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memo

COVID-19-EPIDEMIC :

Should individuals in the community without respiratory symptoms wear facemasks to reduce the spread of Covid-19? – Update 1 - a rapid review

Title Should individuals in the community without respiratory symptoms wear facemasks to reduce the spread of Covid-19? – Update 1

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Key messages

We did a rapid review of evidence to inform a recommendation regarding people without respiratory symptoms wearing facemasks in the community to reduce the spread of Covid-19. We used an Evidence to Decision (EtD) framework to guide the process from reviewing the evidence to a recommendation. The present report is an update of a recommendation from June 2020 [NIPH 2020a].

There is evidence of a protective effect of medical facemasks against respiratory infections in community settings. Randomised trials from community settings indicate a small protective effect. There is no reliable evidence of the effectiveness of non-medical facemasks in community settings. There is likely to be substantial variation in effectiveness between products.

Potential undesirable effects of facemasks include the risks of incorrect use, a false sense of security (leading to relaxation of other interventions), and contamination of masks. In addition, some people experience problems breathing, discomfort, and problems with communication.

Since we published our first report and recommendation in June 2020, the incidence of Covid-19 has increased in Norway. In defined areas with a high incidence and risk of spread, use of facemasks has been recommended, or mandated. Surveys indicate that facemasks are currently accepted by the healthy population in Norway. However, the extent to which facemasks are used correctly and if use leads to a false sense of security is uncertain.

The most important criteria for our recommendation were the **problem priority** (the baseline risk and seriousness of the spread of Covid-19 in the community from people without respiratory symptoms) and the **balance of desirable and undesirable effects**.

Conditional recommendation for use of facemasks in the community

In situations where the incidence of Covid-19 is low and controlled, we do not recommend the use of facemasks by individuals without respiratory symptoms in the community who are not in close contact with people who are known or assumed to be infected.

In situations where the incidence is high, increasing or the spread is uncontrolled, either locally, regionally or nationally, use of facemasks should be considered even though study results of the protective effect vary greatly and the certainty of the evidence is low. A recommendation to use facemasks should be based on a risk assessment, not the incidence alone, and should be targeted to settings where distance cannot be kept indoors, including on public transport, and especially where contact tracing is difficult. Facemasks should only be recommended as an additional measure when the incidence cannot be controlled by less burdensome measures.

Medical facemasks or quality controlled non-medical facemasks with a documented filtration effect should be used. For personal protection, for example by people belonging to medical risk groups, only medical facemasks type II or IIR should be used.

If a recommendation to use facemasks is made, the community should be given information to ensure correct use and the risks should be explained, including the risks of a false sense of security and

contamination of masks. The training should be tailored to the needs of different groups, including people with different levels of fluency in Norwegian and different socio-economic circumstances. There is some evidence that suggests information which emphasizes caring and fairness may improve compliance more than mandates that emphasize authority. Gender and age specific information may also increase compliance.

Facemasks should not replace other interventions such as physical distancing, avoiding situations where social distancing is not possible, hand washing, and use of disinfectants.

Hovedbudskap

Vi utarbeidet en hurtigoppsummering av kunnskap om effekt av munnbind brukt av asymptomatiske personer i samfunnet for å forebygge spredning av Covid-19. Vi benyttet et Evidence to Decision (EtD) rammeverk til å gjennomgå kunnskapen og utarbeide en anbefaling. Denne rapporten er en oppdatering av en rapport publisert i juni 2020 [NIPH 2020a].

Det finnes dokumentasjon for at medisinske munnbind kan beskytte mot spredning av luftveisinfeksjoner i samfunnet. Randomiserte studier gjennomført utenfor helseinstitusjoner tyder på at medisinske munnbind har en liten beskyttende effekt. Det finnes ingen pålitelig dokumentasjon for effekten av ikke-medisinske munnbind brukt i samfunnet, og det er sannsynligvis betydelig variasjon i effekt mellom ulike produkter.

Ulemper ved bruk av munnbind omfatter risiko for feil bruk, falsk trygghetsfølelse (som kan føre til lemping av andre tiltak) og tilskitning av maskene. Noen opplever også pustebesvær, andre ubehag og kommunikasjonsvansker.

Siden den første rapporten ble publisert i juni 2020 har insidensen av Covid-19 økt i Norge. I definerte områder med høy insidens og smitterisiko er det gitt anbefalinger, eller påbud, om bruk av munnbind i situasjoner der avstand ikke kan opprettholdes. Spørreundersøkelse viser at bruk av munnbind er akseptert i store deler av den friske befolkningen i Norge i dag. Vi har liten kunnskap om munnbind brukes korrekt i befolkningen, eller om munnbind fører til en falsk trygghetsfølelse.

Den tilgjengelige dokumentasjonen ble vurdert etter gitte kriterier. Kriteriene som ble lagt mest vekt på for vår anbefaling var problemets prioritet (hvor alvorlig er problemet med spredning av covid-19 i samfunnet fra personer uten luftveissymptomer) og balansen mellom fordeler og ulemper ved bruk av munnbind.

Betinget anbefaling om bruk av munnbind i samfunnet

I situasjoner med lav insidens og kontroll på spredningen anbefaler vi ikke bruk av munnbind for personer i samfunnet som ikke har symptomer på luftveisinfeksjon.

I situasjoner med høy eller økende insidens og ukontrollert spredning i samfunnet, enten lokalt, regionalt eller nasjonalt, bør bruk av munnbind vurderes. Anbefalingen om bruk bør gis på grunnlag av en risikovurdering, og anbefalingen bør være rettet mot situasjoner der det ikke er mulig å holde avstand, særlig innendørs, og situasjoner der smittesporing ikke er mulig. Andre tiltak bør være prøvd før munnbind anbefales.

Både medisinske munnbind og ikke medisinske munnbind med dokumentert filtrasjonseffekt kan anbefales. Bare medisinske munnbind type II eller IIR bør anbefales når hensikten er å beskytte brukeren, slik som for personer i risikogrupper.

Dersom munnbind anbefales bør det gis informasjon og opplæring i korrekt bruk og håndtering. Ulempene bør forklares, slik som falsk trygghetsfølelse og forurensing av masker. Opplæringen bør tilpasses behovet i ulike målgrupper, inkludert personer med manglende norskkunnskaper og ulik sosioøkonomisk bakgrunn. Det finnes noe dokumentasjon på at informasjon som vektlegger omsorg

og rettferdighet gir bedre oppslutning en autoritære påbud. Alders- og kjønnsspesifikk informasjon kan også gi bedre oppslutning

Munnbind bør ikke erstatte andre tiltak.

Contents

Background

Transmission of Covid-19 in the community can be reduced by use of facemasks in the general population, but the size of the effect is uncertain. The impact depends on:

- The infection rate (incidence)
- The proportion of asymptomatic cases among all cases
- The proportion of people who wear facemasks
- The effectiveness of facemasks for reducing transmission

Interventions have both desirable and undesirable effects. The desirable effect of wearing facemasks in the community is preventing spread of Covid-19. The primary purpose of wearing a facemask in situations where social distancing is difficult is for people who are infectious but do not have symptoms and do not know they are infectious to wear facemasks to prevent them from transmitting the virus to others (source control). Wearing a facemask may also protect the wearer against infection. Potential undesirable effects include incorrect use leading to a false sense of security and relaxation of other measures or cross-contamination, skin irritation, discomfort, problems breathing, and problems with communication. Use of medical facemasks can also have undesirable environmental effects.

Recommendations regarding the use of facemasks by asymptomatic individuals in the community to reduce the spread of Covid-19 vary across jurisdictions and have changed over time. In June, the Norwegian Institute of Public Health (NIPH) determined that: "In the current epidemiological situation in Norway, wearing facemasks to reduce the spread of Covid-19 is not recommended for individuals in the community without respiratory symptoms who are not in near contact with people who are known to be infected. If the epidemiological situation worsens substantially in a geographical area, the use of facemasks as a precautionary measure should be reconsidered. Measures to reduce risks during necessary public transport and during mass events, including wearing facemasks, should be explored further" [NIPH 2020a]. More recently, (14.08.2020) NIPH recommended that facemasks should be used on public transport in situations with increasing and high transmission of SARS-CoV-2 when a physical distance of 1 m cannot be kept [NIPH 2020b]. In situations with high transmission, facemasks should be used in public settings where distance cannot be kept. Facemasks are currently mandated or recommended in Oslo and Bergen, and in some other municipalities where transmission is high or increasing (https://www.oslo.kommune.no/koronavirus/rad-og-regler-i-oslo/, https://www.bergen.kommune.no/hvaskjer/tema/koronavirus/rad-til-befolkningen).

We have updated the rapid review and Evidence to Decision framework used to inform recommendations for use of facemasks in the community. The search strategy, selection and search results are described in the Supplement.

Question

Should individuals in the community without respiratory symptoms wear facemasks to reduce the spread of Covid-19?

Question details

Problem

- Spread of Covid-19 in the community by people without respiratory symptoms

Interventions

- Medical facemasks or advice to wear medical facemasks
- Non-medical facemasks or advice to wear non-medical facemasks

Comparison

- No facemasks, no advice to wear or not to wear facemasks, or advice not to wearface masks

Outcomes

- All Covid-19 infections
- Covid-19 infections in people wearing facemasks
- Covid-19 infections in people exposed to asymptomatic but infected individuals
- Incorrect use
- Potential undesirable effects, including neglect of other preventive measures, such as hand washing and social distancing, and reduced access to facemasks by people who need them most

Setting

- Norway

Perspective

- Societal

Methods

Process overview

This is an update of a rapid review and EtD framework from June 2020 [NIPH 2020a]. The search strategy and selection criteria are described in the Supplement. Final decisions about the content of the EtD framework were made by the panel responsible for the recommendations. Screening of research evidence and monitoring of the situation in Norway is ongoing.

We used an Evidence to Decision (EtD) framework to guide the process from reviewing the evidence to a recommendation. EtD frameworks are used to help make recommendations or decisions by moving from evidence to decisions in a structured way (https://ietd.epistemonikos.org/#/about/introduction) [Alonso-Coello 2016] [Moberg 2018]. The process ensures that the pros and cons and important criteria for decisions are considered and makes the decision process transparent. EtD frameworks also make it possible for people to understand the basis for recommendations.

The process included gathering and reviewing evidence, discussion, and assessment by an expert panel using an explicit set of criteria. The assessments provided the basis for a conclusion and recommendation.

Selection criteria

Priority of the problem

Any research, including modelling studies, of Covid-19 infection rates in Norway, outbreaks in nursing homes in Norway, or the availability of cloth, medical or N95 facemasks.

Information about infection rates from NIPH weekly reports is included under "Additional considerations".

Effects of using facemasks or advice to use facemasks

a) Direct evidence

Any randomised or non-randomised study that estimated the effect on Covid-19 infections or any other important outcome for any kind of facemask used by asymptomatic individuals in the community or by asymptomatic people working in long-term care facilities. The inclusion criteria were:

- P: People potentially exposed to Covid-19
- I: Use of or advice to use any kind of facemask
- C: non-use of facemasks, no advice to use facemasks, or use of a different kind of facemask
- O: any important outcome
- Study design: any quantitative, comparative study design

b) Systematic reviews of randomised and non-randomised studies of the effects of facemasks to reduce the spread of respiratory infections

Any systematic review that directly addressed the effects of using facemasks or advice to use facemasks for primary prevention (when no cases have yet been identified) of respiratory infections. The following criteria were used to select the primary systematic review summarised in the EtD: comprehensiveness, inclusion of both randomised and non-randomised studies, sensible grouping of studies in meta-analyses and forest plots, assessments of the risk of bias, and a Summary of Findings with assessments of the certainty of the evidence using GRADE[12] or a similar explicit approach. Other systematic reviews that did not meet the inclusion criteria were used to supplement the findings of the primary systematic review.

c) Systematic reviews comparing different types of facemasks

Any systematic review of randomised or non-randomised studies comparing the effectiveness of different types of facemasks for preventing respiratory infections, randomised trials not included in a systematic review, and any randomised or non-randomised study comparing the use of different types of facemasks for Covid-19.

d) Laboratory studies

Systematic reviews of laboratory studies of the filtering effects of different types of facemasks for respiratory infections, any laboratory study of the filtering effects of different types of masks for Covid-19 not included in a systematic review, and laboratory studies of different types of masks for other respiratory infections that were considered relevant for Covid-19.

Values

Any research that measured how people value the potential benefits and harms of facemasks or advice about facemasks.

Resources required

Any research that estimated the potential costs and savings of the use of any type of facemask by asymptomatic individuals in the community or by asymptomatic people working in long-term care facilities.

Cost-effectiveness

Any cost-effectiveness analysis that used a transparent model, a plausible range of values, and sensitivity analyses that address the uncertainties in the estimates and assumptions that were used in the model.

Equity

Any research that addressed impacts or potential impacts of facemask use on equity.

Acceptability

Any research that investigated the acceptability of facemask usage or recommendations for using facemasks.

Feasibility

Any research that investigated the feasibility of implementing recommendations to use facemasks.

Data collection

Judgements about which articles to include and what information to include in the draft EtD frameworks were made by ADO, who applied criteria described above, summarised key findings from included research, and identified additional considerations noted in the literature that was reviewed.

Assessments of the risk of bias and the certainty of the evidence were based on the judgements of authors of included systematic reviews, whenever possible. The risk of bias of the primary systematic review used to inform judgements about the effects of facemasks was assessed by Eva Marie-Louise Denison using ROBIS (Table S1) [Whiting P 2016].

Panel discussion and judgement

The final content of the EtD framework was determined by the expert panel. The panel consisted of six co-workers in the Division of Infection Control and Environmental Health at NIPH (Senior Adv isor Torunn Alberg, Senior Medical Officer Tone Bruun, Senior Advisor Mette Fagernes, Senior Medical Officer Siri Feruglio, Specialty Director Frode Forland, and Senior Medical Officer Bjørn Iversen). The evidence and additional considerations were presented to the panel, followed by a discussion and judgments for each assessment criteria. A summary of the discussion was entered in the framework. The panel made individual judgments and then agreed on a consensus judgment for each criterion. The panel did not take into consideration the shortage of medical facemasks. The lead authors of this report (DFV and BGI) prepared a draft recommendation based on the judgments for the criteria. The recommendation and ths report were then reviewed by and agreed on by the panel.

The assessment criteria that were judged by the panel were those included in the GRADE Evidence to Decision framework for health system and public health recommendations [Alonso-Coello 2016]:

- Problem
- Effects;
    - Desirable effects
    - Undesirable effects
    - Certainty of the evidence
    - Values
    - Balance of desirable and undesirable effects
- Resources,
    - Resources required
    - Certainty of evidence of required resources
    - Cost-effectiveness
- Equity
- Acceptability
- Feasibility

A summary of the panel discussions is included under *Panel discussion and judgments* in this report.

Results

A summary of the evidence and additional considerations are presented in this section. The research evidence that was included and used to inform the panel's judgments is summarised in the Supplement.

Problem

Research evidence

Since week 30, the number of Covid-19 cases has increased in Norway. An increase has also been observed in several European countries. Localised outbreaks contribute to the increase in Norway. In addition, the testing activity has increased. The capacity in the health services is good.

By week 45 there was a risk of accelerated spread and strengthened national advice and measures have been given. In addition, local measures have been taken in municipalities and regions with outbreaks and an unstable situation. Among the measures are restrictions for gatherings, closure of services and facilities where people meet and restrictions on serving alcohol. (https://www.fhi.no/contentassets/8a971e7b0a3c4a06bdbf381ab52e6157/vedlegg/andre-halvar-2020/2020.11.11-ukerapport-uke-45-Covid-19.pdf)

The weekly number of reported cases in Norway decreased from week 13 to week 20, then was relatively stable with small variations until an increase in weeks 31 and 32. The weekly incidence was between 10 and 11 per 100,000 for weeks 32 to 35 (https://www.fhi.no/contentassets/8a971e7b0a3c4a06bdbf381ab52e6157/vedlegg/andre-halvar-2020/2020-09-02-ukerapport-uke-35-Covid-19.pdf). Since week 43, a sharp increase in cases has been observed, with differences across the country. In Oslo the weekly incidence was 136 per 100,000 in week 45(https://www.fhi.no/contentassets/8a971e7b0a3c4a06bdbf381ab52e6157/vedlegg/andre-halvar-2020/2020.11.11-ukerapport-uke-45-Covid-19.pdf). The weekly incidence was 5 per 100,000 at the end of May, when this evidence summary was first prepared [NIPH 2020a].

By week 44 it is estimated that 1.3% of the population in the Oslo-area have been infected since the start of the outbreak (https://www.fhi.no/studier/prevalensundersokelser-korona/resultat---moba/).

Additional considerations

Basic infection control measures are needed to control the spread of Covid-19. No specific treatment or preventive pharmaceutical intervention is currently available.

Worldwide, there has been a shortage of medical facemasks, leaving doctors, nurses, and other frontline workers dangerously ill-equipped to care for Covid-19 patients. At the time of writing, there seems to be sufficient supplies available in Norway for those who can pay.

The use of facemasks has become highly politicised and controversial internationally and has received a great deal of attention in mass and social media. It is widely perceived to be an effective means of reducing transmission and making it possible to engage in activities where social distancing

is not possible. This perception has contributed to a political imperative to encourage or mandate the use of facemasks in the community, despite the lack of robust evidence.

Effects

Evidence of the desirable and undesirable effects of using facemasks includes:

- Direct evidence of the effects of facemasks on preventing Covid-19 infections in community settings
- Indirect evidence of the effects of facemasks on preventing respiratory infections in community settings
- Indirect evidence of the effects of facemasks on preventing Covid-19 or other respiratory infections in healthcare or household settings when caring for infected individuals
- Evidence from laboratory studies

Direct evidence of the effects of facemasks on preventing Covid-19 infections in community settings (Desirable effects)

There are now at least 14 studies that have attempted to measure the effect of using facemasks in community settings on Covdi-19 infection rates. This includes case-control, interrupted time-series, and ecological studies. These studies are summarised in Table S3a. There is a high risk of bias in all these studies, which measure associations between facemask use or policies and infection rates, deaths, or other consequences.

It is difficult to control for confounders, including other measures or combination of measures. Studies that rely on available data sources in different jurisdictions, are limited by the nature of the data that are available. Studies that utilise surveys or questionnaires have a high risk of recall bias. No prospective studies have been reported. One randomised trial has been conducted in Denmark, but the results are not yet available [Bundgaard 2020].

Studies that modelled the impact of facemasks use or policies are summarised in Table S3b. Most of the modelling studies suggest that facemasks could have an important impact on the growth rate. However, these studies depend on assumptions about the effectiveness of facemasks on reducing transmission, as well as other assumptions. As noted by the authors of one of these models, which is frequently referenced in the media, “there are a multitude of limitations in any modelling study of this type” [IHME 2020].

