NA	Powered; re-usable; expensive; hood or loose-fitting; extended working hours
SAR	Needed	Provided	External uncontaminated source of breathing air	External uncontaminated source of breathing air	External uncontaminated source of breathing air	NA	Powered; re-usable; expensive; continuous or on demand flow; self-contained or airline source of breathing air

The table provides a summary of the main characteristics of medical masks and respirators.
Data were retrieved from ECDC and OSHA documents. [10,11]

[a] The common name of the device or the respirator class, according to EU-OSHA classification, is reported.
[b] A fit test with an indicator aerosol should be performed before first use of a model/size. If the test is positive, the respirator is leaking, and another model or size must be chosen.
[c] Protection from body fluid splashes. If the device is not certified as splash-proof, a separate hood should be used for this purpose.
[d] Filter performance measures the reduction in concentration of specific test aerosols passing through the filter. It is calculated at specific standard conditions that can vary according to national regulations. Minimal variations can occur among equivalent classes around the world.
[e] Inward leakage measures the amount (%) of a specific aerosol allowed to enter the device in a test chamber.
[f] Respirators performance characteristics are tested at national regulatory standard conditions. These standards have similarities around the world; thus recommendations usually refer to a specific class and its foreign equivalent models. Examples of FFP2 equivalents: N95 (United States), KN95 (China), P2 (Australia/New Zeland), DS (Japan), Korea 1st class (Korea).
* The presence of an expiratory valve results in a more comfortable breathing, offering less resistance to exhalation. The valve also reduces goggles fogging. Valved respirators are usually not certified as splash-proof.
EU-OSHA: European Agency for Safety and Health at Work; FFP: Filtering facepiece; NA: not available; N-: tested with NaCl filter loading; R-: tested with dioctylphthalate filter loading; P-: tested with dioctylphthalate at maximum filter degradation; PAPR: Powered Air-purifying respirator; SAR: Atmosphere-supplying respirator

Appendix 6: Example of a risk stratified approach (Wang et al)

Table 1
The mask use strategy in different scenarios based on risks (Bureau of Disease Control and Prevention, 2020).

Population	Scenario	Risk	Mask
General public	Residential and outdoor environments or places with adequate ventilation and no gatherings	–	No mask
	Crowded places such as offices, shopping malls, restaurants, conference room, etc. or relatively closed environments such as elevators, transportation vehicles, etc.	High[a]	Disposable medical mask
		Middle to low[b][c]	Disposable medical mask (when distance between surrounding people is within 1 m)
	People who has symptoms of cough or sneezing	–	Disposable medical mask or surgical mask
	People who lives together with recovered COVID-19 patients or isolated individuals	–	Disposable medical mask or surgical mask
People in specific places	Public crowded places such as hospitals, railway stations, airport, supermarkets, restaurants, etc.	High	Surgical mask or respirator
		Middle to low	Disposable medical mask or surgical mask
	Relatively closed crowded places such as prison, nursing homes, classrooms, dormitories, etc.	High	Workers: surgical mask or respirator Others: disposable medical mask
		Middle to low	Disposable medical mask or surgical mask (when people gather or distance between surrounding people is within 1 m)
Key people	Suspected cases, confirmed cases, asymptomatic carriers, and close contacts	–	Surgical mask or respirator without valve
Occupational exposed worker	Emergency healthcare workers	High to middle	Medical respirator
		Low	Surgical mask
	Healthcare workers in general outpatient clinics or wards, administrative personnel such as police, security, cleaning workers, etc.	–	Surgical mask
	Workers in ICU or wards of confirmed cases or suspected cases; healthcare workers of the fever clinic in designated hospitals; laboratory detection personnel; epidemiological investigation personnel; environmental disinfection personnel; environmental infection worker; personnel who transport confirmed or suspected cases	–	Medical respirator

[a] High risk denotes to cumulative confirmed cases over 50 with clusters in 14 d in the region.
[b] Medium risk denotes to cumulative confirmed cases of 1–50 or cumulative confirmed cases over 50 without clusters in 14 d in the region.
[c] Low risk denotes to cumulative confirmed cases over 50 with clusters in 14 d in the region.