Evidence of the effects of facemasks on preventing respiratory infections

We identified 20 systematic reviews of the effects of facemask use on preventing respiratory infections in different settings (Table S2a). Eleven reviews provided estimates for the effect of using facemasks in community settings (Table 1). The estimates are based on different settings, types of masks, outcomes (types of respiratory infections), and study designs. Several of the reviews include multiple subgroup analyses bases on, for example, the setting or the study design. The effect estimates vary widely. Overall, the effect estimates based on randomized trials were lower than estimates based on non-randomized studies. For the most part, review authors assessed the certainty of the evidence as low or very low.

Table 1. Facemask effect estimates in community settings from systematic reviews *

Effect estimate	95% CI	I^2	Setting	Type of mask	Outcome	Study design [a]	Certainty [b]	Review
OR 0.94	0.75 to 1.19	29%	community [c]	medical	influenza like illness	3 randomised	Low	Brainard 2020
OR 0.71	0.24 to 2.05	95%				6 cohort	NR	
OR 0.39	0.10 to 0.84	77%				4 case control	NR	
OR 0.83	0.57 to 1.10	11%	community [d]	medical	influenza like illness	5 randomised	NR	Aggarwal 2020
OR 0.66	0.54 to 0.81	23%	household and community [e]	medical	respiratory infections	10 randomised, 1 cohort, 1 case control	NR	Chaabna 2020
OR 0.23 [f] OR 0.87 [g]	0.09 to 0.60 0.41 to 1.84	-	community	medical	Covid-19	1 case control	Insufficient [k]	Chou 2020
NR [h]	NR [h]	NR [h]	community	medical [j]	SARS or MERS	2 case control, 1 cohort	Low [k]	
			community [i]	medical	non-pandemic viral respiratory infections	12 randomised	Moderate [k]	
OR 0.56	0.40 to 0.79	76%	non-healthcare	medical [j]	SARS or MERS	2 case control, 1 cohort	Low or very low [l]	Chu 2020
RR 0.97	0.72 to 1.31		Community	any	Respiratory infections	3 randomised	Very low	Coclite 2020
RR 0.90	0.74 to 1.20					4 cross sectional	Very low	
RR 0.59 [m]	0.34 to 1.03					4 case control	Very low	
RR 0.55	0.11 to 2.75					2 prospective	Very low	
RR 0.93	0.83 to 1.05	0%	healthcare and community	any	influenza like illness	9 randomised	NR	Jefferson 2020 [†]
RR 0.84	0.61 to 1.17	0%			laboratory confirmed influenza	5 randomised		
OR 0.53	0.36 to 0.79	45%	non-healthcare	any	respiratory viral infections	5 randomised, 2 case control,1 before after	NR	Liang 2020 [†]
OR 0.44	0.33 to 0.59	54%	non-healthcare and non-household			2 randomised, 2 case control,1 before after		
RR 0.49 [n]	0.30 to 0.78	59%	healthcare [o]	cotton or paper	SARS or H1N1	5 case control	"Moderate" [p]	Mills 2020 [†]
RR 0.61	0.39 to 0.96	71%	non-hospital and non-household	any	respiratory infection	5 randomised	NR	Ollila 2020 [†]
RR 0.81	0.70 to 0.95	30%	non-hospital	medical [q]	Influenza like illness	8 randomised	NR	Wei 2020 [†]
RR 0.77	0.65 to 0.91	0%		all [q]		5 randomised		
RR 0.95	0.58 to 1.56	0%		infected [q]		2 randomised		
RR 1.26	0.69 to 2.31	-		uninfected [q]		1 randomised		

NR = not reported, RR = risk ratio, OR = odds ratio

* Reviews that compared N95 respirators to medical asks (Bartoszko 2020, Long 2020), that did not report either an effect estimate (meta-analysis) or the certainty of the evidence (Gupta 2020, MacIntyre 2020, Saijonkari 2020, Stern 2020), or that did not include any studies (Marasinghe 2020) are excluded.

[†] Preprint that has not been peer reviewed

a) Note: case control studies only measure protection of the individuals wearing masks, not source control (preventing infected individuals from infecting others)
b) GRADE certainty of the evidence, unless otherwise reported
c) Primary prevention only (when no cases have yet been identified)
d) Primary and secondary prevention (when an individual was diagnosed with an infection and the aim was to prevent contacts from getting disease)
e) includes 9 studies in households
f) wearing a facemask all the time
g) inconsistent use of a facemask
h) Meta-analysis was not attempted owing to study limitations and heterogeneity in study designs, comparisons, and analyses.
i) In households with an index case and other community settings
j) Not specified in one study
k) Strength of evidence (Berkman et al. Grading the strength of a body of evidence when assessing health care interventions: an EPC update. J Clin Epidemio. 2015; 68:1312-1324. https://doi.org/10.1016/j.jclinepi.2014.11.023)
l) Schünemann et al. Use of facemasks during the COVID-19 pandemic. Lancet Respir Med 2020; https://doi.org/10.1016/S2213-2600(20)30352-0
m) estimate reported as a risk ratio, but it is not clear how it was calculated
n) Risk ratios are calculated and reported although the studies were case control studies (so that odds ratios should have been calculated).
o) No studies of cotton or paper facemasks in a non-healthcare setting were found. All of the studies evaluated protection of the wearer, not reducing spread.
p) The basis for judgements about the certainty of the evidence is unclear (and inconsistent with GRADE).
q) The overall results are reported for 8 included randomised trials and subgroup analyses are reported for 5 studies where all (both infected and uninfected people wore facemasks, 2 studies where only infected individuals wore facemasks, and 1 study where only uninfected individuals wore facemasks.

In our previous evidence summary, we found a preprint of the review by Brainard and colleagues [Brainard 2020] to be the most comprehensive to present the most directly relevant evidence of using facemasks in the community, and to have a low risk of bias. That review has now been accepted for publication and we have not found another review that is more comprehensive or provides a better summary of the most directly relevant evidence of the effect of facemasks in the community to prevent respiratory infections. This systematic review found three randomised trials that provide low-certainty evidence that wearing medical facemasks in community settings may reduce the odds of primary infection with influenza-like illness by around 6% (Table 2). This estimate is based on two studies in university residencies and one in Hajj pilgrims.

Table 2. Summary of Findings table (from [Brainard 2020])

Masks compared to no masks for influenza-like illness

Patient or population: people without ILI, either in contact with a person with ILI (secondary transmission) or not (primary prevention). **Setting**: Any. **Intervention (or exposure)**: Advice to wear a mask and/or provision of masks (or wearing a mask). **Comparison**: No advice to wear a mask/advice to not wear masks (or not wearing a mask).

Setting (outcome always ILI)	Study type	Anticipated absolute effects* (95% CI) Risk without masks	Risk with masks	Relative effect (95% CI)	№ of participants (studies)	Quality of the evidence (GRADE)	Comments
Primary prevention, well wear masks	RCTs	108 per 1,000	**102 per 1,000** (83 to 125)	**OR 0.94** (0.75 to 1.19)	5183 (3 RCTs)	⊕⊕◯◯ LOW [a,b,c,d,e]	Wearing a mask may very slightly reduce the odds of primary infection with influenza-like illness (ILI) by around 6 to 15%. Low-quality evidence (downgraded once each for risk of bias and imprecision).
	Cohort studies	197 per 1,000	**141 per 1,000**	**OR 0.85** (0.32 to 2.27)	5217 (7 cohorts)		
	Case control studies	405 per 1,000	**184 per 1,000**	**OR 0.39** (0.18 to 0.84)	1501 (4 studies)		
	Cross- sectional	341 per 1,000	**223 per 1,000**	**OR 0.61** (0.45 to 0.85)	10,058 (8 studies)		
Secondary transmission, use of masks in homes, only ill person wears mask	RCTs	68 per 1,000	**65 per 1,000** (38 to 108)	**OR 0.95** (0.53 to 1.72)	903 (2 RCTs)	⊕◯◯◯ VERY LOW [f,g]	When one household member becomes ill with an ILI the effect of their wearing a mask on the odds of house-mates developing ILI is unclear, as the evidence is of very low quality (downgraded once for risk of bias, twice for imprecision).
	Case control studies	248 per 1,000	**491 per 1,000**	**OR 2.93** (1.48 to 5.81)	162 (1 study)		
Secondary transmission, use of masks in homes, only well person(s) wears mask	RCTs	121 per 1,000	**114 per 1,000** (86 to 150)	**OR 0.93** (0.68 to 1.28)	2078 (2 RCTs)	⊕⊕◯◯ LOW [f,h]	House-mates wearing masks once another household member has contracted ILI may modestly reduce the odds of further household members becoming ill by around 7%. Low quality evidence (downgraded twice overall for risk of bias, imprecision and inconsistency).
	Cohort studies	**53 per 1,000**	**OR 1.04** (0.05 to 19.52)	163 (1 study)	Cohort studies 45 per 1,000		
	Case control studies	337 per 1,000	**329 per 1,000**	**OR 0.96** (0.50 to 1.86)	162 (1 study)		
Secondary transmission, use of masks in homes, both well and ill person(s) wear mask	RCT	192 per 1,000	**173 per 1,000** (121 to 242)	**OR 0.81** (0.48 to 1.37)	1605 (5 RCTs)	⊕⊕◯◯ LOW [h,i,j]	Both housemates and the infected household member wearing masks once one household member has contracted ILI may modestly reduce the odds of further household members becoming ill by around 19%. Low quality evidence (downgraded twice overall for risk of bias, imprecision and inconsistency).
	Case control studies	173 per 1,000	**86 per 1,000**	**OR 0.45** (0.18 to 1.05)	191 (1 study)		

***The risk in the intervention group** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of

the intervention (and its 95% CI). **CI:** Confidence interval; **OR:** Odds ratio

GRADE Working Group grades of evidence

High quality: We are very confident that the true effect lies close to that of the estimate of the effect

Moderate quality: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different

Low quality: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect

Very low quality: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

Explanations

a. Risk of bias: Outcome assessors were not blinded for ILI (as outcomes are self-reported and participants could not be blinded), but were for lab-based diagnoses (not shown). Allocation concealment often unclear. Downgraded once.

b. Inconsistency: I2 was 19%. Evidence from other study designs were roughly confirmatory of a small beneficial effect. Not downgraded.

c. Indirectness: measured exactly what we wanted to know re primary prevention. Not downgraded.

d. Imprecision: the 95% CIs included both benefits and harms. Downgraded once.

e. Publication bias: no suggestion of publication bias, not downgraded.

f. Risk of bias: In most trials outcome assessors were not blinded (as outcomes are self-reported and participants could not be blinded), and allocation concealment was often unclear. Downgraded once.

g. Imprecision: the 95% CIs included both big benefits and big harms. Downgraded twice.

h. Imprecision: the 95% CIs included both benefits and harms. Downgraded once.

i. Risk of bias: In most trials outcome assessors were not blinded (as outcomes were self-reported and participants could not be blinded). Downgraded once in conjunction with inconsistency.

j. Inconsistency: I2 was 53%. Downgraded in conjunction with Risk of Bias (downgraded once between both factors).

Other randomised trials of facemasks are less applicable to the use of facemasks in the community for primary prevention of Covid-19, and effect estimates from non-randomised studies vary widely. In a systematic review by Chu et al., an odds ratio of 0.56 was estimated from two case-control studies and one cohort study [Chu 2020]. Mills et al in a preprint estimated a "risk ratio" of 0.49 for cotton or paper facemasks based on five case control studies in healthcare settings [Mills 2020]. They did not find studies of cotton or paper facemasks in a non-healthcare setting. The other effect estimates in Table 1 are based largely or entirely on the use of medical facemasks.

One cluster-randomised trial of cloth facemasks compared with medical facemasks in hospital healthcare workers found higher rates of influenza-like illness and laboratory-confirmed virus when cloth facemasks were used compared to medical facemasks or normal practice (which may or may not have included wearing a facemask) [MacIntyre 2015]. A post hoc analysis of unpublished data from that study suggested that the risk of infection was higher in healthcare workers who washed their own facemasks compared to those whose facemasks were washed by the hospital laundry, and that there was not a statistically significant difference in infection rates in healthcare workers whose facemasks were washed in the hospital laundry compared to those who wore medical facemasks (Table S2b) [MacIntyre 2020].

Evidence from laboratory studies

Evidence from laboratory filtration studies suggests that non-medical facemasks may reduce the transmission of larger respiratory droplets. There is little evidence regarding transmission of small, aerosolized particulates of the size potentially exhaled by asymptomatic or pre-symptomatic individuals with Covid-19 [NAS 2020]. Key findings of relevant laboratory studies are summarised in Table S4. These studies provide some information about the potential effectiveness of facemasks for preventing Covid-19 infections. They do not provide evidence of the actual effects of facemask use or policies to promote facemask use.

Evidence of the undesirable effects of facemasks in community settings

We identified one systematic review of undesirable effects of using facemasks (Table S2a), 10 studies of undesirable effects from using facemasks to prevent the spread of Covid-19 (Table S3a), and five laboratory studies of undesirable effects (Table S4). The systematic review found limited evidence to quantify adverse effects of wearing facemasks [Bakhit 2020]. Most of the evidence was from healthcare settings.

One study reported that distance to other people were slightly reduced following facemask mandates, whereas another study showed that those who wore masks all the time were more likely to practice social distancing than those who did not. Another study using smart device location data found that, on average, participants spent less time at home following facemask mandates and increased trips to places such as restaurants. A fourth study showed that mask wearing was associated with a reduction in face touching in China and South Korea, whereas results from Europe and USA were inconclusive.

One study estimated a large amount of plastic waste from disposable facemasks, but it was unclear what proportion of the waste was from medical facemasks and what proportion was from N95 masks [Abassi 2020].

One laboratory study found that ventilation and cardiopulmonary exercise capacity were reduced by medical facemasks and participants reported consistent and marked discomfort wearing facemasks. However, two other studies found that wearing facemasks did not have a large impact on respiratory function. Other laboratory studies found that people had problems reading emotions when others wear facemasks, and that the materials used in cloth facemasks affects how uncomfortable they are.

Additional considerations

Impact of the construction of non-medical facemasks: A study of how well different fabrics (woven, woven brushed, knitted, knitted brushed, knitted pile) and materials (cotton, polyester, polypropylene, silk) stop particles (filtration efficiency) found wide variation in filtration efficiency. Fabrics with greater breathing resistance had higher filtration efficiency. However, facemasks with greater breathing resistance are more difficult for users to wear consistently, which could reduce their effectiveness. Fit of facemasks may also be important since particles can escape through creases and gaps between the mask and face.

Impact of reusing non-medical facemasks: Cloth facemasks must be washed or decontaminated between uses. Various decontaminated methods have been documented, for example, autoclave, isopropyl alcohol, bleach, hydrogen per oxide, microwave, soap and water, ultraviolet radiation, and dry heat. While the material of cloth facemasks is unlikely to degrade with standard means of disinfection (e.g., chemicals, heat, and radiation), unlike other types of disposable facemasks or respirators, there is little evidence about the effectiveness of these decontamination methods [Chugtai 2013].

Impact of correct use of facemasks: The effectiveness of facemasks depends on their being used correctly. Even if a facemask has a high filtration efficiency and fits well, its effectiveness depends on how well individuals put it on and keep it in place. "Moisture saturation is inevitable with fabrics available in most homes. Moreover, moisture can trap virus and become a potential contamination source for others, after a mask is removed [NAS 2020].

Resources

Resources required
The costs of routine use of facemasks by individuals in the community without respiratory symptoms are uncertain. It also is uncertain what if any savings there might be from reducing the spread of Covid-19. Although facemasks are inexpensive, from an individual perspective, the cost of facemasks might be a deterrent for some people to adhere to a recommendation to use facemasks, if they must pay for facemasks out of pocket. From a public health perspective, if facemasks were to be purchased and distributed using public funds, this might divert resources from other more effective uses of those funds. In addition, funds would be diverted from other potentially more effective interventions to effectively communicate a recommendation to use facemasks, to ensure that they are available, and to ensure that they are used correctly.

Certainty of evidence of required resources
The resource requirements (costs) of using or promoting the use of facemasks are uncertain.

Cost-effectiveness
The costs, savings, and effectiveness of routine use of facemasks by individuals in the community without respiratory symptoms are uncertain.

A systematic review of economic evaluations of facemasks for protection against respiratory infection found 2 studies that considered the use of medical facemasks [Mukerji 2015]. One evaluation considered the use of medical facemasks for seasonal influenza in a school setting in Taiwan [Chen 2013]. The other considered various distribution strategies for large scale use of medical facemasks in the U.S. for pandemic influenza (H1N1) [Cahill 2008]. Neither cited evidence from trials or epidemiological studies to inform the estimates of intervention effectiveness that were used. The U.S. evaluation found that distribution strategies for medical facemasks were cost-effective for pandemic influenza. However, the evaluation had important limitations and the supply of medical facemasks was extremely limited, so only partial mask strategies were feasible.

A modelling study assumed that facemasks reduce infection rates by between 44 and 82%, with a base-case reduction of 50% and adherence of 50%. Given those assumptions, they estimated that masks alone would cost USD $76 per infection-prevented ($17,300 per QALY) [Losina 2020]. Hatzius et al [Hatzius 2020] estimated that a national mandate could raise the percentage of people who wear masks by 15% and cut the daily growth rate of confirmed cases by 1.0% to 0.6%. Based on those findings and using the estimated cross-country relationship between lock downs and GDP, they estimated that a facemask mandate could potentially substitute for lockdowns, which would otherwise subtract nearly 5% from GDP.

Acceptability

Acceptability by the public

A survey of in the middle of July by Opinion (n = 3800) found that 39% of respondents were positive about the use of facemasks in Norway, 30% were negative, and 31% were neither positive nor negative. In May 33% were positive, 37% were negative, and 31% were neither positive nor negative. Only respondents over 60 years were more positive than negative (https://opinion.no/2020/07/nordmenn-mer-positive-til-munnbind/).

A more recent survey by Opinion in early August (n = 8549) found that 54% were positive and 23% were negative, and 23% were neither positive nor negative (https://opinion.no/2020/08/nordmenn-flest-er-positive-til-munnbind-og-nedbremsing/).

In another recent survey by YouGov done for the online pharmacy Farmasiet prior to the governments planned announcement regarding facemasks on 14 August, 75% of respondents said they would use facemasks if it is recommended or required and 17% responded they would refuse to use facemasks. 50% supported requiring facemasks on public transportation and flights, 30% supported requiring them on ferries and boats, and 20% did not want facemasks to be required anywhere. 38% of respondents were worried that people would stop caring about social distancing if facemask were required and used. 30% thought wearing a facemask was annoying or bothersome, 10% believed facemasks would make it easier for criminals to hide behind a facemask, 8% that facemasks would make people feel lonely, and 2% that facemasks are unattractive. Up to 33% of respondents were worried that facemasks would be in short supply (https://kommunikasjon.ntb.no/pressemelding/stor-munnbindundersokelse-avslorer-700000-nordmenn-vil-nekte-a-bruke-munnbind?publisherId=17847162&releaseId=17890047).

Other surveys by YouGov in 22 countries between 14 May 14 and 4 June found that 74% of respondents would be willing to wear facemasks if an international organization advised it. They would be more willing if it were advised by government (77%) or if it were the law (82%). People in Norway, Sweden, Denmark, and Finland were least likely to be willing to wear a facemask, ranging from 50% in Norway to 35% in Finland. Feelings of safety and responsibility were associated with wearing facemasks. Nearly equal proportions of respondents were willing and not willing to make their own facemasks, with only a third of respondents stating that they would be able to make their own facemasks at home (47% in Norway). Difficulty accessing medical facemasks varied from most difficult in Thailand to least difficult in China. In Norway, 40% of respondents responded that it was very or quite difficult to find medical facemasks. Respondents reported using homemade facemasks because they were easier to wash, cheap, and more comfortable. Ease to wash was the most popular reason across countries, including Norway. Feeling too hot and difficulties breathing were the most reported negative experiences with wearing facemasks. Respondents in the Nordic countries were most likely to report not wearing a facemask. Over half of people who wore facemasks reported washing their hands more during those days. Half reported touching their face and objects in public less [ICL-YouGov 2020].

Discomfort

Multiple studies have found that compliance with wearing facemasks for a longer time was hindered by discomfort. Factors that increase discomfort and compliance include physical exertion, environmental factors such as temperature and ventilation, and mask fit. Although there are few community studies of facemask wearing, appropriate fit appears to be key to avoid adjusting or removing the facemask [Mills 2020].

Understanding

People's understanding of the purpose of wearing facemasks varies. For example, an international survey found that people expect others to wear a facemask around them, so they do not get sick is between 53% and 58% in Italy (53%), Vietnam (55%), and Japan (58%). On the other hand, respondents in Australia (46%) and the U.K. (41%) were most likely to say they did not see the value in wearing a facemask if they are not sick.

Perceived susceptibility, severity, and effectiveness

A review of published peer-reviewed articles that focused on the general, non-pharmacological interventions, and factors that impact on engagement found 53 relevant articles. An included review of the use of facemasks drawing on principles of the Health Belief Model found that individuals are more likely to wear facemasks if they perceived themselves to by susceptible and if they perceive

wearing a facemask to be beneficial [Sim 2014]. A survey during the SARS outbreak in Hong Kong found that individuals were 1.4 times more likely to wear facemasks if they had strong beliefs in the effectiveness of wearing them. Another study during the 2009 H1N1/A influenza pandemic found that perception of a very high fatality rate was associated with the likelihood of wearing facemasks regularly in public areas (OR 1.64, $p < 0.01$). Another survey in Taiwan found that individuals were four times less likely to practice appropriate preventive behaviours, including facemask-wearing if they lacked correct knowledge about the fatality rate of avian influenza.

A cross-sectional survey with 1005 respondents investigated beliefs, attitudes, and actions of the US population regarding nonpharmaceutical interventions for COVID-19. Overall, adherence was associated with a belief that nonpharmaceutical interventions would reduce personal risk of developing COVID-19 (OR 3.06; 95% CI 1.25 to 7.48) and with a belief that the they were not difficult to perform (OR 1.79; 95% CI 1.38 to 2.31). Respondents were compliant with straightforward, familiar, and heavily encouraged recommendations such as handwashing. More onerous interventions, such as wearing facemasks, were performed less frequently. At the time the survey was performed, no recommendations were in place to encourage use of facemasks by the public in the US The survey found that respondents were most uncertain regarding the effectiveness of wearing facemasks, with 31% unsure whether their use would slow the spread of COVID-19. Only 23% agreed that facemasks slow the spread of COVID-19, and only 11% reported wearing a facemask always or most of the time [Kantor 2020].

Social norms (or perceived social pressures) and messaging

A survey during the SARS outbreak in Hong Kong found that participants who were more aware of reminders from family members or government were 2.4 times more likely to wear facemasks. Sequential telephone surveys in during the SARS epidemic in Hong Kong found that 95% of respondents believed that it was their civic responsibility to wear a facemask in public places as frequently as possible and that they would wear a mask if they had symptoms. This social norm (or perceived social pressure) may be related to a difference in the use of facemasks between Eastern and Western countries prior to the COVID-19 pandemic [Seale 2020].

Communication

Studies of non-pharmaceutical interventions during the SARS outbreak in Canada and H1N1 in several countries found that inconsistent information from various sources led some people to question the credibility of available information and resulted in fear and denial of the pandemic. Many participants in the Canadian study expressed doubts about the information from the public health department, which in turn influenced their level of perceived risk. Studies examining the H1N1 2009 pandemic in the UK and Spain found that the public became sceptical about the way in which the communication about that new respiratory infection was presented, particularly by the media. They found the communications to be unreliable, premature, inconsistent, sensationalist, and unduly alarmist. Several UK studies reported scepticism from individuals due to their perception of the media's propensity to create hype and panic in what they viewed as an attempt to scare people. Doubts about the trustworthiness of information and a general information fatigue were related to people disregarding advice in New Zealand and the UK in relation to H1N1 [Mills 2020].

1526 respondents to an online survey of people in Germany were randomised to read background information about why it is important to wear a facemask (background information alone), to read text in which a woman with a rare immune disease reported being severely affected by COVID-19 and stated that she did not like it when people met others without wearing a facemask (empathy condition), or to a control group. Participants in the empathy condition group reported higher empathy levels and were more likely to be motivated to wear a facemask than participants in the other two groups. The level of empathy correlated with motivation to wear a facemask. Background information alone did not increase motivation [Pfattheicher 2020].

A survey of 1033 US citizens investigated associations between the five moral foundations (caring, fairness, loyalty, authority, and sanctity) and three behaviours (staying-at-home, wearing facemasks, and social distancing). It found caring and fairness were associated with compliance with wearing facemasks. This suggests that public health campaigns to promote wearing facemasks should emphasize how this show that one is caring and is fair for all members of society. In contrast, some health campaigns have stressed the mandate nature of these orders, using fines and punishment. Fines and punishments may do little to promote compliance, given that they relate to authority, which was not associated with compliance [Chan 2020].

Another survey conducted in March and April 2020 in eight Organisation for Economic Cooperation and Development countries found large gender differences in Covid-19–related beliefs and behaviours. Women were more likely to perceive the pandemic as a very serious health problem and to agree and comply with wearing facemasks. This suggests that differential public messages by gender may be required to increase compliance among men [Galasso 2020].

Feasibility

A review of 24 studies in healthcare and non-health-care settings during the current pandemic of Covid-19, previous epidemics of SARS and MERS, or in general use, concluded that use of facemasks is acceptable, feasible, and reassuring. Challenges that were identified included frequent discomfort, high resource use linked with potentially decreased equity, less clear communication, and perceived reduced empathy of care providers by those they were caring for [Chu 2020].

Compliance

The proportion of people who report wearing facemasks has increased sharply in many countries. The proportion of people who report wearing facemasks in surveys varies [Mills 2020].

Observations of people in retail stores in Wisconsin (3 and 9 June) found that women were more likely to wear facemasks than men (45% vs 38%). In addition, that study found that older people were more likely than middle-aged or young people to wear facemasks (57% vs 41% vs 37%), and people in rural areas were less likely to wear facemasks than people in suburban or urban areas (20% vs 49% vs 47%) [Haischer 2020].

A cross-sectional internet-based survey in Japan completed by 2141 people between 1 and 6 April investigated compliance with WHO recommendations for correct use of facemasks. In Japan, wearing medical masks is normal. 81% of respondents wore facemasks. Compliance with measures for correct use ranged from 38% to 84%. Only 23% complied with all recommendations. Compliance was low in men and people with low household incomes [Machida 2020].

Mandatory versus voluntary use of facemasks

Data from weekly surveys (April 14 to May 26, 2020) of German participants (n = 1000 per week) indicated that implementing a mandatory facemask policy increased compliance despite moderate acceptance, and that facemask wearing correlated positively with avoiding handshakes, keeping physical distance and (to a lesser extent) with hand washing. In a randomised trial with a hypothetical scenario (n = 925) 77% of respondents reported they would wear a mask in the fruit department of their local grocery store under a voluntary facemask policy compared to 96% under a mandatory policy ($P < 0.001$) [Betsch 2020].

Access

A barrier to wearing facemasks in many countries is getting access to one. For example, an international survey found that 57% of people in Japan say they have heard masks are not available or are

too expensive even if they wanted to wear one. This sentiment is also high in France (49%), Germany and Spain (45%) [Mills 2020].

Fear and helplessness

A systematic review found that negative emotions such as fear can lead to a change in behaviour only if people feel that they are able to control the threat. If they cannot – such as facemask regulations without a clear supply of access to facemasks – reactions will be defensive due to feelings of helplessness. Fear is thus only effective when individuals feel a strong ability or level of efficacy, otherwise it will elicit a defensive and negative response [Mills 2020].

Equity

Issues of access and affordability amongst vulnerable groups may impact on mask use [Seale 2020]. Given the relation between access to facemasks, fear, helplessness, and compliance (see Feasibility) [Mills 2020] and the cost of facemasks for people with little income [Chu 2020], it may be important to ensure access to facemasks if they are recommended, especially for those unable to purchase or make face coverings, for example by cutting costs or free distribution to certain groups.

Similarly, given the potential impact of communication on compliance [Mills 2020], it may be important to ensure appropriate communication of any advice to wear facemasks, especially for people who are less fluent in Norwegian, less likely to receive messages through media that are normally used by authorities, or more likely to be exposed to contradictory information or misinformation.

Participants in a survey in Germany perceived a mandatory facemask policy to be fairer than a voluntary facemask policy [Betsch 2020].

A survey of 129 adults with hearing loss in Scotland investigated effects of safety measures, including the use of facemasks, on people with hearing loss. A large majority found it hard to converse with people in facemasks due to muffled sound and lack of speechreading cues but conversing at a safe distance was not universally problematic. A majority would like all key workers to be equipped with transparent face masks [Naylor 2020].

Panel discussion and judgments

When assessing the criteria in the EtD framework, the panel considered both the evidence and additional data. The panel also discussed each of the criteria before reaching a consensus.

The consensus judgements following the panel discussions are summarised in tables 4 to 6.

Table 4. Panel consensus judgment of the evidence for advice to wear medical facemasks

	Favours medical facemasks	Probably favours medical facemasks	Neither favours medical facemasks or other options	Probably does not favour medical facemasks	Does not favour medical facemasks
Problem			✔		
Desirable effects		✔			
Undesirable effects				✔	
Certainty of the evidence		✔			
Values			✔		
Balance of effects			✔		
Resources required			✔		
Certainty of evidence of required resources				✔	
Cost-effectiveness			✔		
Equity				✔	
Acceptability		✔			
Feasibility		✔			

Table 5. Panel consensus judgment of the evidence for advice to wear non-medical facemasks

	Favours non-medical face-masks	Probably favours non-medical face-masks	Neither favours non-medical facemasks or other options	Probably does not favour non-medical face-masks	Does not favour non-medical face-masks
Problem			✔		
Desirable effects			✔		
Undesirable effects				✔	
Certainty of the evidence				✔	
Values			✔		
Balance of effects			✔		
Resources required			✔		
Certainty of evidence of required resources			✔		
Cost-effectiveness			✔		
Equity			✔		
Acceptability		✔			
Feasibility		✔			

Table 6. Panel consensus judgment of the evidence for advice to wear or not to wear facemasks

	Favours no face-masks	Probably favours no face-masks	Neither favours no facemasks or other options	Probably does not favour no facemasks	Does not favour no facemasks
Problem			✔		
Desirable effects			✔		
Undesirable effects		✔			
Certainty of the evidence			✔		
Values			✔		
Balance of effects		✔			
Resources required		✔			
Certainty of evidence of required resources		✔			
Cost-effectiveness		✔			
Equity		✔			
Acceptability			✔		
Feasibility		✔			

Problem - Is the problem a priority?

Preventing spread of Covid-19 from asymptomatic or pre-symptomatic cases in the community is a high priority. It is likely that asymptomatic infections contribute to the spread of the infection. With increasing incidence, the priority of the problem is increased. In addition to the infection rate, it is important to consider other factors, such as whether the infection rate is increasing and what other control measures are in place, when assessing the baseline risk.

The current strategy to prevent and control spread of Covid-19 in the community includes testing on suspicion of infection, isolation of confirmed cases, contact tracing and quarantine of contacts. Use of facemasks has become highly politicized and controversial internationally and has received a great deal of attention in mass and social media. It is widely perceived to be an effective means of reducing transmission and making it possible to engage in activities where social distancing is not possible. This perception has contributed to a political imperative to encourage or mandate the use of facemasks in the community.

By week 45 there was an increasing number of smaller and larger outbreaks in Norway. Some municipalities, especially in more densely populated areas, have experienced a gradual increase after the summer. The prevalence of Covid-19 in the general population is low in parts of the country. In areas with increasing incidence and outbreaks, contact tracing is strained.

We assume that between 20% and 40% of cases are asymptomatic [Buitrago-Garcia 2020]. A proportion of these cases will be in quarantine as close contacts to known cases. However, the probability of a random meeting between a pre- or asymptomatic case and a susceptible person in the general population is increased when the incidence of Covid-19 increases, and when the capacity for contact tracing is strained.

Transmission of Covid-19 occurs primarily in households and indoor situations with close contact (work, restaurants, bars, gatherings). Among notified cases with reported information about transmission, approximately 75% report having been infected in these settings. Transmission in public spaces, buses, and trains is difficult to document (https://www.fhi.no/contentassets/8a971e7b0a3c4a06bdbf381ab52e6157/vedlegg/andre-halvar-2020/2020.11.11-ukerapport-uke-45-Covid-19.pdf).

An increase in the prevalence of contagious people without symptoms, either locally or nationally, should prompt a re-assessment of the advice given. A definitive incidence threshold is difficult to determine, and the threshold for recommending the use of facemasks depends on other risk factors. The risk should be assessed using both quantitative and qualitative information, such as trend development, whether the increase is mostly limited to localised outbreaks or a diffuse spread, and other local factors. NIPH is currently investigating how local risk assessments can be linked to a threshold or set of indicators.

Desirable effects - How substantial are the desirable anticipated effects?

There is evidence of a protective effect of medical facemasks in community settings. However, study results vary greatly. Randomised trials from community settings indicate a small protective effect. One case-control study indicated an effect of medical facemasks for prevention of Covid-19 for those who were wearing them at all times during contact, although inconsistent use decreased the effect [Doung-ngern 2020]. Laboratory studies indicate a potentially larger effect when facemasks are worn by asymptomatic but contagious individuals to prevent the spread of virus, than when they are worn by susceptible individuals to protect themselves from becoming infected. To ensure correct use and disposal of facemasks, country-wide training programmes adapted to a variety of audiences would need to be implemented. The extent to which high compliance with correct use of facemasks could be achieved is uncertain.

Non-medical facemasks include a variety of products. There is no reliable evidence of the effectiveness of non-medical facemasks in community settings. There is likely to be substantial variation in

effectiveness between products. However, there is only limited evidence from laboratory studies of potential differences in effectiveness when different products are used in the community.

With a low prevalence of Covid-19 the difference in infection rates between using facemasks and not using facemasks would be small. Use of self-isolation when symptomatic or test-positive, and active testing, contact tracing and quarantining will reduce the number of contagious people without symptoms in the community.

Social distancing will have more impact on the spread of Covid-19 than wearing facemasks and should be considered a more important measure.

Undesirable effects - How substantial are the undesirable anticipated effects?

The undesirable effects of facemasks include the risks of incorrect use, and contamination of masks. There is also a risk that other measures are relaxed, such as less adherence to social distancing. This can lead to lack of effect, or even increased risk of infection. However, there is limited evidence of the extent to which this occurs, and there is some evidence that facemasks can, in fact, increase compliance with other measures in some circumstances.

Some people experience problems breathing, discomfort, mental challenges, problems with communication, and difficulty accessing or paying for facemasks. These undesirable effects are mostly minor and the proportion of people who experience them is uncertain. However, when there is a low prevalence of Covid-19, the number of people who experience undesirable effects is likely to be much larger than the number of infections prevented.

Adding to the undesirable effects for the individual, are the environmental effects of disposable facemasks.

Certainty of the evidence - What is the overall certainty of the evidence of effects?

There is low-certainty evidence for a protective effect of medical facemasks used in a community setting from randomised trials and inconsistent evidence from non-randomised studies. Evidence of the magnitude of undesirable effects is limited.

Evidence of the desirable effects of non-medical facemasks is very uncertain. The range of different products, without standards for production, contributes to the uncertainty. The undesirable effects of non-medical facemasks are also not well documented.

The effectiveness of facemasks for primary prevention compared to not using facemasks is uncertain. At the same time, it is certain that facemasks have some undesirable effects compared to not using facemasks, although the magnitude of the undesirable effects is uncertain.

Values – Is there important uncertainty about, or variability in, how much people value the main outcomes?

The value (importance) of limiting the spread of Covid-19 in the population is likely to be dependent on the prevalence and knowledge about the risk of severe disease. The panel believes that the potential desirable and undesirable effects of using facemasks on average are likely to be valued more by the elderly and people belonging to high-risk groups than by younger people without risk factors. Similarly, some people are likely to be more bothered by adverse effects of facemasks than others.

Balance of effects – Does the balance between desirable and undesirable effects favour the option or the comparison?

The available research evidence suggests a small desirable effect of individuals in the community without symptoms using medical facemasks to prevent the spread of virus. However, there are important undesirable effects.

With increasing incidence, and especially when the increase is not confined to limited or localised outbreaks, the balance of effects may favour use of facemasks. When the risk of spread varies across the country, local or regional recommendations should be made, based on an assessment of the risk of spread in the community. Use of facemasks should first be considered when other mitigation measures do not adequately control the infection rate, and primarily for settings where distance cannot be kept, especially indoors, and when contact tracing is not possible.

The panel considered that most people would feel that the potential desirable effects of wearing facemasks outweigh the undesirable effects in many situations. This is because the consequences of Covid-19 and an increasing infection rate are severe, whereas there is no evidence of severe adverse effects of wearing facemasks. Thus even though many people may need to wear facemasks in the community to prevent one new infection per week, and some of those people would experience discomfort or minor adverse effects, the desirable effects are likely to outweigh the undesirable effects when the infection rate is high and increasing. On the other hand, when the infection rate is low and under control, the undesirable effects are likely to outweigh the desirable effects, especially when costs and potential environmental consequences are considered.

The desirable effects of non-medical facemasks are uncertain. Both the desirable and undesirable effects of non-medical facemasks depend on the material that is used and the fit of the facemask. The panel judged the balance of effects for using non-medical facemasks that fulfil the requirements set by the workshop agreement by CEN (SN-CWA 17553:2020) to be acceptable, but not up to the standard of medical facemasks. The panel does not favour using non-medical facemasks with undocumented properties.