Appendix 7: Data extraction tables

7.1 Peer reviewed studies

Author, year	Study design	Population Healthcare setting	What did they test or review?	Outcomes measured	Results	Conclusion	Recommend respirator?	Other
Bein et al, 2020 (COVID specific)	Narrative review conducted on 3 April 2020	Health care	Diagnosis, therapy, and protection of health workers (translated from German)	3 reviews were considered (one available in German only)	Regarding masks, the authors report that while all healthcare staff should be	While all healthcare staff should be maximally protected with FFP2/P3 masks, providing both patients and clinicians with surgical masks should be protective, based on Radonovich et al's findings that surgical masks are not inferior to filtering respirator masks.	**Prefer N95,** but likely that providing patients and healthcare staff with surgical masks will be non inferior	
Burton et al 2006	Rapid review	Clinical	Filtering respirators for use in healthcare settings	Comparabiity of international standards, impact of proper fit and use, impact on clinical skills, impact of clinical activities on	Standards are broadly comparable across jurisdictions, fitting, training in use and regular	A wide range of respirator types can be used in patient care during the COVID-19 pandemic. Careful consideration of performance and impact is needed to maximise protection	NA	

Author, year	Study design	Population Healthcare setting	What did they test or review?	Outcomes measured	Results	Conclusion	Recommend respirator?	Other
				effectiveness of masks	checking is essential, little impact on clinical skills, some clinical activities reduce protection provided by filtering respirators	and minimise disruption to delivery of care		
Chou et al, 2020	Review	Community and healthcare settings	To examine the effectiveness of N95, surgical, and cloth masks in community and health care settings for preventing respiratory virus infections, and effects of reuse or extended use of N95 masks.			Evidence on mask effectiveness for respiratory infection prevention is stronger in health care than community settings. N95 respirators might reduce SARS-CoV-1 risk versus surgical masks in health care settings, but applicability to SARS-CoV-2 is uncertain.	Insufficient evidence for SARS-CoV-2. Yes for SARS-CoV-1	

Author, year	Study design	Population Healthcare setting	What did they test or review?	Outcomes measured	Results	Conclusion	Recommend respirator?	Other
Chu et al, 2020	Systematic review	Healthcare and non-healthcare settings n=25 697 patients, most with SARS, MERS.	The effects of physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19. Most studies (80) reported on SARS or MERS, and 64 provided direct evidence on COVID-19	Analysis was done on intervention effects for transmission and contextual factors such as acceptability, feasibility, effect on equity, and resource considerations	In between-study and within-study comparisons, we noted a larger effect of N95 or similar respirators compared with other masks although the certainty of effect is not rated as high	Although direct evidence is limited, the optimum use of face masks, in particular N95 or similar respirators in health-care settings and 12–16-layer cotton or surgical masks in the community, could depend on contextual factors; action is needed at all levels to address the paucity of better evidence	Yes. Plausible that N95s offer greater protection regardless of aerosolisation. The stronger association with N95 or similar respirators over other masks persisted when adjusted for AGPs. The effects seen were large and probably clinically important. May depend on contextual factors. Gai check whether this relates to AGPs only	

Author, year	Study design	Population Healthcare setting	What did they test or review?	Outcomes measured	Results	Conclusion	Recommend respirator?	Other
Conly et al, 2020 (on behalf of the WHO Infection Prevention and Control Expert Group for COVID-19)	Commentary	Healthcare workers	The use of medical face masks versus particulate respirators as a component of PPE for health care workers (HCWs) working in the context of the COVID pandemic	Routes of transmission	Currently available evidence supports that the predominant route of human-to-human transmission of SARS-CoV-2 is through respiratory droplets and/or contact routes. The view of the authors is that SARS-Cov-2 is not spread by the airborne route to any significant extent.	The weight of scientific evidence to date indicates that particulate respirators offer no advantage over medical masks as a component of PPE for the prevention of respiratory viral infections transmitted by the droplet/contact route when used for routine care in clinical settings. The available evidence to date supports that the predominant route of transmission of SARS-CoV-2 is droplet/contact. Additional evidence on the use of medical masks and respirators is needed.	No	