Resources required – How large are the resource requirements (costs)?

The resources required are uncertain. The price of facemasks is dependent on supply and demand. Early in the pandemic prices were high due to low production and high and increasing demands. Production has increased and the cost of facemasks is decreasing. However, the situation is uncertain, and costs may increase again. Facemasks should not be used over a long time. How many people need to wear a facemask to prevent one case of Covid-19 is highly dependent on the prevalence of contagious people without symptoms and should be considered before making a recommendation.

Certainty of evidence of required resources – What is the certainty of the evidence of resource requirements (costs)?

The costs for reusable non-medical facemasks are over time most probably lower than for disposable medical facemasks, which may vary greatly depending on quality, documented filtration properties, and demand.

Cost-effectiveness – Does the cost-effectiveness of the option favour the option or the comparison?

Both the effects and the costs of facemasks are uncertain. However, with a low incidence of Covid-19, the costs of using either medical or non-medical facemasks and ensuring correct use most probably outweigh the preventive effect, even if it was assumed that the undesirable effects were minimal.

Equity – What would be the impact on health equity?

Preventive measures, if recommended, should be available and affordable for all. The price of facemasks, whether medical or non-medical, will impact equity, as will the ability of different social groups to benefit from training programmes to use facemasks correctly.

Acceptability – Is the option acceptable to key stakeholders?

The panel believes that most people likely would find using medical or non-medical facemasks, or not using facemasks, all acceptable options, if a clear recommendation is given by authorities with an appropriate rationale that is consistent with the available evidence and the epidemiological circumstances. Both observations and questionnaire-based studies indicate that the acceptability for using facemasks has increased. Adherence to recommendations may vary between age groups and subgroups in the society.

Feasibility – Is the option feasible to implement?

Use of medical facemasks and non-medical facemasks requires training and follow-up. Given increased availability and knowledge on correct use in the population, it is feasible to achieve widespread use of facemasks in the community it the epidemiological situation calls for this. However, achieving high compliance with correct use of facemasks will likely require a substantial effort, including clear and effective communication tailored to different audiences and ensuring easy and equitable access to facemasks.

Conclusion and recommendation

Type of recommendation

The panel agreed on a conditional recommendation for the use of facemasks. A recommendation to use facemasks should be based on a local risk assessment, taking into consideration local epidemiological factors such as the incidence, and whether there are localised outbreaks or a diffuse spread, as well as other factors. A recommendation should first be considered when the infection rate is not controlled by other mitigation measures. It should focus on settings where distance cannot be kept, especially indoors, and when contact tracing is not possible.

When making the recommendation, the panel considered the use of facemasks primarily for source control for individuals in the community without respiratory symptoms, although it also provides some individual protection. When used for individual protection, for example by persons belonging to medical risk groups, only medical facemasks type II or IIR should be used. Only medical facemasks or quality controlled non-medical facemasks should be used when use of facemasks is recommended.

Recommendation

In an epidemiological situation with low incidence and good infection control, use of facemasks is not recommended for individuals in the community without respiratory symptoms who are not in near contact with people who are known to be infected.

In situations with increased incidence and uncontrolled spread in the community, either locally, regionally or nationally, use of facemasks should be considered. The recommendation should be based on an assessment of the risk, should be targeted to settings where distance cannot be kept, especially indoors, and when contact tracing is not possible. Facemasks should only be recommended in these situations when other measures do not adequately control the infection rate.

If facemasks are recommended, medical facemasks or quality controlled non-medical facemasks with a documented filtration effect should be recommended for individuals without respiratory symptoms in the community. Only medical facemasks type II or IIR should be recommended for the intention of individual protection, for example by persons belonging to medical risk groups.

If a recommendation is made, the community should be given training to ensure correct use and the risks should be explained, especially the risks of a false sense of security and contamination of masks. The training should be tailored to the needs of a range of different groups, including age groups and people with different levels of fluency in Norwegian, different socio-economic circumstances, and various geographical areas.

Limitations

The evidence that is included was based on a rapid review. Additional data came from national surveillance and surveys. The aim was not to perform a systematic review, but to provide the best available evidence to inform judgments by the panel and decision makers. A more detailed review process may have identified additional research and provided a more reliable assessment of the available evidence. However, we believe that the most relevant research that was available was identified.

The process of assessing the evidence with the EtD framework was done by an expert panel. The panel assessed the evidence base and made a judgement for each of the criteria in the framework. In this process, limitations of the evidence were identified and discussed.

The assessment was done by consensus, allowing each panel member to provide input to the judgement. The judgements are reported here, making the basis for our recommendation transparent.

The panel focused primarily on the priority of the problem and the effects of the options. The resource criteria were considered, but the evidence base was limited.

A limitation of the process is that all the panel members were employed by NIPH. We did not invite external panel members, mainly due to limited time. Involving external panel members could strengthen the process. It is uncertain whether this would have affected the recommendation.

List of references

List of references from the text. The complete research evidence that was included and used to inform the panel's judgments is summarised in the Supplement.

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Supplement: Search and included studies

Search

For this update, the L·OVE COVID-19 database, Cochrane COVID-19 Study Register, and PubMed database of articles referencing SARS-CoV-2 and COVID-19 were searched 17 August 2020, and again 3 November 2020. The NIPH COVID-19 evidence map, and ClinicalTrials.gov were searched 17 August 2020. Details of the search strategy for this update and the first report are at the end of this Supplement.

Results

Judgements about the eligibility of the articles that were screened for this update are summarised in a flow diagram (Figure S1a). We screened over 600 references and assessed 186 full-text articles.

We included 85 new articles that met the inclusion criteria: 11 systematic reviews of the effects of facemasks on the transmission of respiratory infections or undesirable effects of facemasks (summarised in Table S2a); one post-hoc analysis of a randomised trial of cloth facemasks to protect hospital health workers against respiratory infections (summarised in Table S2b); 22 studies of the effects of facemasks on Covid-19 infection rates and undesirable effects of facemask use during the Covid-19 pandemic (summarised in Table S3a); 14 modelling studies of the effects of facemasks on Covid-19 infection rates (summarised in Table S3b); four systematic reviews of laboratory studies and 18 laboratory studies of filtration properties of facemasks, undesirable effects, and decontamination and reuse of facemasks (summarised in Table S4); seven protocols for evaluations of the effects of facemasks (listed in Table S5); and eight studies of the acceptability and feasibility of facemasks (listed in Table S6). Articles that were included in the first report are shown in grey text in the tables.

Supplementary tables and figures

Figure S1a. Flow diagram for this update (for use of facemasks in the community and in nursing homes)

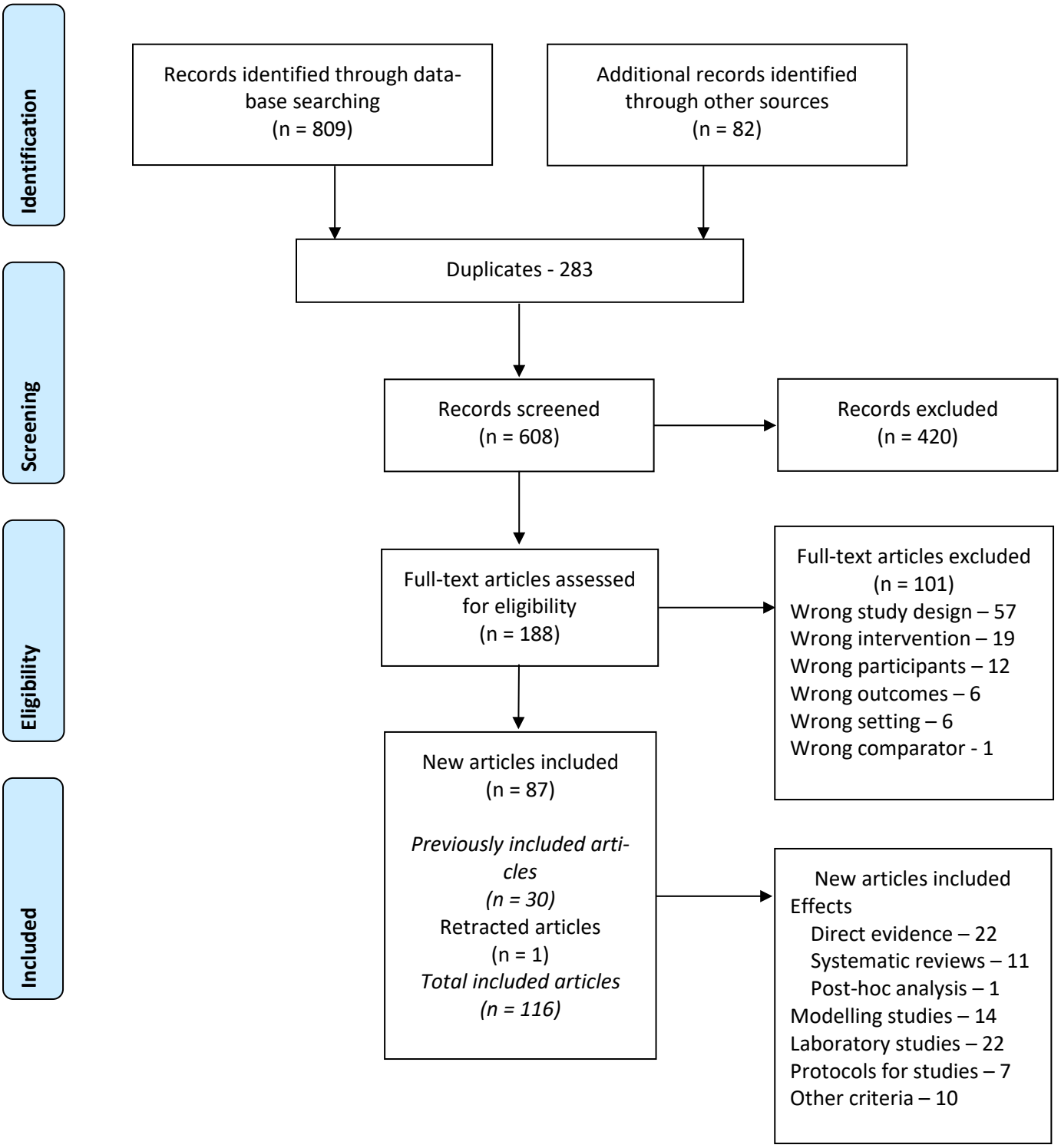

Table S1. ROBIS assessment of the primary systematic review for effects [Whiting P 2016]

Domain*	Judgement†	Comment
1. Eligibility	**Low**	Urgency of question justifies potential lack of a protocol in a rapid review?
1.1	NI	No mention of protocol
1.2	Y	
1.3	Y	
1.4	Y	
1.5	Y	Not guidelines, discussion, regulations, debate, or commentary
2. Identification and selection	**Low**	
2.1	Y	SCOPUS; EMBASE and Medline via OVID
2.2	Y	Two previous relevant reviews were used to find exemplar studies. Search strategy designed to find those studies and similar research.
2.3	Y	
2.4	Y	Studies published in English since January 1980
2.5	PY	The full text of each article that passed screening was retrieved and eligibility verified as part of data extraction (see 3)
3. Data collection and study appraisal	**Unclear**	Cochrane Rapid Reviews. Interim Guidance 2020 states that rapid reviews should use independent risk of bias assessment.
3.1	PY	Reported in synthesis section.
3.2	Y	
3.3	Y	
3.4	Y	RCTs assessed by Cochrane Risk of bias tool.
3.5	N	Single reviewer "Risk of bias in included RCTs was assessed (by LH)", no info on verification by second author
4. Synthesis	**Low**	
4.1	Y	Three RCTs provide evidence on effect of wearing a mask on respiratory infection.
4.2	NI	No mention of protocol
4.3	Y	
4.4	Y	
4.5	Y	Three RCTs with total 5183 participants
4.6	Y	Addressed in GRADE and shown in SoF tables.
1 Eligibility	**Low**	
2 Study identification and selection	**Low**	
3 Data collection and study appraisal	**Unclear**	Single reviewer assessment of risk of bias.
4 Synthesis	**Low**	

5. RISK OF BIAS	**Low**	
5.1	PY	The interpretation of the results appears very balanced and risk of bias discussion seems reasonable.
5.2	Y	
5.3	Y	

*The criteria used for each domain are as follows:

DOMAIN 1: STUDY ELIGIBILITY CRITERIA

1.1 Did the review adhere to pre-defined objectives and eligibility criteria?

1.2 Were the eligibility criteria appropriate for the review question?

1.3 Were eligibility criteria unambiguous?

1.4 Were any restrictions in eligibility criteria based on study characteristics appropriate (e.g. date, sample size, study quality, outcomes measured)?

1.5 Were any restrictions in eligibility criteria based on sources of information appropriate (e.g. publication status or format, language, availability of data)?

DOMAIN 2: IDENTIFICATION AND SELECTION OF STUDIES

2.1 Did the search include an appropriate range of databases/electronic sources for published and unpublished reports?

2.2 Were methods additional to database searching used to identify relevant reports?

2.3 Were the terms and structure of the search strategy likely to retrieve as many eligible studies as possible?

2.4 Were restrictions based on date, publication format, or language appropriate?

2.5 Were efforts made to minimise error in selection of studies?

DOMAIN 3: DATA COLLECTION AND STUDY APPRAISAL

3.1 Were efforts made to minimise error in data collection?

3.2 Were sufficient study characteristics available for both review authors and readers to be able to interpret the results?

3.3 Were all relevant study results collected for use in the synthesis?

3.4 Was risk of bias (or methodological quality) formally assessed using appropriate criteria?

3.5 Were efforts made to minimise error in risk of bias assessment?

DOMAIN 4: SYNTHESIS AND FINDINGS

Describe synthesis methods:

4.1 Did the synthesis include all studies that it should?

4.2 Were all pre-defined analyses reported or departures explained?

4.3 Was the synthesis appropriate given the nature and similarity in the research questions, study designs and outcomes across included studies?

4.4 Was between-study variation (heterogeneity) minimal or addressed in the synthesis?

4.5 Were the findings robust, e.g. as demonstrated through funnel plot or sensitivity analyses?

4.6 Were biases in primary studies minimal or addressed in the synthesis?

RISK OF BIAS IN THE REVIEW

Describe whether conclusions were supported by the evidence:

A Did the interpretation of findings address all of the concerns identified in Domains 1 to 4?

B Was the relevance of identified studies to the review's research question appropriately considered?

C Did the reviewers avoid emphasizing results on the basis of their statistical significance?

† The response options are:

Y = Yes

PY = Probably yes

PN = Probably no

N = No

NI = No information

Table S2a. Systematic reviews of the effects of facemasks*

Reference	Key findings
Prevention of viral respiratory infections	
Aggarwal N, Dwarakanathan V, Gautam n, Ray A. Facemasks for prevention of viral respiratory infections in community settings: A systematic review and meta-analysis. Indian J Public Health 2020;64, Suppl S2:192-200. http://dx.doi.org/10.4103/ijph.IJPH_470_20	Randomised trials published up to 25 April 2020 of facemask use in community settings to prevent viral respiratory illnesses were reviewed. Nine studies were included. Risk of bias was assessed as low (n = 4), medium (n = 3), or high (n = 1) risk. Interventions included using a triple-layered mask alone or in combination with hand hygiene. The average reduction in influenza-like illness (ILI) in 5 trials of facemask use alone was 17% (95% CI −43% to +10%; P = 0.23; I2 = 10.9%). In 6 trials of facemask use with handwashing, the average reduction in ILI was 9% (95% CI -58% to +40%; P = 0.71, I2 = 69.4%).
Bartoszko JJ, Farooqi MAM, AlhazzaniW, Loeb M. Medical Masks vs N95 Respirators for Preventing COVID-19 in Health Care Workers A Systematic Review and Meta-Analysis of Randomized Trials. Influenza Other Respir Viruses 2020. https://dx.doi.org/10.1111/irv.12745	This review compared medical masks to N95 respirators in preventing laboratory-confirmed viral infection and respiratory illness including coronavirus specifically in healthcare workers. Four randomised trials were included. The overall odds ratio for respiratory infection was 1.06 (95% CI 0.90 to 1.25; I^2 = 0%; low certainty evidence). For clinical respiratory illness, the odds ratio was 1.49 (95% CI 0.98 to 2.28; I^2 = 78%; very low certainty evidence). Only one trial evaluated coronavirus infections separately. It did not find an important difference. 4.3% of nurses in the medical mask group had confirmed coronavirus infection compared with 5.7% in the N95 respirator group (P = 0.49).
Brainard J, Jones N, Lake I. Hooper L, Hunter P, Community use of facemasks and similar barriers to prevent respiratory illness such as COVID-19: A rapid scoping review (Accepted/In press) Eurosurveillance. 25 Aug 2020. https://ueaeprints.uea.ac.uk/id/eprint/76669/1/Accepted_Manuscript.pdf	This systematic review of the effects of facemasks to prevent respiratory infections found three randomised trials that provide evidence of low certainty that wearing medical facemasks in com-munity settings may reduce the odds of primary infection with influenza-like illness by around 6%. This estimate is based on two studies in university residencies and one in Hajj pilgrims
Chaabna K, Doraiswamy S, Mamtani R, Cheema S. Facemask use in community settings to prevent respiratory infection transmission: a rapid review and meta-analysis. International Journal of Infectious Diseases. 2020 Sep 26. https://doi.org/10.1016/j.ijid.2020.09.1434	This review included 12 primary studies on the effectiveness of medical facemasks to prevent respiratory disease: 10 randomised trials, one retrospective cohort, and one case-control. The effect in community settings was estimated from two randomized trials and the case-control. The OR for the two randomized trials was 0.65 (0.48-0.86). The review also provides pooled estimates for the effect of preventing respiratory infections in close contacts to infected individuals in household settings: OR 0.67 (0.49-0.90).

Table S2a. Systematic reviews of the effects of facemasks*

Reference	Key findings
Camargo MC, Martinez-Silveira MS, Lima AA, et al. Effectiveness of the use of non-woven face mask to prevent coronavirus infections in the general population: a rapid systematic review. Ciencia & saude coletiva. 2020 Aug 28;25:3365-76. https://doi.org/10.1590/1413-81232020259.13622020	The review reports results from studies of non-woven facemasks in the community. Three studies were included: one cluster-randomized trial (MacIntyre CB 2016) and two systematic reviews (Liang M 2020 and Benkouiten S 2014). No meta-analysis was performed.
Chou R, Dana T, Jungbauer R, et al. Masks for prevention of respiratory virus infections, including SARS-CoV-2 in health care and community settings: a living rapid review. Ann Intern Med 24 June 2020. https://dx.doi.org/10.7326/M20-3213 Update alert 1. 2020 Sep 1. https://doi.org/10.7326/L20-0948 Update alert 2. 2020 Oct 6. https://doi.org/10.7326/L20-1067 Update alert 3. 2020 Oct 27. https://doi:10.7326/L20-1292	Direct evidence for SARS-CoV-2 was limited to 2 observational studies with serious limitations. 12 randomised trials in community settings, typically conducted during influenza seasons did not indicate effectiveness of mask use versus no mask use for reducing viral respiratory infection risk, though mask compliance was suboptimal. Observational data (1 cohort study and 2 case control studies) on mask use effectiveness in community settings for preventing infections associated with epidemic coronaviruses were limited but suggest possible reduced risk for SARS-1. The difference in findings could be related to higher mask compliance in pandemic outbreak settings, greater effectiveness of masks for SARS-1, or residual confounding. Update alert 2: one case-control study among SARS-CoV-2 infected HCWs and controls was included. Update alert 3: One case control study in a community setting was included. The strength of evidence for mask use and risk for SARS-CoV-2 in community settings remained insufficient. In healthcare settings, one cohort and one case control study was included. Evidence for mask use versus non-use and comparing mask types in healthcare settings remained insufficient.