Author, year	Study design	Population Healthcare setting	What did they test or review?	Outcomes measured	Results	Conclusion	Recommend respirator?	Other
Garcia Godoy et al, 2020	Review	Health care workers (HCWs)	Medical-grade facial protection (surgical masks, N95 respirators and face shields) for healthcare workers, the safety and efficacy of decontamination methods, and the utility of alternative strategies in emergency shortages or resource-scarce settings.		N95 masks provide superior protection to surgical masks when tested in the laboratory. Studies comparing different types of medical grade masks in the inpatient setting have conflicting results	More robust evidence is required on different types of medical-grade facial protection. As research on COVID-19 advances, investigators should continue to examine the impact on alternatives of medical-grade facial protection	Yes	
Ippolito et al 2020 (COVID specific)	Narrative review	Health care settings	Reviews recommendations (WHO, CDC, ECDC) for inward protection (mask protects the wearer) and outward protection (mask protects the enivironment).	Reduction in concentration of specific aerosols passing through the filter ie limiting inhalation of droplets and aerosols	Respirators afford higher protection; but Long et al conclude masks are not inferior to respirators	Both patient and health care worker should wear a medical mask ; respirators critical for AGPs including swabs	Respirators better, but Long found no significant difference.	

Author, year	Study design	Population Healthcare setting	What did they test or review?	Outcomes measured	Results	Conclusion	Recommend respirator?	Other
Long et al 2020 (includes 'coronaviruses')	SR MA including 6 RCTS with 9171 participants	Hospital and community settings	Effectiveness of N95 respirators versus medical masks for the prevention of influenza, viral infections (including coronaviruses), respiratory infection.		No statstically significant differences were found between the use of N95 respirators and medical masks for the outcomes of laboratory confirmed respiratory viral infections (RR = 0.89, 95% CI 0.70-1.11), laboratory-confirmed influenza (RR = 1.09, 95% CI 0.92-1.28), laboratory-confirmed respiratory	N95 respirators should not be recommended for the general public and healthcare workers performing low-risk procedures.	No	

Author, year	Study design	Population Healthcare setting	What did they test or review?	Outcomes measured	Results	Conclusion	Recommend respirator?	Other
					infection (RR = 0.74, 95% CI 0.42-1.29) or influenza like illness (RR = 0.61, 95% CI 0.33-1.14).			
Ma Qing-Xa et al, 2020	Simulated breathing tests to collect virus containing aerosols after passing through masks; and literature review	Simulated test	(1) efficacy of three types of masks in blocking avian influenza virus (AIV) in aerosols and (2) the efficacy of instant hand wiping in removing AIV from hands. Previous studies on mask-wearing were reviewed	Concentration of viral RNA after aerosols containing the virus were passed through the mask	N95 masks blocked 99.98%, medical masks blocked 97.14%, and homemade masks 95.15% of the virus in aerosols	Medical masks are not fully protective in hospitals but are useful for common social occasions. We propose mask-wearing and instant hand hygiene (MIH), ie that common people should wear effective masks and bring an appropriate item for instant hand hygiene when needed, to slow the rapid spread of the virus worldwide	Yes, in hospitals	

Author, year	Study design	Population Healthcare setting	What did they test or review?	Outcomes measured	Results	Conclusion	Recommend respirator?	Other
MacIntyre & Chughtai 2020 (includes coronaviruses)	Systematic review of randomised controlled clinical trials (n=19). Six RCTs in health care settings	Healthcare workers, sick patients and community members Health care and non health care	Prevention of infection		Respirators were effective in preventing infection in health care settings. Medical masks were not effective, and cloth masks even less effective when used by sick patients.	Trials in healthcare workers support the use of respirators continuously during a shift. This may prevent health worker infections and deaths from COVID-19, as aerosolisation in the hospital setting has been documented.	Yes	
Ong et al 2020 (Transmission modes and implications)	Review	Health care workers Hospitals	Modes of transmission for SARS-C0V-2	Transmission routes: fomite and environmental; stool shedding and faecal; airborne (aerosol) and droplet	COVID-19 patients can shed viable viruses from both respiratory and gastrointestinal tracts resulting in secondary infection	With regard to masks: Given the current paucity of data on SARS-CoV-2 and its transmission routes, no conclusions can be drawn as to whether N95 respirators or surgical masks are superior in the protection of healthcare personnel.	Inconclusive. PPE likely to be sufficient, however advice may change as transmission progresses	