Table S2a. Systematic reviews of the effects of facemasks*

Reference	Key findings
Chu DK, Akl EA, Duda S, et al. 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. Lancet 2020. https://doi.org/10.1016/S0140-6736(20)31142-9	This review included 30 studies of the association between use of various types of facemasks and respirators by health-care workers, patients, or both with transmission of COVID-19, SARS, or MERS. 10 studies contributed data to a meta-analysis of adjusted associations. The estimated OR for surgical facemask or similar (e.g., 12–16-layer cotton) vs no facemask was 0.33 (95% CI 0.17 to 0.61). However, only one study of primary prevention in the community was included [Wu 2004], which was also included in the Brainard review [Brainard 2020] and was considered in our review. The review authors assessed the certainty of the evidence for facemasks vs no facemasks as low overall for any setting without distinguishing between primary and secondary prevention or considering non-medical facemasks. The estimate is very uncertain for the use of masks in the community for primary prevention, especially for non-medical facemasks. It is likely an overestimate, because compliance with correct use would likely be lower and non-medical facemasks are likely to be less effective.
Coclite D, Napoletano A, Gianola Set al. Face mask use in the Community for Reducing the Spread of COVID-19: a systematic review. medRxiv. 2020. https://doi.org/10.1101/2020.08.25.20181651	This preprint is a review of the effectiveness and efficacy of wearing facemasks in the community, excluding healthcare and household settings. There were 35 included studies: 3 cluster-randomised trials, 2 cohort studies, 4 case-control studies, 4 cross-sectional studies, 13 quantitative-deterministic predictive models, and 9 laboratory experimental studies. Relative effect estimates are presented in a summary of findings table. The certainty of the evidence is very low for all study designs. The estimated effect for prevention of respiratory infection was 0.97 (0.72 to 1.31 based on the 3 cluster-randomised trials, 0.90 (0.74 to 1.10) based on the 4 cohort studies, 0.59 (0.34 to 1.03) based on the 2 case-control studies, and 0.55 (0.11 to 2.75) based on 2 prospective studies.
Gupta M, Gupta K, Gupta S. The use of facemasks by the general population to prevent transmission of Covid 19 infection: A systematic review. medRxiv 2020. https://doi.org/10.1101/2020.05.01.20087064	This preprint of a systematic review aimed to summarize the available evidence regarding the role of facemasks in community settings in slowing the spread of respiratory viruses such as SARS- CoV-2. Studies focused on the use of masks and N95 respirators in healthcare workers were excluded. 7 randomised trials, 3 laboratory study, 2 observational studies, and 2 modelling studies were included in the review based on quality and eligibility criteria. It presents a narrative summary of those studies.

Table S2a. Systematic reviews of the effects of facemasks*

Reference	Key findings
Jefferson T, Foxlee, Del Mar C, et al. Physical interventions to interrupt or reduce the spread of respiratory viruses: systematic review. medRxiv 2020. BMJ https://dx.doi.org/10.1101/2020.04.06.20054841	This preprint of an updated systematic review examined the effectiveness of eye protection, facemasks, or person distancing on interrupting or reducing the spread of respiratory viruses. It included randomised trials of people of any age, testing the use of eye protection, facemasks, or person distancing against standard practice, or a similar physical barrier. Outcomes included any acute respiratory illness and its related consequences. 15 cluster-randomised comparisons investigating the effect of masks (14 trials) in healthcare workers and general population were included. Overall, for influenza-like illness (ILI) cases the risk ratio for facemasks compared to no facemasks was 0.93 (95% CI 0.83 to 1.05). For laboratory-confirmed influenza the risk ratio was 0.84 (95% CI 0.61 to 1.17) for the general population and 0.37 (95% CI 0.05 to 2.50) for healthcare workers. For surgical masks compared to N95 respirators the risk ratio was 0.83 (95% CI 0.63 to 1.08) for ILI and 1.02 (95% CI 0.73 to 1.43) for laboratory-confirmed influenza. Harms were poorly reported and limited to discomfort resulting in lower compliance with wearing facemasks.
Liang M, Gao L, Cheng C, et al. Efficacy of face mask in preventing respiratory virus transmission: a systematic review and meta-analysis. medRxiv 2020. https://doi.org/10.1101/2020.04.03.20051649	This preprint of a review included 21 studies of mask use to prevent respiratory virus transmission. It did not include any non-healthcare worker studies that were not included in Bainard 2020. The estimated OR for mask use vs control for non-healthcare workers was 0.53 (95% CI 0.36 to 0.79). There was variation in the effect estimates (I^2 = 45%) and a subgroup difference between healthcare workers and non-healthcare workers (P=0.008), with a stronger association for healthcare workers (OR 0.20; 95% CI 0.11 to 0.37). There were also subgroup differences for different viruses (influenza, SARS-CoV an SARS-CoV2) (P=0.002), and different study designs (P=0.0002). Cluster-randomised studies indicated a smaller effect (OR 0.65; 95% CI 0.47 to 0.91) and case-control studies indicated the largest effect (OR 0.24; 95% CI 0.18 to 0.33).
Long Y, Hu T, Liu L, et al. Effectiveness of N95 respirators versus surgical masks against influenza: a systematic review and meta-analysis. J Evid Based Med 2020; 13:93-101. https://dx.doi.org/10.1111/jebm.12381	Six randomised trials with a total of 9171 participants were included. The risk ratio for N95 masks versus surgical facemasks was 1.09 (95% CI 0.92 to 1.28, P > .05) for laboratory-confirmed influenza, 0.89 (95% CI 0.70 to 1.11) for laboratory-confirmed respiratory viral infections, 0.74 (95% CI 0.42 to 1.29) for laboratory-confirmed respiratory infection, and 0.61 (95% CI 0.33 to 1.14) for influenza-like illness.
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	This review included randomised trials of facemasks and respirators for healthcare workers, sick patients, and the public. It gives a narrative summary of 19 trials – 8 in community settings, 6 in healthcare settings, and 5 as source control. The interventions and

Table S2a. Systematic reviews of the effects of facemasks*

Reference	Key findings
healthcare workers and sick patients. Int J Nurs Stud 2020; NS103629. https://doi.org/10.1016/j.ijnurstu.2020.103629	outcome measures varied across studies. Quantitative results are not reported, and the risk of bias is not assessed.
Marasinghe KM. A systematic review investigating the effectiveness of face mask use in limiting the spread of COVID-19 among medically not diagnosed individuals: shedding light on current recommendations provided to individuals not medically diagnosed with COVID-19. Research Square 17 July 2020. https://doi.org/10.21203/rs.3.rs-16701/v4	This preprint of a systematic review searched for randomised trials, cohort, retrospective or prospective studies that evaluated the effectiveness or ineffectiveness of facemasks in limiting the spread of COVID-19 among the general population or in community settings that were published in English (up to the 2nd week of April 2020). It did not find any studies that met its selection criteria.
Mills M, Rahal C, Akimova E. Face masks and coverings for the general public: behavioural knowledge, effectiveness of cloth coverings and public messaging. The Royal Society 26 June 2020. https://royalsociety.org/topics-policy/projects/set-c-science-in-emergencies-tasking-Covid/	This review found five randomised trials of cotton or paper facemasks. All were conducted in a healthcare setting and focused on protecting the wearer. The overall risk ratio was 0.49 (95% CI 0.30 to 0.78; I2 = 59.3%).
Ollila HM, Partinen M, Koskela J, et al. Face masks prevent transmission of respiratory diseases: a meta-analysis of randomized controlled trials. medRxiv 4 August 2020. https://doi.org/10.1101/2020.07.31.20166116	This meta-analysis of randomised trials of non-surgical facemasks in preventing viral respiratory infections in non-hospital and non-household settings. Five studies (three in pilgrims and 2 in students) were included. Overall, facemasks decreased infections at maximum follow-up (RR = 0.61; 95% CI 0:39 to 0:96, P = 0:03). However, there was substantial heterogeneity (I2 = 71.2%). The RR varied from 0.58 to 1.08. Use of facemasks in the control group (which varied from 12 to 53%) was associated with smaller effects. No severe adverse effects were reported.
Saijonkari M, Booth N, Isojärvi J, Finnilä J, Mäkelä M. Kasvosuojukset COVID-19-tartunnalta suojautumisessa ja infektioepidemian hallinnassa: järjestelmällinen katsaus ja näytön arviointi. (Face masks in preventing COVID-19 infections and controlling the epidemic.) (In Finnish). In: Report on the use of community face coverings to prevent the spread of the COVID-19 epidemic. Reports and Memorandums of the Ministry of Social Affairs and Health 2020:21, Appendix 1. http://urn.fi/URN:ISBN:978-952-00-5421-2	This review included six systematic reviews and six randomised trials. Four of the six trials were included in the Brainard review [Brainard 2020]. Saijonkari et al. did not conduct a meta-analysis. None of the included studies examined use of facemasks in a situation similar to the normal living environment of the Finnish population. The review assessed safety and found that facemasks appear to cause discomfort to users, but not actual harm. This review concluded that the effect of facemasks used outside the home on the spread of droplet-mediated respiratory infections in the population is minimal or non-existent.

Table S2a. Systematic reviews of the effects of facemasks*

Reference	Key findings
Sharma SK, Mishra M, Mudgal SK. Efficacy of cloth face mask in prevention of novel coronavirus infection transmission: A systematic review and meta-analysis. J Edu Health Promot 2020;9:192. https://doi.org/10.4103/jehp.jehp_533_20	This review of effect of cloth facemasks on the prevention of respiratory infections included 12 studies examining cloth facemask filtration effectiveness, and efficacy in clinical and community settings. Three interventional studies compared cloth facemasks and medical facemasks (MacIntyre 2015, Bae 2020 and Davies 2013). The review gives a narrative summary of the studies. The authors concluded that cloth facemasks are less efficacious than medical facemasks.
Stern D, López-Olmedo N, Pérez-Ferrer C, et al. [Rapid review of the use of community-wide surgical masks and acute respiratory infections]. Salud Publica Mex 2020. https://dx.doi.org/10.21149/11379	This rapid review (published in Spanish) assessed the effectiveness of using surgical facemasks in community settings to reduce the probability of infection by SARS-CoV-2 or other acute viral respiratory infections, compared to not using surgical masks. 21 articles were included, including six systematic reviews and one modelling study. Overall, evidence of the effectiveness of using surgical facemasks in community settings to reduce the transmission of viral respiratory infections was found to be inclusive.
Wei J, Doherty M, Persson SM, et al. Facemasks prevent influenza-like illness: implications for COVID-19. medRxiv 12 May 2020. https://doi.org/10.1101/2020.05.07.20094912	This meta-analysis of randomised trials of wearing facemasks to prevent influenza-like illness (ILI) in community settings included 8 trials. Overall, participants wearing facemasks had a lower risk of developing ILI than those not wearing facemasks (RR=0.81; 95% CI 0.70 to 0.95; I2 = 0%). In 5 studies where participants wore facemask irrespective of whether they were infected or not, the RR was 0.77 (95% CI 0.65 to 0.91). The RR was 0.95 (95% CI 0.58 to 1.56 in 2 studies where only infected participants wore facemasks and 1.26 (95% CI 0.69 to 2.31) in 1 study where only uninfected participants wore facemasks.
Undesirable effects	
Bakhit M, Kryzaniak N, Scott AM, et al. Downsides of face masks and possible mitigation strategies: a systematic review and meta-analysis. medRxiv 19 June 2020. https://doi.org/10.1101/2020.06.16.20133207	This review found limited evidence to quantify adverse effects of wearing facemasks. It included 37 studies, of which 25 were in healthcare settings. Adherence to wearing a facemask was higher for surgical/medical facemasks compared to N95/P2 masks (OR 1.26 (95% CI 1.08 to 1.46; I^2 27%). Twenty studies reported on discomfort and irritation. In five of those: between 12 and 34% of people reported difficulty breathing, between 11 and 52% reported facial irritation or discomfort, between 4 and 13% reported headaches in 3 of the studies, and 46% reported warmth in one study. Only 4 studies, all in healthcare settings, reported on the misuse of masks, and none reported on mask contamination or risk compensation behaviour. A randomised trial found that with facemask use *more participants were fearful that they and their family would get

Table S2a. Systematic reviews of the effects of facemasks*

Reference	Key findings
	sick from the flu. Another randomised trial found that 29% of patients wearing masks reported they did not like being seen wearing a mask. Of 2001 healthcare workers in Toronto responding to a survey during the SARS outbreak, difficulty communicating (47%), and difficulty recognizing) were perceived as being particularly bothersome. No studies examined the potential for self-contamination.

*Grey text indicates previously included reviews.

Table S2b. Post hoc analysis of a randomised trial providing supplementary information*

Reference	Key findings
MacIntyre CR, Dung TC, Chughtai, et al. Contamination and washing of cloth masks and risk of infection among hospital health workers in Vietnam: a post hoc analysis of a randomised controlled trial. BMJ Open 2020; 10:e042045. https://doi.org/10.1136/bmjopen-2020-042045	This is a post hoc analysis of unpublished data on mask washing from a trial that found higher rates of respiratory infections in healthcare workers (HCWs) wearing cloth compared to medical facemasks (MacIntyre CR, et al. A cluster randomised trial of cloth masks compared with medical masks in healthcare workers. BMJ Open 2015;5:e006577.) Viral contamination with rhinovirus was found on both medical and cloth facemasks. The risk of infection was higher in HCWs who washed their own facemasks compared to HCWs whose facemasks were washed by the hospital laundry (HR 2.04; 95% CI 1.03 to 4.00; p=0.04). There was not a statistically significant difference in infection rates in HCWs whose facemasks were washed in the hospital laundry compared to HCWs who wore medical facemasks (p=0.5; no other data reported).

Table S3a. Direct evidence of the effects of using facemasks*

Reference	Key findings
Desirable effects	
Cheng VCC, Wong SC, Chuang VWM, et al. The role of community-wide wearing of face mask for control of coronavirus disease 2019 (COVID-19) epidemic due to SARS-CoV-2. J Infect. 2020; pii:S0163-4453(20)30235-8. http://dx.doi.org/10.1016/j.jinf.2020.04.024	This is an ecological study that compared the incidence of Covid-19 in Hong Kong to other "non mask wearing" countries using graphs of the cumulative number of Covid-19 cases and chi square tests for comparisons with two countries (Singapore and South Korea). It has a high risk of bias.
Clipman SJ, Wesolowski AP, Gibson DG, et al. Rapid real-time tracking of non-pharmaceutical interventions and their association with SARS-CoV-2 positivity: The COVID-19 Pandemic Pulse Study. Clin Infect Dis 2020; ciaa1313. https://doi.org/10.1093/cid/ciaa1313	This study surveyed 2322 people in Maryland, and 1030 responded. In univariate analyses, the odds ratio of testing positive for SARS-CoV-2 for always wearing a facemask in public indoors compared to never or sometimes wearing a facemask was 0.63 (95% CI 0.36 to 1.09). For always wearing a facemask in public outdoors the odds ratio was 1.06 (95% CI 0.61 to 1.85). In multivariate analysis, practicing social distancing was negatively associated with testing positive for SARS-CoV-2 both indoors (sometimes vs never: OR 0.26, 95% CI 0.08 to 0.90; and always vs never: OR 0.32, 95% CI 0.10 to 0.99) and outdoors (sometimes vs never: OR 0.34, 95% CI 0.10 to 1.19; and always vs never: OR 0.10, 95% CI 0.03 to 0.33).
Doung-ngern, Suphanchaimat R, Panjangampatthana A, et al. Case-control study of use of personal protective measures and risk for SARS coronavirus 2 infection, Thailand. Emerg Infect Dis 2020; 26:2607-16. https://doi.org/10.3201/eid2611.203003	Wearing a facemask all the time during contact was associated with lower risk of Covid-19 infection compared to not wearing masks (adjusted odds ratio (aOR) 0.23, 95% CI 0.09 to 0.60), while sometimes wearing a facemask during contact was not (aOR 0.87, 95% CI 0.41 to1.84). No association was found between the type of mask and infection. Those who wore masks all the time also were more likely to practice social distancing. Maintaining at least 1 meter distance from a Covid patient (aOR 0.15, 95% CI 0.04 to 0.63), duration of close contact ≤15 minutes versus longer (aOR 0.24, 95% CI 0.07 to 0.90), and handwashing often (aOR 0.33, 95% CI 0.13 to 0.87) were associated with lower risk of infection.

Table S3a. Direct evidence of the effects of using facemasks*

Reference	Key findings
Hatzius J, Struyven D, Rosenberg I. Face masks and GDP. Goldman Sachs Global Economics Analyst 29 June 2020. https://www.goldmansachs.com/insights/pages/face-masks-and-gdp.html	This study estimates the association between facemask usage and infection rates + fatalities using three data sets: 1) a US regional panel in which they relate the growth rate of infections and fatalities to the introduction of state face mask mandates, 2) a large country-level cross sectional study in which they relate cumulative infections and fatalities to the lag between the onset of spread and the introduction of a face mask mandate, and 3) a smaller country-level panel in which they relate the growth rate of infections and fatalities to lagged mask usage. All three analyses indicate that facemask usage is associated with better Covid-19 outcomes. They estimate that a national mandate could raise the percentage of people who wear masks by 15% and cut the daily growth rate of confirmed cases by 1.0% to 0.6%. Based on those findings and using the estimated cross-country relationship between lock downs and GDP, they estimate that a facemask mandate could potentially substitute for lockdowns, which would otherwise subtract nearly 5% from GDP.
Hunter PR, Colon-Gonzalez F, Brainard JS, Rushton S. Impact of non-pharmaceutical interventions against COVID-19 in Europe: a quasi-experimental study. medRxiv 2020. http://dx.doi.org/10.1101/2020.05.01.20088260	This is an ecological study that attempts to estimate the effects of mass gathering restrictions, initial business closure, educational facilities closer, non-essential services closure, stay at home orders, severe travel limitations, and advice or requirements for citizens to wear facemasks or face coverings. It compares data on new Covid-19 and fatalities in 30 European countries using Bayesian generalised additive mixed models. It has a high risk of bias.
Kenyon C. Widespread use of face masks in public may slow the spread of SARS CoV-2: an ecological study. medRxiv 2020. http://dx.doi.org/10.1101/2020.03.31.20048652	This is an ecological study that compares Covid-19 diagnoses per inhabitant in 49 countries, of which wearing facemasks was advocated in 8, using linear regression. It has a high risk of bias.