Author, year	Study design	Population Healthcare setting	What did they test or review?	Outcomes measured	Results	Conclusion	Recommend respirator?	Other
					either directly (droplet and opportunisitic aerosol generation) or indirectly via contaminatio n of the environment or fomites.	Current isolation, PPE and decontamination protocols are likely sufficient but progression of the outbreak and resource restraints may force a redrawing of these protocols. Further studies are needed to clarify the extent and importance of each transmission route and other factors that affect transmission to tailor infection control recommendations		
Radonovich et al 2020	RCT 1993 participants in 189 clusterswer e randomly assigned to wear N95 respirators and 2058 in	Heatlh care professionals Outpatient	The effect of N95 respirators vs medical masks for prevention of influenza and other viral respiratory infections among HCP.	The primary outcome: incidence of laboratory-confirmed influenza. Secondary outcomes: included incidence of acute respiratory illness, laboratory-detected	There were 207 laboratory-confirmed influenza infection events (8.2%of HCP-seasons) in	Among outpatient health care personnel, N95 respirators vs medical masks as worn by participants in this trial resulted in no significant difference in the incidence of laboratory-confirmed influenza.	No: (implied)	

Author, year	Study design	Population Healthcare setting	What did they test or review?	Outcomes measured	Results	Conclusion	Recommend respirator?	Other
	191 clusterswere randomly assigned to wear medical masks when near patients with respiratory illness.			respiratory infections, laboratory-confirmed respiratory illness, and influenza like illness. Adherence to interventions was assessed.	the N95 respirator group and 193 (7.2%of HCP-seasons) in the medical mask group (difference, 1.0%, [95%CI, −0.5%to 2.5%]; P = .18) (adjusted odds ratio [OR], 1.18 [95%CI, 0.95-1.45]). There were 1556 acute respiratory illness events in the respirator group vs 1711 in the mask group			

Author, year	Study design	Population Healthcare setting	What did they test or review?	Outcomes measured	Results	Conclusion	Recommend respirator?	Other
					(difference, −21.9 per 1000 HCP-seasons [95%CI, −48.2 to 4.4]; P = .10); 679 laboratory-detected respiratory infections in the respirator group vs 745 in the mask group (difference, −8.9 per 1000 HCP-seasons, [95%CI, −33.3 to 15.4]; P = .47); 371 laboratory-confirmed respiratory illness events in the respirator			

Author, year	Study design	Population Healthcare setting	What did they test or review?	Outcomes measured	Results	Conclusion	Recommend respirator?	Other
					group vs 417 in the mask group (difference, −8.6 per 1000 HCP-seasons [95%CI, −28.2 to 10.9]; P = .39); and 128 influenza like illness events in the respirator group vs 166 in the mask group (difference, −11.3 per 1000 HCP-seasons [95%CI, −23.8 to 1.3]; P = .08). In the respirator group, 89.4%of			

Author, year	Study design	Population Healthcare setting	What did they test or review?	Outcomes measured	Results	Conclusion	Recommend respirator?	Other
					participants compliant and 90.2%in the mask group.			
Sommerstein	Literature review and expert opinion					There is no scientific evidence from head-to-head studies in favor of using FFP2 instead of a surgical mask outside the so called AGPs for COVID 19.	No	
Verbeek et al, 2020 OUT	SR of 24 studies	Health care staff and volunteers Simulation studies (n=2)	PPE types: powered, air-purifying respirator (PAPR) plus coverall versus N95 mask plus gown. Did not compare N95 and medical masks.	Risk of contamination and infection and compliance with PPE protocols ie •contamination of skin or clothing, •infection with EVD, another viral haemorrhagic fever, or comparable highly infectious disease with serious consequences such	A powered, air-purifying respirator with coverall may protect against the risk of contaminatio n better than a N95 mask and gown (risk ratio (RR) 0.27, 95% confidence	A powered, air-purifying respirator (PAPR) with a hood may protect better than an N95 mask with a gown but is more difficult to don, posing additional risk of contamination	Prospective follow-up of HCW involved in the treatment of patients with highly infectious diseases, with careful registration of PPE, donning and doffing and risk of infection is	