Table S3a. Direct evidence of the effects of using facemasks*

Reference	Key findings
Leffler CT, Ing E, Lykins JD, et al. Association of country-wide coronavirus mortality with demographics, testing, lockdowns, and public wearing of masks. Am J Trop Med Hyg 2020. http://dx.doi.org/10.4269/ajtmh.20-1015	This study used multivariable linear regression analysis to investigate potential predictors of Covid-19 deaths using mortality data for 169 countries up to May 2020. In countries with cultural norms or government policies supporting public mask-wearing, per-capita coronavirus mortality increased on average by 16.2% each week compared with 61.9% each week in remaining countries. For each week that masks were worn, the per-capita mortality was associated with a lesser increase of 12.6% each week ($p<0.001$). As with other between country comparisons, this study has a high risk of bias.
Lyu W, Wehby GL. Community use of face masks and COVID-19: evidence from a natural experiment of state mandates in the US. Health Affairs 2020; 39:1419-25. http://dx.doi.org/10.1377/hlthaff.2020.00818	This study compared changes in daily county-level Covid-19 growth rates for U.S. states that mandated facemask use compared to states that did not. Mandating facemask use in public was associated with a decline in the daily Covid-19 growth rate by 0.9, 1.1, 1.4, 1.7, and 2.0 percentage points in 1–5, 6–10, 11–15, 16–20, and 21 or more days after state facemask orders were signed, respectively. The reference period was the first five days before the mandate order was signed. The model controlled for major Covid-19 mitigation policies as time-varying (closure of K–12 schools, county-level or state-wide shelter-in-place orders, nonessential business closure, closure of restaurants for dining in, closure of gyms or movie theatres), and Covid-19 tests per 100,000 people.
Matzinger P, Skinner J. Strong impact of closing schools, closing bars and wearing masks during the Covid-19 pandemic: results from a simple and revealing analysis. medRxiv [Preprint]. 2020. http://dx.doi.org/10.1101/2020.09.26.20202457	This study simply plotted cases, hospitalizations, and deaths, on a log2 Y axis and linear date-based data on the X axis in U.S. states, and analysed associations using segmented regression. The data fit straight lines with correlation coefficients ranging from 92% - 99%. Mask mandates were investigated in four states. Graphs are shown for those four states, but statistical analyses are not reported. The authors report that they found the largest drops in association with three interventions: closing schools, closing bars, and wearing masks. This analysis is similar to the analysis by Zhang et al. (see below) and has similar limitations.

Table S3a. Direct evidence of the effects of using facemasks*

Reference	Key findings
Mehl-Madrona L, Bricaire F, Cuyugan A, et al. Understanding SARSCOV-2 propagation, impacting factors to derive possible scenarios and simulations. medRxiv 2020. https://doi.org/10.1101/2020.09.07.20190066	This study analysed associations between factors that potentially impact infection and mortality rates in various countries. The authors report not finding an association between facemask mandates and positivity rates in California, Texas, or France. Graphs are shown but statistical analyses are not reported.
Mitze T, Kosfeld R, Rode J, Wälde K. Face masks considerably reduce COVID-19 cases in Germany: a synthetic control method approach. IZA Institute of Labor Economics Discussion Paper Series 2020; IZA DP No. 13319. http://ftp.iza.org/dp13319.pdf	This study compares infection rates in the city of Jena, Germany where facemasks were introduced on 6 April 2020 to other areas in Germany where facemasks were not introduced until later using a synthetic control, i.e. using a weighted combination of infection rates in other areas as the control to which infection rates in Jena were compared in regression analyses. The study estimates that facemasks reduced the cumulative number of registered Covid-19 cases between 2.3% and 13% over a period of 10 days after they became compulsory and that the daily increase in reported infections was reduced by around 40%.
Rader B, White LF, Burns MR, et al. Mask wearing and control of SARS-CoV-2 transmission in the United States. medRxiv 2020. https://doi.org/10.1101/2020.08.23.20078964	This study used serial cross-sectional surveys in the U.S. to analyse the association between self-reported use of facemasks and SARS-CoV-2 transmission (R_t <1) using multivariate logistic regression models. They found that communities with high mask wearing and social distancing had the highest predicted probability of a controlled epidemic (Rt <1). These positive associations were maintained across sensitivity analyses. The OR for a 1% increase in mask wearing and community transmission control (Rt <1) was 3.53 (95% CI 2.03 to 6.43). The analyses did not control for time-dependent confounding or variations in mask usage by susceptibility status. There was not a statistically significant change in self-reported mask wearing following state mandates. However, the positive trend of increased mask wearing over time continued.
Rodriguez-Barranco M, Rivas-Garcia L, Quiles JL, et al. The spread of SARS-CoV-2 in Spain: hygiene habits, sociodemographic profile, mobility patterns and comorbidities. Environ Res 2020; 192:110223. https://doi.org/10.1016/j.envres.2020.110223	This study investigated associations between risk factors and hygiene measures with infection rates in Spain using survey data from 2086 respondents. They did not find statistically significant associations between self-reported use of facemasks and self-reported COVID-19 infection.

Table S3a. Direct evidence of the effects of using facemasks*

Reference	Key findings
Zhang R, Li Y, Zhang AL, et al. Identifying airborne transmission as the dominant route for the spread of COVID-19. Proc Natl Acad Sci 2020; 117:14857-63. https://doi.org/10.1073/pnas.2009637117	This study conducted interrupted time series analysis to estimate the effect of facemask policies in Italy and New York City. The study estimated that facemask policies reduced the number of infections by 78,000 in Italy from April 6 to May 9 and by over 66,000 in New York from April 17 to May 9. However, the model used in this study had several important limitations. It did not include a lag between implementation of the policy and when the infection rate would start to decline. Based on what is known about the incubation time, a reduction in infections would not be expected for one or two weeks after implementing a facemask policy. The infection rate was already declining before then and the rate of decline did not increase further. The model may also have been oversimplistic in assuming a simple linear regression model since increases in infection rates typically do not follow a straight line for very long.
Asymptomatic infections and transmission	
Buitrago-Garcia DC, Egli-Gany D, Counotte MJ, et al. Asymptomatic SARS-CoV-2 infections: a living systematic review and meta-analysis. medRxiv 2020. https://www.medrxiv.org/content/10.1101/2020.04.25.20079103v3	This systematic review included 94 studies of the proportion of Covid-19 infections that are asymptomatic or pre-symptomatic. The overall estimate of the proportion of people who become infected with SARS-CoV-2 and remain asymptomatic throughout infection was 20% (95% CI 17 to 25%) with a prediction interval of 3-67% in 79 studies. In seven studies of defined populations screened for SARS-CoV-2 and then followed, 31% (95% CI 26 to 37%, prediction interval 24-38%) remained asymptomatic. Estimates of the proportion of infections that are pre-symptomatic were heterogeneous. Most included studies were not designed to estimate the proportion of asymptomatic SARS-CoV-2 infections and were at risk of selection biases. In addition, the proportion of asymptomatic infections may have been underestimated in some studies because of false negative test results.

Table S3a. Direct evidence of the effects of using facemasks*

Reference	Key findings
Yang B, Huang AT, Garcia-Carreras B, et al. Effect of specific non-pharmaceutical intervention policies on SARS-CoV-2 transmission in the counties of the United States. medRxiv 2020. https://doi.org/10.1101/2020.10.29.20221036	This study estimated the association between weekly values of the effective basic reproductive number (R_{eff}) and seven policies to reduce infection rates in the U.S. No single intervention was implemented alone for a sustained period and many combinations of interventions never occurred. Hence, the study only estimated associations for combinations of policies that may have complex interactions. Combinations that included school and leisure activities closure and nursing home visiting bans were all associated with an R_{eff} below 1 when combined with either stay at home orders (median R_{eff} 0.97; 95% CI 0.58 to 1.39) or facemasks (median R_{eff} 0.97; 95% CI 0.58 to 1.39).
Zhen J, Chan C, Schoonees A, et al. 2020. Transmission of respiratory viruses when using public ground transport: a rapid review to inform public health recommendations during the COVID-19 pandemic. South African Medical Journal, 110(6), doi:10.7196/SAMJ.2020.v110i6.14751. http://scholar.sun.ac.za/handle/10019.1/108564	This rapid review of interventions that might reduce viral transmission on public ground transportation found four studies that met its inclusion criteria. One modelling study (Furuya H. Risk of transmission of airborne infection during train commute based on mathematical model. Environ Health Prev Med 2007;12(2):78-83) found an estimated reproduction number (R_a) of 1.13 for highly efficient masks and 1.17 for doubling the rate of ventilation. The author of the modelling study concluded that masks may not be available to all passengers, and improved ventilation of railway carriages may be a more effective and feasible intervention.
Undesirable effects	
Abassi SA, Khalil AB, Arslan M. Extensive use of face masks during COVID-19 pandemic: (micro-)plastic pollution and potential health concerns in the Arabian Peninsula. Saudi J Biol Sci 2020. https://doi.org/10.1016/j.sjbs.2020.09.054	They estimated that Saudi Arabia, the most populated country in the region (population 34.8 million), may contribute 32 to 235 thousand tons of (micro-)plastic based on 25% usage of N95 masks and 75% usage of disposable medical facemasks and varying assumptions about acceptance and daily usage rates. This is concerning because the plastic ends up in marine ecosystems. It also allows colonization of pathogenic microorganisms and might serve as carriers of disease transmission, affecting the living organisms in these ecosystems. The authors suggest that appropriate regulations of facemask waste should be devised to avoid these consequences.

Table S3a. Direct evidence of the effects of using facemasks*

Reference	Key findings
Atay S, Cura ŞÜ. Problems encountered by nurses due to the use of personal protective equipment during the coronavirus pandemic: results of a survey. Wound Manag Prev 2020 Oct;66(10):12-16. https://doi.org/10.25270/wmp.2020.10.1216	This study investigated problems with facemasks and other personal protective equipment based on a cross-sectional survey of nurses caring for Covid-19 patients in state or university hospitals in Turkey. Commonly reported problems were sweating when wearing medical facemasks (51% of 309 respondents) or N95 masks (64.2%) and dry mouth (50% and 56% respectively), and headache (50% for N95 masks). Of the 297 respondents who reported wearing medical masks, 78% wore them more than four hours per day.
Chen Y-J, Qin G, Chen J, et al. Comparison of face-touching behaviors before and during the coronavirus disease 2019 pandemic. Jama Network Open 2020; 3:e2016924. https://doi.org/10.1001/jamanetworkopen.2020.16924	This study reviewed videos of 4699 individuals in public areas in 9 countries before the Covid-19 pandemic and 2887 individuals during the pandemic. Enclosed spaces were not included. During the periods studied, mask wearing increased in all regions except the US. Surgical masks were predominant in China and fabric masks were predominant in the other regions. Overall, face-touching behaviours decreased from before Covid-19 to during Covdi-19 among individuals in China (from 4% to 1%; P < .001), South Korea (from 11% to 2%; P < .001), and Europe (from 11% to 6%; P = .01). Logistic regression found that mask wearing was associated with a reduction in face touching in China (OR 3.91; 95% CI 2.11-7.24) and South Korea (OR 6.69; 95% CI 2.69-16.69) and of touching the nose, mouth, and eyes (China: OR 8.60; 95% CI 2.65-27.86; South Korea: OR 29.27; 95% CI 1.79-478.22). There were fewer videos from Europe and the U.S. and those findings were inclusive.
Heider CA, Álvarez ML, Fuentes-López E, et al. Prevalence of voice disorders in healthcare workers in the universal masking COVID-19 Era Laryngoscope 2020. https://doi.org/10.1002/lary.29172	This cross-sectional survey of healthcare personnel in Covid-19 high-risk hospital units in Chile found overall that 33% of 221 respondents reported having trouble with their voice during the last month and 26% had an abnormal score on the Voice Handicap Index VHI-10 questionnaire. Most respondents wore both F95 and surgical facemasks. More working hours andmore hours of daily mask use were associated with higher VHI-10 scores. Use of only medical facemasks was associated with lower VHI-10 scores.

Table S3a. Direct evidence of the effects of using facemasks*

Reference	Key findings
Hua W, Zuo Y, Wan R, et al. Short-term skin reactions following use of N95 respirators and medical masks. Contact Dermatitis 13 May 2020. https://doi.org/10.1111/cod.13601	In this randomised crossover study with repeated measurements, 20 healthy Chinese volunteers were recruited. Skin parameters were measured on areas covered by the facemasks and on uncovered skin 2 and 4 hours after putting on and 0.5 and 1 hour after taking off the facemasks. Half (10 of 20) participants reported adverse skin reactions caused by the medical mask. The average discomfort score (1=most comfortable you've ever felt to 5=mort uncomfortable you've ever felt) for medical facemasks was 1.4 (SD 0.8). The average touching score (1=you never want to touch or adjust the mask to 5=you always want to touch or adjust the mask) was 1.8 (SD 1.4). The score for wanting to take off the mask (1=you never want to take off the mask to 5=you always want to take off the mask) was 1.8 (SD 1.4). More adverse reactions and higher scores for discomfort, touching, and desire to take off the masks were reported for N95 masks than for medical facemasks.
Matusiak L, Szepietowska M, Krajewski P, et al. Inconveniences due to the use of face masks during the COVID-19 pandemic: a survey study of 876 young people. Dermatologic Therapy 2020. https://doi.org/10.1111/dth.13567	Out of 876 students in Poland who participated in a survey only 27 people (3%) did not complain of any problems related to facemask wearing. Out of all reported inconveniences, difficulty in breathing appeared to the most common one (36%), followed by warming/sweating (21%), misting up of glasses (21%) and slurred speech (12%). Skin reactions were reported less often (itch - 7.7%, skin irritation - 0.9%). Wearing surgical masks compared to other types of masks had a lower risk for difficulty in breathing, warming/sweating, glasses misting up, slurred speech and itch (OR=0.42, OR=0.60, OR=0.10, OR=0.17 and OR=0.04, respectively). Wearing cloth masks had a higher risk of difficulty in breathing (OR=1.56), warming/sweating (OR=1.31), glasses misting up (OR=1.92), slurred speech (OR=1.86) and itch (OR=2.99).

Table S3a. Direct evidence of the effects of using facemasks*

Reference	Key findings
Seres G, Balleyer A, Cerutti N, et al. Face mask use and physical distancing before and after mandatory masking: evidence from public waiting lines. SSRN 2020. http://dx.doi.org/10.2139/ssrn.3641367	In this study, the investigators randomly (based on a coin toss) did or did not wear a facemask when facing sideways in queues outside a shop, and then measured the distance kept by the person behind them. The experiment was done before and after facemasks were mandated in Berlin. The distance decreased slightly (about 3 cm on average, p=0.002) in both groups after facemasks were mandated. People wearing a facemask keep a larger distance prior to the mandate (p=0.009), but not after the mandate (p=0.264). Compliance with maintaining a distance of 1.5 meters was greater when people stood behind an investigator wearing a mask than one not wearing a mask (54% versus 69% before the mask mandate and 40% versus 49% after the mandate was introduced.
Szepietowski JC, Matusiak L, Szepietowska M, et al. Face mask-induced itch: a self-questionnaire study of 2,315 responders during the COVID-19 pandemic. Acta Dermato-Venereologica 2020; 100: adv00152. https://doi.org/10.2340/00015555-3536	2315 people responded to a survey of the public. Of the 1393 that reported using facemasks during the previous week, 273 (19.6%) reported facemask induced itch. Most people (64.5%) reported moderate itching. Severe or very severe itching was reported by 12.1%. Of the 273 who reported itching, 18.7% reported scratching their face without removing the mask, 9.9% took their masks off and then scratched the skin, and 6.2% took the mask off and did not use it for some time.
Techasatian L, Lebsing S, Uppala R, et al. the effects of the face mask on the skin underneath: a prospective survey during the COVID-19 pandemic. J Prim Care Comm Health 2020; 11: https://doi.org/10.1177/2150132720966167	This survey in Thailand investigated skin reactions from wearing facemasks. 55% of 883 respondents reported skin reactions of which acne was the most frequent (40%), followed by rashes on the face (18%), and itching (16%). More skin reactions were reported by people wearing medical compared to cloth facemasks (OR 1.54; 95% CI 1.16 to 2.06), by those wearing a facemask more than 4 hours/day (OR 1.96; 95% CI 1.29 to 2.98), and by those who reused facemasks (OR 1.5; 95% CI 1.11 to 2.02).
Yan Y, Bayham J, Fenichel EP, Richter A. Do face masks create a false sense of security? A COVID-19 dilemma. medRxiv 2020. https://doi.org/10.1101/2020.05.23.20111302	This study used SafeGraph smart device location data to evaluate the association between facemask mandates in the U.S. and behaviours that could expose individuals to COVID-19, focusing on data for two weeks before and after 36 states implemented facemask mandates. On average, participants spent less time at home following facemask mandates (20 to 23 minutes or 3 to 5%). They also increased trips to places such as restaurants, gas stations, building supply stores, and museums.

*Grey text indicates previously included studies.

Table S3b. Modelling studies

Reference	Key findings
Chen Y, Dong M. How efficient can non-professional masks suppress COVID-19 pandemic? medRxiv 2020. https://doi.org/10.1101/2020.05.31.20117986	This study characterised cotton facemasks by a virus penetration rate (VPR) and used Monte Carlo simulations to estimate the effective reproduction number R of Covid-19 or similar pandemics. They estimated that the basic reproduction number can be reduced by VPN^4 if facemasks with 70 to 90% are universally applied.
Chernozhukov V, Kasahara H, Schrimpf P. Causal impact of masks, policies, behavior on early Covid-19 pandemic in the U.S. J Econometrics 2020. https://doi.org/10.1016/j.jeconom.2020.09.003	The paper estimated associations between policies and the spread of Covid-19 in the U.S. using state-level data on cases, tests, policies, and social distancing behaviour measures from Google Mobility Reports; and evaluated the dynamic impact of policies and behaviours on the growth rates of confirmed Covid-19 cases and deaths. They estimate that nationally mandating facemasks for employees early in the pandemic could have reduced the weekly growth rate of cases and deaths by more than 10% in late April and could have led to as much as 19 to 47% fewer deaths nationally by the end of May.
Fisman DN, Greer AL, Tuite AR. Bidirectional impact of imperfect mask use on reproduction number of COVID-19: a next generation matrix approach. Infect Dis Model 2020; 5:405-8. https://doi.org/10.1016/j.idm.2020.06.004	Based on a simple model, without precise estimates for mask effectiveness in the context of Covid-19, this study suggests that widespread wearing of facemasks could suppress COVID-19 epidemics in regions with R(t) at or near 1.
IHME COVID-19 Forecasting Team. Modeling COVID-19 scenarios for the United States. Nature Med 2020. https://doi.org/10.1038/s41591-020-1132-9	This study used state-level Covid-19 case and mortality data in the U.S. from 1 February 2020 to 21 September 2020 and a deterministic SEIR (susceptible, exposed, infectious and recovered) compartmental framework to model possible trajectories of Covid-19 infections and the effects of non-pharmaceutical interventions from 22 September 2020 through 28 February 2021. They assessed scenarios of social distancing mandates and levels of facemask use. They estimate that universal mask use (95% mask use in public) could be sufficient to ameliorate the worst effects of epidemic resurgences in many states. As noted by the authors, "there are a multitude of limitations in any modelling study of this type."

Table S3b. Modelling studies

Reference	Key findings
Losina E, Leifer V, Millham L, et al. College campuses and COVID-19 mitigation: clinical and economic value. medRxiv 2020. https://doi.org/10.1101/2020.09.03.20187062	This study examined the effects and cost-effectiveness of Covid-19 mitigation strategies on college campuses. They used a dynamic microsimulation that tracks infections accrued by students and faculty, accounting for community transmissions. They assumed that facemasks reduce infection rates by between 44 and 82%, with a base-case reduction of 50% and adherence of 50%. They varied these parameters in sensitivity analyses. They estimated that mandatory facemasks would reduce infections more than social distancing, and that combining facemasks with extensive social distancing would prevent 87% of infections among students and faculty.
Mingwang S, Zu J, Fairley CK, et al. Projected COVID-19 epidemic in the United States in the context of the effectiveness of a potential vaccine and implications for social distancing and face mask use. medRxiv 2020. https://doi.org/10.1101/2020.10.28.20221234	This study developed a dynamic compartmental model of Covid-19 transmission for the four most severely affected states in the U.S. (New York, Texas, Florida, and California). They evaluated the vaccine effectiveness and coverage required to suppress the Covid-19 epidemic in scenarios when social contact was to return to pre-pandemic levels and facemask use was reduced. Daily and cumulative Covid-19 infection and death cases were obtained from the Johns Hopkins University Coronavirus resource centre and used for model calibration. They estimate that without a vaccine, the spread of Covid-19 could be suppressed in these states by maintaining strict social distancing measures and facemask use levels, but relaxing social distancing restrictions to the pre-pandemic level without changing the current facemask use would lead to a new Covid-19 outbreak. In this scenario, they estimate that introducing, a vaccine would partially offset this negative impact even if the vaccine effectiveness and coverage were relatively low. However, if facemask use is reduced by 50%, a vaccine that is only 50% effective (weak vaccine) would require coverage of 55-94% to suppress the epidemic in these states. A vaccine that is 80% effective (moderate vaccine) would only require 32-57% coverage to suppress the epidemic. If facemask usage stops completely, they estimate that a weak vaccine would not suppress the epidemic, and further major outbreaks would occur. A moderate vaccine with coverage of 48-78% or a strong vaccine (100% effective) with coverage of 33-58% would be required to suppress the epidemic.

Table S3b. Modelling studies

Reference	Key findings
Mittal R, Meneveau C, Wu W. A mathematical framework for estimating risk of airborne transmission of COVID-19 with application to face mask use and social distancing. Physics Fluids 2020; 32:101903. https://doi.org/10.1063/5.0025476	This study used a simple mathematical model for estimating the risk of airborne transmission of a respiratory infection such as Covid-19. The model employs basic concepts from fluid dynamics and incorporates the known scope of factors involved in the airborne transmission of such diseases. The model is used to assess the protection from transmission afforded by facemasks made from a variety of fabrics. Given the large uncertainties in estimates of the effectiveness of the facemasks, the authors only make general conclusions about the effectiveness of facemasks using different fabrics.
Ngonghala CN, Iboi EA, Gumel AB. Could masks curtail the post-lockdown resurgence of COVID-19 in the US? Math Biosci 2020; 329: 108452. https://doi.org/10.1016/j.mbs.2020.108452	This study used a mathematical model to explore whether the universal use of facemasks can halt resurgence of the Covid-19 pandemic and possibly avert having to undergo another cycle of major community lockdowns in the states of Arizona, Florida, New York, and the entire US. They estimate that the increased use of facemasks after a lockdown period greatly reduces the burden of the pandemic in each jurisdiction.For a high lockdown lifting scenario, none of the four jurisdictions would experience a second wave if half of their residents wore facemasks consistently after the lockdown period. They also estimate that the universal use of facemasks in public, with at least a moderate level of compliance, could halt the post-lockdown resurgence of Covid-19, in addition to averting the potential for (and severity of) a second wave of the pandemic in each of the four jurisdictions.
Silva PCL, Batista VC, Lima HS, et al. COVID-ABS: An agent-based model of COVID-19 epidemic to simulate health and economic effects of social distancing interventions. Chaos, Solitons Fractals 2020; 139: 110088 https://doi.org/10.1016/j.chaos.2020.110088	This study uses a SEIR (Susceptible-Exposed-Infected-Recovered) agent-based model to estimate the impacts of policies of (1) do nothing, (2) lockdown, (3) conditional lockdown, (4) vertical isolation (social isolation of high risk groups), (5) partial isolation, (6) use of facemasks, and (7) use of facemasks together with 50% of adhesion to social isolation. They estimate that lock downs would have the largest impact. Conditional lockdowns and facemasks together with 50% social isolation would have the next largest impact, followed by use of facemasks and partial isolation.

Table S3b. Modelling studies

Reference	Key findings
Stutt ROJH, Retkute R, Bradley M, et al. A modelling framework to assess the likely effectiveness of face-masks in combination with 'lock-down' in managing the COVID-19 pandemic. Proc R Soc A 2020; 476:20200376. http://dx.doi.org/10.1098/rspa.2020.0376	A simple modelling framework is used to examine the dynamics of CovidD-19 epidemics when facemasks are worn by the public, with or without imposed 'lock-down' periods. Two mathematical models suggest that when facemasks are used by the public all the time (not just from when symptoms first appear), the effective reproduction number, Re, can be decreased below 1, leading to the mitigation of epidemic spread. The analyses indicate that a high proportion of the population would need to wear facemasks to achieve reasonable impact of the intervention. The models also indicate the need for improved parameter estimates, especially for transmission rates and the effects of face-masks.
Tatapudi H, Das R, Das TK. Impact assessment of full and partial stay-at-home orders, face mask usage, and contact tracing: An agent-based simulation study of COVID-19 for an urban region. Global Epidemiol 2020; 2:100036. https://doi.org/10.1016/j.gloepi.2020.100036	This study used an agent-based simulation model of outbreak in a large urban region (Miami-Dade County, Florida) to assess the impacts of social interventions. Using an odds ratio of 0.33 as the estimated effectiveness of medical face-masks and assuming 100% compliance at workplaces, schools and community places as their base case, they estimated that universal use of medical facemasks could reduce the number of Covid-19 infections by 20%.
Teslya A, Pham TM, Godijk NG, et al. SARS-CoV-2; COVID-19; mathematical model; prevention measures; disease awareness; epidemic control; social distancing; handwashing; mask-wearing; public health. Lancet 2020, preprint. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3555213	A transmission model was developed to evaluate the impact of self-imposed prevention measures (handwashing, mask-wearing, and social distancing) due to Covid-19 awareness and of short-term government-imposed social distancing on the peak number of diagnoses, attack rate and time until the peak number of diagnoses. The model indicated that for fast awareness spread in the population, self-imposed measures could reduce the attack rate, diminish and postpone the peak number of diagnoses. A large epidemic could be prevented if the effectiveness of these measures exceeds 50%. For slow awareness spread, self-imposed measures could reduce the peak number of diagnoses and attack rate but do not affect the timing of the peak. Early implementation of short-term government interventions could only delay the peak.

Table S3b. Modelling studies

Reference	Key findings
Wang T, Wu Y, Lau JY-N, et al. A four-compartment model for the COVID-19 infection—implications on infection kinetics, control measures, and lockdown exit strategies. Precision Clin Med 2020; 3:104-12. https://doi.org/10.1093/pcmedi/pbaa018	This study used a four-compartment model for Covid-19 infection based on the Wuhan data and validated with data collected in Italy, the UK, and the US to assess the potential effectiveness of various infection control measures. Analysing different lockdown exit strategies, the model indicated that a lockdown exit strategy with a combination of social separation and general facemask use may work, but this would need to be supported by intense monitoring, which would allow reintroduction or tightening of control measures if the number of new infections increased again.
Zhang K, Vilches TN, Tariq M, et al. The impact of mask-wearing and shelter-in-place on COVID-19 outbreaks in the United States. Int J Infect Dis 2020; S1201-9712(20)32204-9. https://doi.org/10.1016/j.ijid.2020.10.002	This study sought to quantify the impact of several public health measures, including non-medical facemasks, shelter-in-place, and detection of silent infections to help inform Covid-19 mitigation strategies. It used an agent-based disease transmission model and parameterized it with estimates of Covid-19 characteristics and US population demographics. Assuming facemasks reduced transmission of infections by 20%, it estimated that non-medical mask-wearing by 75% of the population reduced infections, hospitalizations, and deaths by 37.7% (IQR 36.1% to 39.4%), 44.2% (IQR 42.9% to 45.8%), and 47.2% (IQR 45.5% to 48.7%), respectively, in the absence of a shelter-in-place strategy. The authors concluded that mask-wearing, even with the use of non-medical masks with only 20% efficacy in preventing disease transmission, has a substantial impact on outbreak control.

Table S4. Laboratory studies*

Reference	Key findings
Filtration and transmission	
Systematic reviews	
Clase CM, Fu EL, Ashur A, et al. Forgotten technology in the COVID-19 pandemic: filtration properties of cloth and cloth masks – a narrative review. Mayo Clin Proc 2020; 95(10):2204-2224. https://doi.org/10.1016/j.mayocp.2020.07.020	This review included 25 articles. Studies of protection for the wearer used healthy volunteers or a manikin with airflow to simulate different breathing rates. Studies of protection of others, also known as source control, used convenience samples of healthy volunteers. Many descriptions of cloth lacked the detail required for reproducibility; no study provided all the expected details of material, thread count, weave, and weight. Some of the homemade mask designs were reproducible. Successful masks were made of muslin at 100 threads per inch (TPI) in 3 to 4 layers (4-layer muslin or a muslin-flannel-muslin sandwich), tea towels (also known as dish towels), made using 1 layer (2 layers would be expected to be better), and good-quality cotton T-shirts in 2 layers (with a stitched edge to prevent stretching). In flat-cloth experiments, linen tea towels, 600-TPI cotton in 2 layers, and 600-TPI cotton with 90-TPI flannel performed well but 80-TPI cotton in 2 layers did not. The authors recommend cotton or flannel at least 100 TPI, at least 2 layers. More layers, 3 or 4, will provide increased filtration but there is a trade-off in that more layers increases the resistance to breathing.
Jain M, Kim ST, Xu C, et al. efficacy and use of cloth masks: a scoping review. Cureus 2020; https://doi.org/10.7759/cureus.10423	Nine articles were included in this review, which aimed to integrate current studies and guidelines to determine the efficacy and use of cloth masks in healthcare settings or the community. The effectiveness of a facemask depends on the filtration efficacy of the material, fit of the mask, and compliance to wearing the mask. The authors conclude that: Household fabrics such as cotton T-shirts and towels have some filtration efficacy and therefore potential for droplet retention and protection against virus-containing particles. However, the percentage of penetration in cloth masks is higher than medical facemasks or N95 respirators. Cloth masks have limited inward protection in healthcare settings where viral exposure is high but may be beneficial for outward protection in low-risk settings and use by the public where no other alternatives to medical facemasks are available.
Studies	

Table S4. Laboratory studies*

Reference	Key findings
Aydin O, Emon AB, Saif MTA. Performance of fabrics for home-made masks against spread of respiratory infection through droplets: a quantitative mechanistic study. medRxiv 2020. http://dx.doi.org/10.1101/2020.04.19.20071779	The performance of ten different fabrics, ranging from cotton to silk, in blocking high velocity droplets, was assessed using a 3-layered commercial medical mask as a benchmark material. Breathability and ability to soak water were also assessed. Most home fabrics substantially blocked droplets, even as a single layer. With two layers, blocking performance can reach that of surgical mask without significantly compromising breathability. Home fabrics were hydrophilic to varying degrees, and hence soak water. In contrast, medical masks are hydrophobic, and tend to repel water. Incoming droplets are thus soaked and 'held back' by home fabrics, which might be an advantage of home-made cloth masks.
Bae S, Kim MC, Kin JY, et al. Effectiveness of Surgical and Cotton Masks in Blocking SARS-CoV-2: A Controlled Comparison in 4 Patients. Ann Intern Med 2020; M20-1342. http://dx.doi.org/10.7326/M20-1342	This article was retracted 7 July 2020. http://dx.doi.org/10.7326/L20-0745
Davies A, Thompson K-A, Giri K, Kafatos G. Testing the Efficacy of Homemade Masks: Would They Protect in an Influenza Pandemic? Disaster Med Pub Health Preparedness 2013; 7:413-8. https://doi.org/10.1017/dmp.2013.43	Several household materials were evaluated for the capacity to block bacterial and viral aerosols in 21 healthy volunteers. The median-fit factor of the homemade masks was one-half that of the surgical masks. Both masks significantly reduced the number of microorganisms expelled by volunteers, although the surgical mask was 3 times more effective in blocking transmission than the homemade mask.
Fischer EP, Fischer MC, Grass D, et al. Low-cost measurement of face mask efficacy for filtering expelled droplets during speech. Sci Adv 2020; 6:eabd3083. https://doi.org/10.1126/sciadv.abd3083	This study used a simple optical measurement method to evaluate the efficacy of masks to reduce the transmission of respiratory droplets during regular speech. It compared a variety of commonly available mask types and observed that some mask types approach the performance of standard medical facemasks, while some mask alternatives, such as neck gaiters or bandanas, offer very little protection.
He W, Guo Y, Liu J, et al. Filtration performance degradation of in-use masks by vapors from alcohol-based hand sanitizers and the mitigation solutions. medRxiv 2020. https://doi.org/10.1101/2020.11.01.20223982	This study suggests that exposure to the vapours from alcohol-based sanitizers during hand disinfection might degrade the filtration performance of facemasks, and the degradation worsened with the increasing number of hand disinfection. After five times, the filtration efficiencies of medical facemasks decreased by ＞8% for 400 and 500nm particles and by 3.68 ± 1.83% for 1μm particles.

Table S4. Laboratory studies*

Reference	Key findings
	This was attributed to the dissipation of electrostatic charges on the masks when exposed to the alcohol vapor generated during hand disinfection. Simple practice of vapor-avoiding hand disinfection could mitigate the effects of alcohol vapor, which was demonstrated on two brands of surgical masks.
Ho K-F, Lin L-Y, Weng S-P, Chuang K-J. Medical mask versus cotton mask for preventing respiratory droplet transmission in microenvironments. Sci Total Env 2020; 735:139510. https://doi.org/10.1016/j.scitotenv.2020.139510	This study investigated whether triple-layer cotton facemasks worn by people with respiratory infections in a regular bedroom or a car with air conditioning could suppress respiratory droplet levels compared to medical facemasks. The study included 205 adults with influenza and 6 with suspected Covid-19. There were increases in the concentration of particles with a size range of 20–1000 nm compared to background concentrations for both medical and cotton facemasks. The concentrations were similar with medical and cotton facemasks.
Kasloff SB, Strong JE, Funk D, Cutts T. Stability of SARS-CoV-2 on critical personal protective equipment. medRxiv 2020. https://doi.org/10.1101/2020.06.11.20128884	This study assessed SARS-CoV-2 stability on experimentally contaminated personal protective equipment, including N-95 and N-100 particulate respirator masks, plastic, and cotton. Viable SARS-CoV-2 in the presence of a soil load persisted for up to 21 days on experimentally inoculated PPE, including materials from filtering facepiece respirators (N-95 and N-100 masks). Conversely, when applied to 100% cotton fabric, the virus underwent rapid degradation and became undetectable in less than 24 hours.
Konda A, Prakash A, Moss GA, et al. Aerosol Filtration Efficiency of Common Fabrics Used in Respiratory Cloth Masks. ACS Nano 2020; 14:6339-47. http://dx.doi.org/10.1021/acsnano.0c03252	Filtration efficiencies of various commonly available fabrics for use as cloth masks in filtering particles in the significant (for aerosol-based virus transmission) size range was measured. Cotton, natural silk, and chiffon can provide good protection, typically above 50% in the entire 10 nm to 6.0 μm range, provided they have a tight weave. Leakages around the mask area can degrade efficiencies by ∼50% or more, pointing out the importance of fit.
Leung NJL, Chu DKW, Shiu EYC, et al. Respiratory virus shedding in exhaled breath and efficacy of face masks. Nature Med 2020; 26:676-80. http://dx.doi.org/10.1038/s41591-020-0843-2	In a cross-over trial, 122 of 246 participants with medically attended acute respiratory infections were randomised to wear or not wear a medical facemask during the first exhaled breath. Corona virus was detected in respiratory droplets and aerosols in 3 of 10 and 4 of 10 samples col-

Table S4. Laboratory studies*

Reference	Key findings
	lected without facemasks, respectively. No virus was detected in respiratory droplets or aerosols collected from participants wearing face masks (P=0.04).
Lustig SR, Biswakarma JH, Rana D, et al. Effectiveness of common fabrics to block aqueous aerosols of virus-like nanoparticles. ACS Nano 2020; 14:7651-8. https://dx.doi.org/10.1021/acsnano.0c03972	This study evaluated over 70 different common fabric combinations and masks under steady-state, forced convection air flux with pulsed aerosols that simulate forceful respiration. The aerosols contain fluorescent virus-like nanoparticles to track transmission through materials that greatly assist the accuracy of detection, thus avoiding artifacts including pore flooding and the loss of aerosol due to evaporation and droplet breakup. Effective materials comprise both absorbent, hydrophilic layers and barrier, hydrophobic layers. Although the hydrophobic layers can adhere virus-like nanoparticles, they may also repel droplets from adjacent absorbent layers and prevent wicking transport across the fabric system. Effective designs are noted with absorbent layers comprising terry cloth towel, quilting cotton, and flannel; and with barrier layers comprising nonwoven polypropylene, polyester, and polyaramid.
Ma QX, Shan H, Zhang HL, et al. Potential utilities of mask wearing and instant hand hygiene for fighting SARS-CoV-2. J Med Virology 2020. http://dx.doi.org/10.1002/jmv.25805	The efficacy of three types of masks and instant hand wiping was evaluated using avian influenza virus to mock the coronavirus. N95 masks, medical masks, and homemade masks made of 4-layer kitchen paper and 1-layer cloth could block 99.98%, 97.14%, and 95.15% of the virus in aerosols.
Mueller AV, Eden MJ, Oakes JM, et al. Quantitative method for comparative assessment of particle filtration efficiency of fabric masks as alternatives to standard surgical masks for PPE. medRxiv 18 May 2020. https://www.medrxiv.org/content/10.1101/2020.04.17.20069567v4	Methods typically used to assess tight-fitting respirators were modified to quantify particle filtration efficiency for community and commercially produced fabric masks. Two particle counters concurrently sampled ambient air and air inside the masks. Mask performance was evaluated by mean particle removal efficiency. A nylon stocking was used to obtain a tight fit and compared to loosely worn masks (without using a nylon stocking). Worn as designed (without the nylon stocking), both commercial surgical masks and cloth masks had widely varying filtration efficiency (53-75% and 28-90%, respectively). Some cloth masks had filtration efficiencies similar to commercial surgical masks. Compared to cone-shaped masks, surgical-style cloth masks had poor fit (i.e., performance was greatly enhanced with the nylon stocking). Masks with good material filtration performance tended to have a filter