Author, year	Study design	Population Healthcare setting	What did they test or review?	Outcomes measured	Results	Conclusion	Recommend respirator?	Other
				as SARS, or COVID-19; •compliance with guidance on selection of type and use of PPE measured, for example, with an observation checklist.	interval (CI) 0.17 to 0.43) but was more difficult to don (non-compliance: RR 7.5, 95% CI 1.81 to 31.1).		needed. Case-control studies comparing PPE use among infected HCW and matched healthy controls, using rigorous collection of exposure data, can provide information about the effects of PPE on the risk of infection.	
Wang2 ety al (Association) OUT wrong comparator	Retrospecti ve	6 hospital departments 493 medical staff: 278 in the N95 mask group and 213 in the no-mask group	N95 (mask group) in respiratory, ICU and infectious diseases areas vs Non-mask Group in 3 other departments	COVID 1-Infections diagnosed by chest CT and confirmed with molecular diagnosis.	Patient exposure was significantly higher for the N95 group (OR 8.33) compared to no-mask	In our study, we found N95 respirators, disinfection and hand washing can help to reduce the risk of 2019-nCoV infection in medical staff	Yes	Two other hospitals similarly found no infections in hospital staff wearing N95 masks.

Author, year	Study design	Population Healthcare setting	What did they test or review?	Outcomes measured	Results	Conclusion	Recommend respirator?	Other
					group. There were 0 infections / 278 people in the N95 group; 10/213 in the no-mask group			

7.2 Jurisdictional recommendations

Australian State and Territory Recommendations		
State/Territory	**Face mask advice for health care workers.**	**Recommends respirator mask outside of AGP y/n**
New South Wales	• Surgical or medical mask unless performing AGPs on patients with suspected or confirmed COVID-19 where a respirator should be used.	N
Victoria	Health Care Workers **must** wear a N95/P2 respirator • When working in COVID-19 ward. • where suspected or confirmed COVID-19 patients are grouped and there is risk of unplanned AGPs and/or behaviours. when undertaking an AGP on suspected or confirmed coronavirus (COVID-19) patient • N95/P2 respirators not required for health care workers when • AGPs on patients who are not suspected or confirmed to (COVID19) risk factors. • working at a coronavirus (COVID-19) testing site and/or undertaking testing for coronavirus (COVID-19) • undertaking procedures at hotel quarantine sites. • Working with patients with aerosol generating behaviours who are not confirmed or suspected of COVID-19.	Y
Queensland	• Surgical or medical mask unless performing AGPs on patients with suspected or confirmed COVID-19 where a respirator should be used.	N
South Australia	Wear a surgical/medical masks when caring for non-ICU patients with confirmed or suspected COVID-19. Where a respirator: • Non-ICU prolonged or close contact with patients requiring frequent attendance • ICU • Aerosol-generating procedures (AGP).	Y
Western Australia	• Surgical or medical mask unless performing AGPs on patients with suspected or confirmed COVID-19 where a respirator should be used.	N

Australian Capital Territory	• Surgical or medical mask unless performing AGPs on patients with suspected or confirmed COVID-19 where a respirator should be used.	N
Northern Territory	• Surgical or medical mask unless performing AGPs on patients with suspected or confirmed COVID-19 where a respirator should be used.	N
Tasmania	• Surgical or medical mask unless performing AGPs on patients with suspected or confirmed COVID-19 where a respirator should be used.	N

Appendix 8: McMasters guide to COVID-19 evidence sources

Webpage and link	Summary of contents
World Health Organization	Technical guidance
National Institutes of Health	Treatment guidelines
National Institute for Health and Care Excellence	Rapid guidelines
BIGG	International database of GRADE guidelines
National COVID-19 Living Evidence Task Force	Guidelines for healthcare professionals
Johanna Briggs Institute	Infection control and prevention measures for health professionals and for health organisations
Cochrane systematic reviews	Specialised collection of COVID-19
US Veterans' Affairs (VA) Evidence Synthesis Program	Inventory of systematic reviews (completed and in progress) focused on COVID-19, with flags for reviews meeting minimum quality standards and for living reviews
Evidence Aid	Summaries of systematic reviews that may be relevant to COVID-19 in eight broad areas (infection prevention and control; clinical characterization and management; therapeutics and vaccines; public-health interventions; health systems and services; epidemiology; ethical considerations; and social science in response)
New South Wales' Agency for Clinical Innovation	COVID-19 Critical Intelligence Unit
National Collaborating Centre for Methods and Tools	COVID-19 Rapid Evidence Review
Ontario Health's Quality Business Unit	Special Reports: Health Quality Ontario's reports and publications.
SPOR Evidence Alliance	Methods and Applications Group in Indirect Comparisons (MAGIC) Network Meta-Analysis team (part of the CIHR Drug Safety and Effectiveness Network) – Coming soon, but with existing rapid reviews listed below
Knowledge to Policy Center	Knowledge to Policy Centre - Lebanon
Norwegian Institute of Public Health	Live map of COVID-19 evidence
National Institute for Health and Care Excellence (NICE)	COVID-19 related material

COVID-NMA	Living evidence map and living network meta-analysis
EPPI Centre	Living evidence map of human studies organised by 11 areas of focus
Norwegian Institute of Public Health	Living evidence map of human, animal, in vitro and in silico studies organised by eight areas of focus,
COVID-19+ by McMaster PLUS	Critically appraised systematic reviews and single studies organised by quality level and document type
DistillerSR	Curated, tagged and downloadable references to single studies
L*VE by Epistemonikos	Existing systematic reviews of effects and the primary studies, including trials, that were included in the reviews
LitCovid from PubMed	Systematic reviews and single studies organised by mechanism, transmission, treatment, case report, and epidemic forecasting
TRIP database	Includes systematic reviews and single studies organised by document type
World Health Organization database	Single studies
BMJ	Coronavirus Hub
CellPress	Coronavirus Hub
EBSCO	COVID Information Portal
Elsevier	Novel Coronavirus Information Centre
Lancet	COVID Resource Centre
New England Journal of Medicine	A collection of articles and other resources on the Coronavirus (COVID-19) outbreak, including clinical reports, management guidelines, and commentary
Sage	COVID-19 specific research
SpringerNature	COVID-19 specific research
SSRN	Coronavirus and Infectious Disease Research page
Wiley	COVID-19: Novel Coronavirus Content
Wolters Kluwer	COVID-19 Resources & Tools (Coronavirus Resources)
Centers for Disease Control and Prevention	Sources of data contained in systematic reviews and single studies
COVID-19 Open Research Dataset Challenge (CORD-19)	Articles from a broader range of sources presented in a way that supports natural-language processing
Doctor Evidence	Articles from a broader range of sources presented in a way that supports natural-language processing

Rayyan	Articles from similar sources and presented in a way that supports natural-language processing
EPI-WIN	WHO Information for Network for Epidemics
Africa Evidence Network	COVID-19 related content
WHO Regional Office for Europe	Technical guidance
Government of Canada	COVID information for Canada
CanCOVID	COVID information for Canada
Government of Ontario	COVID information for Ontario, Canada
Public Health Ontario	Information from Public Health Ontario on COVID.
Chinese Center for Disease Control and Prevention	COVID information
Health Information and Quality Authority	COVID related publications
American University of Beirut	COVID related material
CHAIN	COVID related material
Public Health England	Collection of COVID material
Center for Disease Control	COVID communication resources
Johns Hopkins Medicine POC-IT Guide	Collection of COVID material

Appendix 9: Jurisdictions

National Governments	
Australia	https://www.health.gov.au/resources/publications/coronavirus-covid-19-information-on-the-use-of-surgical-masks
Canada	https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/prevention-risks/about-non-medical-masks-face-coverings.html
New Zealand	https://www.health.govt.nz/our-work/diseases-and-conditions/covid-19-novel-coronavirus/covid-19-novel-coronavirus-health-advice-general-public/covid-19-face-mask-and-hygiene-advice
United Kingdom (Scotland)	https://www.gov.scot/publications/coronavirus-covid-19-public-use-of-face-coverings/
United Kingdom (Ireland, England and Wales)	Nil.
United States CDC	https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover.html https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html
Other jurisdictions and organisations	
European Centre for Disease Prevention and Control	https://www.ecdc.europa.eu/sites/default/files/documents/COVID-19-use-face-masks-community.pdfhttps://www.ecdc.europa.eu/en/publications-data/using-face-masks-community-reducing-covid-19-transmission
World Health Organization(15, 16)	https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public/when-and-how-to-use-masks
Singapore	https://www.gov.sg/article/when-should-i-wear-a-mask
Hong Kong	https://www.coronavirus.gov.hk/eng/health-advice.html

NZ	https://www.health.govt.nz/our-work/diseases-and-conditions/covid-19-novel-coronavirus/covid-19-novel-coronavirus-health-advice-general-public/covid-19-face-mask-and-hygiene-advice
Germany	https://de.usembassy.gov/german-mask-regulations-state-by-state/

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