Table S4. Laboratory studies*

Reference	Key findings
	layer (e.g., meltblown BFE85 filter layer) in addition to two layers of cotton or non-woven fabric.
Mueller AV, Fernandez LA. Assessment of fabric masks as alternatives to standard surgical masks in terms of particle filtration efficiency. medRxiv 18 May 2020. http://dx.doi.org/10.1101/2020.04.17.20069567	Percent particle removal was determined for ten home-made, fabric masks of different designs. Home-made masks worn as designed always had lower particle removal rates than the 3M masks, achieving between 38% and 96% of this baseline.
Parlin AF, Stratton SM, Culley TM, Guerra PA. Silk fabric as a protective barrier for personal protective 1 equipment and as a functional material 2 for face coverings during the COVID-19 pandemic. MedRxiv 2020. https://doi.org/10.1101/2020.06.25.20136424	This study examined the hydrophobicity of fabrics (silk, cotton, polyester), as measured by their resistance to the penetration of small and aerosolized water droplets, an important transmission avenue for the virus causing Covid-19. It also examined the breathability of these fabrics and their ability to maintain hydrophobicity despite undergoing repeated cleaning. Tests were done when fabrics were fashioned as an overlaying barrier and when constructed as do-it-yourself face coverings. As a protective barrier and face covering, silk is more effective at impeding the penetration and absorption of droplets due to its greater hydrophobicity relative to other tested fabrics. Silk face coverings repelled droplets as well as masks, but unlike medical facemasks they are hydrophobic and can be readily sterilized for immediate reuse.
Rodriguez-Palacios A, Cominelli F, Basson AR, Pizarro TT. Textile masks and surface covers—a spray simulation method and a "universal droplet reduction model" against respiratory pandemics. Front Med 2020; https://doi.org/10.3389/fmed.2020.00260	This study assessed household textiles to quantify their potential as effective environmental droplet barriers. Using a bacterial-suspension spray simulation model of droplet ejection (mimicking a sneeze), it quantified the extent by which widely available clothing fabrics reduce the dispersion of droplets onto surfaces within 1.8m, the minimum distance recommended for Covid-19 "social distancing." All textiles reduced the number of droplets reaching surfaces, restricting their dispersion to <30 cm, when used as single layers. When used as double-layers, textiles were as effective as medical facemasks, reducing droplet dispersion to <10 cm, and the area of circumferential contamination to ~0.3%.
Teesing GR, van Straten B, de Man P, Horeman-Franse T. Is there an adequate alternative to commercially manufactured face masks? A comparison of various materials and forms. J Hosp Infect 2020; 106:246-53. https://doi.org/10.1016/j.jhin.2020.07.024	This study evaluated the effectiveness of readily available materials and models for making a face mask. The outcomes were compared with N95/FFP2/KN95 masks that entered the Netherlands in April-May 2020. Masks were tested to determine whether they filtered a minimum of 35% of 0.3-mm particles, are hydrophobic, seal on the

Table S4. Laboratory studies*

Reference	Key findings
	face, are breathable, and can be washed. Fourteen of the 25 (combinations of) materials filtered at least 35% of 0.3-mm particles. Four of the materials proved hydrophobic, all commercially manufactured filters. Two models sealed the face. Twenty-two of the 25 materials were breathable at <0.7 mbar. None of the hydrophobic materials stayed intact after washing.
Varallyay C, Li N, Case B, Wolf B. Material suitability testing for nonmedical grade community face masks to decrease viral transmission during a pandemic. Diaster Med Public Health Prep 2020; https://doi.org/10.1017/dmp.2020.262	This study assessed the filtration efficiency and airflow resistance of common household materials available for homemade mask production by comparing numbers of fabrics, various layers, and manipulation. Common household woven, knitted, and nonwoven fabrics were tested for filtration efficiency using a fit testing setup and airflow resistance with pressure gauge setup. Three different levels of layering (1, 2, and 4) were tested. Some fabric material was further tested after washing and drying. Filtration performance, the area under the fitted curve comparing airflow resistance and filtration efficiency, was calculated for each fabric material, and compared. Layering increased filtration efficiency and airflow resistance ($P < 0.0001$ and $P < 0.01$, respectively). Polyester felt demonstrated the highest filtration performance index ($P < 0.0001$), higher than all tested 100% cotton materials (all $P < 0.05$) as well as medical facemasks ($P < 0.05$). Washing plus drying did not alter filtration performance significantly ($P > 0.05$).
van der Sande M, Teunis P, Sabel R. Professional and home-made face masks reduce exposure to respiratory infections among the general population. PLoS One 2008; 3:e2618. http://dx.doi.org/10.1371/journal.pone.0002618	All types of masks reduced aerosol exposure, relatively stable over time, unaffected by duration of wear or type of activity, but with a high degree of individual variation. Personal respirators were more efficient than surgical masks, which were more efficient than home-made masks. Regardless of mask type, children were less well protected. Outward protection (mask wearing by a mechanical head) was less effective than inward protection (mask wearing by healthy volunteers).
Wang D, You Y, Zhou X, et al. Selection of homemade mask materials for preventing transmission of COVID-19: a laboratory study. PLoS ONE 2020; 15(10):e0240285. https://doi.org/10.1371/journal.pone.0240285	This study tested four key indicators for 17 materials for homemade masks: pressure difference, particle filtration efficiency, bacterial filtration efficiency, and resistance to surface wetting. Eleven single-layer materials met the standard of pressure difference, of which three met the standard of resistance to surface wetting, and one met the standard of particle filtration efficiency, and none met the

Table S4. Laboratory studies*

Reference	Key findings
	standard of bacterial filtration efficiency. Based on the testing results of single-layer materials, fifteen combinations of paired materials were tested. The results showed that three double-layer materials including double-layer medical non-woven fabric, medical non-woven fabric plus non-woven shopping bag, and medical non-woven fabric plus granular tea towel could meet all the standards of pressure difference, particle filtration efficiency, and resistance to surface wetting, and were close to the standard of the bacterial filtration efficiency.
Zangmeister CD, Radney JG, Vicenzi EP, Weaver JL. Filtration efficiencies of nanoscale aerosol by cloth mask materials used to slow the spread of SARS-CoV-2. ACS Nano 2020; 14:9188-9200. https://dx.doi.org/10.1021/acsnano.0c05025	This study measured filtration efficiency (FE), differential pressure, quality factor, and construction parameters for 32 cloth materials (14 cotton, 1 wool, 9 synthetic, 4 synthetic blends, and 4 synthetic/cotton blends) used in cloth masks intended for protection from the SARS-CoV-2 virus (diameter 100 ± 10 nm). Seven polypropylene-based fibre filter materials were also measured including medical facemasks and N95 respirators. Additional measurements were performed on both multilayered and mixed-material samples of natural, synthetic, or natural-synthetic blends to mimic cloth mask construction methods. Materials were microimaged and tested against size selected NaCl aerosol with particle mobility diameters between 50 and 825 nm. Three of the top five best performing samples were woven 100% cotton with high to moderate yarn counts, and the other two were woven synthetics of moderate yarn counts. In contrast to other studies, samples utilizing mixed materials did not exhibit a significant difference in the measured FE when compared to the product of the individual FE for the components. The FE and differential pressure increased monotonically with the number of cloth layers for a lightweight flannel, suggesting that multi-layered cloth masks may offer increased protection from nanometer-sized aerosol with a maximum FE dictated by breathability (i.e., differential pressure).
Zhong H, Zhu Z, Lin J, et al. Reusable and recyclable graphene masks with outstanding superhydrophobic and photothermal performance. ACS nano 2020. http://dx.doi.org/10.1021/acsnano.0c02250	A method for producing commercially available surgical masks with “outstanding” self-cleaning and photothermal properties is described. Superhydrophobic states were observed on the treated masks' surfaces, which can cause the incoming aqueous droplets to bounce off. Under sunlight illumination, the surface temperature of the functional

Table S4. Laboratory studies*

Reference	Key findings
	mask can quickly increase to over 80 °C, making the masks reusable after sunlight sterilization.
Undesirable effects	
Fikenzer S, Uhe T, Lavall D, et al. Effects of surgical and FFP2/N95 face masks on cardiopulmonary exercise capacity. Clin Res Cardiol 27 May 2020. https://doi.org/10.1007/s00392-020-01704-y	This prospective cross-over laboratory study quantitated the effects of wearing no facemask, a medical facemask, and a FFP2/N95 mask in 12 healthy men. Ventilation and cardiopulmonary exercise capacity were reduced by surgical facemasks and participants reported consistent and marked discomfort wearing facemasks.
Carbon C-C. wearing face masks strongly confuses counterparts in reading emotions. Front Psychol 2020; 11:566886. https://doi.org/10.3389/fpsyg.2020.566886	Many people feel that social interaction is affected by wearing a mask. This study tested the impact of facemasks on the readability of emotions. The participants (41 healthy volunteers age 18–87 years) assessed the emotional expressions displayed by 12 different faces. Each face was randomly presented with six different expressions (angry, disgusted, fearful, happy, neutral, and sad) while being fully visible or partly covered by a facemask. Lower accuracy and lower confidence in one's own assessment of the displayed emotions indicate that emotional reading was strongly irritated by the presence of a mask. Specific confusion patterns were detected, mostly misinterpreting disgusted faces as being angry plus assessing other emotions (e.g., happy, sad, and angry) as neutral.
Ciocan C, Clari M, Fabbro D, et al. Impact of wearing a surgical mask on respiratory function in view of a widespread use during COVID-19 outbreak: a case-series study. Med Lav 2020; 111: 354-364. https://doi.org/10.23749/mdl.v111i5.9766	This study evaluated the impact of respiratory protective devices on the respiratory function in healthy and asthmatic subjects, to identify the fitness for use mainly, but not only for, occupational purposes during the COVID-19 pandemic. Ten individuals were included, three of which had asthma and three current smokers. A Respiratory Functional Test (RFT) was performed at three times: at the beginning of the work shift 1) without wearing and 2) wearing medical facemasks, and 3) after 4 hours of usual working activities wearing facemasks. Arterial Blood Gas (ABG) samples were also tested before the first test and the third test. Wearing facemasks did not have a large impact on RFTs and ABG parameters, except for Maximal Voluntary Ventilation (P=0.002). Data on asthmatic subjects and smokers were comparable to that for healthy subjects.

Table S4. Laboratory studies*

Reference	Key findings
Epstein D, Korytny A, Isenberg Y, et al. Return to training in the COVID-19 era: the physiological effects of face masks during exercise. Cand J Med Sci Sport 2020; https://doi.org/10.1111/sms.13832	This multiple cross-over trial of healthy volunteers assessed the physiological effects of wearing medical facemasks and N95 respirators during a short-term strenuous workout. Using a standard cycle ergometry ramp protocol, each subject performed a maximal exercise test without a mask, with a medical facemask, and with an N95 respirator. Short term moderate-strenuous aerobic physical activity with a facemask was associated with only minor changes in physiological parameters, particularly a mild increase in end-tital carbon-dioxide levels with N95 respirators.
Lee K-P, Yip J, Kan C-W, et al. Reusable face masks as alternative for disposable medical masks: factors that affect their wear-comfort. Int J Environ Res Public Health 2020; 17:6623. https://doi.org/10.3390/ijerph1718662	This study examined factors that affect the comfort of seven types of reusable facemasks. The masks were subjected to air and water vapor permeability testing, thermal conductivity testing and a wear trial. The results indicated that washable facemasks made of thin layers of knitted fabric with low density and a permeable filter were more breathable. Additionally, masks that contain highly thermally conductive materials and have good water vapor permeability were often more comfortable to wear as they can transfer heat and moisture from the body quickly, and thus do not easily dampen and deteriorate.
Decontamination and reuse	
Systematic reviews	
Seresirikachorn K, Phoophiboon V, Chobarporn T, et al. Decontamination and reuse of surgical masks and N95 filtering facepiece respirators during COVID-19 pandemic: a systematic review. Cont Hosp Epidemiol 2020; https://dx.doi.org/10.1017/ice.2020.379	Fifteen studies were identified. Low level evidence supported four decontamination methods: ultraviolet germicidal irradiation (9 studies), moist heat (5 studies), microwave generated steam (4 studies), and hydrogen peroxide vapor (4 studies).
Toomey E, Conway Y, Burton C, et al. Extended use or re-use of single-use surgical masks and filtering facepiece respirators: a rapid evidence review. medRxiv 5 June 2020. https://doi.org/10.1101/2020.06.04.20121947	The review found limited evidence on the impact of extended use on medical facemasks and respirators. Vaporised hydrogen peroxide and ultraviolet germicidal irradiation were the most promising reprocessing methods, but evidence on the relative effectiveness and safety of different methods was limited.
Zorko DJ, Gertsman S, O'Hearn K, et al. Decontamination interventions for the reuse of surgical mask personal protective equipment: a systematic review. OSF Preprints 4 May 2020. https://doi.org/10.31219/osf.io/z7exu	This preprint of a systematic review evaluated interventions to decontaminate surgical masks for the purpose of reuse. Seven studies met the eligibility criteria: one evaluated the effects of heat and chemical decontamination interventions applied after mask use on mask performance, and six evaluated interventions applied prior to mask use

Table S4. Laboratory studies*

Reference	Key findings
	to enhance antimicrobial properties or mask performance. Mask performance and germicidal effects were both evaluated in a variety of test conditions across a variety of mask samples (whole masks and pieces or individual mask layers). Safety outcomes were infrequently evaluated. Mask performance was best preserved with dry heat decontamination. Germicidal effects were best in salt-, N-halamine- and nanoparticle-coated masks.
Studies	
Yap TF, Liu Z, Shveda RA, Preston DJ. A predictive model of the temperature-dependent inactivation of coronaviruses. Appl Physics Let 2020; 117:060601. https://doi.org/10.1063/5.0020782	This study used a thermodynamic model that synthesizes existing data into an analytical framework built on first principles, including the rate law for a first-order reaction and the Arrhenius equation, to accurately predict the temperature-dependent inactivation of coronaviruses. The model provides a basis for thermal decontamination guidelines for personal protective equipment, including facemasks. For example, at 70 oC, a 3-log (99.9%) reduction in virus concentration can be achieved, on average, in 3 minutes (a more conservative decontamination time of 39 minutes represents the upper limit of a 95% interval) and can be performed in most home ovens without reducing the efficacy of typical N95 respirators.
Card KJ, Crozier D, Dhawan A, et al. UV Sterilization of Personal Protective Equipment with Idle Laboratory Biosafety Cabinets During the Covid-19 Pandemic. medRxiv 2020. http://medrxiv.org/cgi/content/short/2020.03.25.20043489	It was calculated that an N95 mask placed within a biosafety cabinet with a manufacturer reported fluence of 100 W/cm^2 should be effectively sanitized for reuse after approximately 15-20 minutes per side.
Lenormand R, Lenormand G. Effect of ethanol cleaning on the permeability of FFP2 mask. medRxiv 2020. http://dx.doi.org/10.1101/2020.04.28.20083840	The effect of ethanol on the filtering properties of FFP2 masks was assessed. After six cleaning cycles, the permeability remained close to the permeability before cleaning.

*Grey text indicates previously included studies.

Table S5. Ongoing intervention studies

First author, title, and ID	Last update, estimated completion date, link
Alkan B. Mask usage and exercise during the COVİD-19 Pandemic. ClinicalTrials.gov Identifier: NCT04498546	6 August 2020 30 September 2021 https://clinicaltrials.gov/ct2/show/NCT04498546
Bandim Health Project. locally produced cloth face mask and Covid-19 like illness prevention. ClinicalTrials.gov Identifier: NCT04471766	22 July 2020 November 2020 https://clinicaltrials.gov/ct2/show/NCT04471766
Bundgaard H. Reduction in COVID-19 infection using surgical facial masks outside the healthcare system. ClinicalTrials.gov Identifier: NCT04337541	7 April 2020 2 June 2020 (no results posted) https://clinicaltrials.gov/ct2/show/NCT04337541
Chilibeck P. Effects of a face mask on oxygenation during exercise. ClinicalTrials.gov Identifier: NCT04557605	20 October 15 October 2020 https://clinicaltrials.gov/ct2/show/NCT04557605
Duo LH. An epidemiological investigation on the correct wearing of face mask. ClinicalTrials.gov Identifier: NCT04474028, NCT04497675, NCT04497753	12 August 2020 August 2020 (no results posted) https://clinicaltrials.gov/ct2/show/NCT04474028 https://clinicaltrials.gov/ct2/show/NCT04497675 https://clinicaltrials.gov/ct2/show/NCT04497753
Kulkarni B. Effect of cotton face-masks and other behavioral and health-related risk factors on COVID-19incidence and severity: Pragmatic cluster-randomized trial and nested observational study in45 villages in Telangana. ICTRP identifier: CTRI/2020/07/026796	7 September 2020 Not reported https://apps.who.int/trialsearch/Trial2.aspx?TrialID=CTRI/2020/07/026796
Labris G. Impact of spectacles on compliance to mask-wearing directives. ClinicalTrials.gov Identifier: NCT04501172	11 August 2020 24 July 2020 (no results posted) https://clinicaltrials.gov/ct2/show/NCT04501172
Loeb M. Medical Masks vs N95 Respirators for COVID-19. ClinicalTrials.gov Identifier: NCT04296643	5 March 2020 1 January 2020 https://clinicaltrials.gov/ct2/show/NCT04296643

Table S5. Ongoing intervention studies

First author, title, and ID	Last update, estimated completion date, link
Alkan B. Mask usage and exercise during the COVİD-19 Pandemic. ClinicalTrials.gov Identifier: NCT04498546	6 August 2020 30 September 2021 https://clinicaltrials.gov/ct2/show/NCT04498546
Sahoo D. Effects of a N95 Respirator vs cloth mask on exercise capacity during treadmill exercise. ClinicalTrials.gov Identifier: NCT04415879	13 August 2020 1 August 2020 (no results posted https://clinicaltrials.gov/ct2/show/NCT04415879

*Grey text indicates previously included studies.

Table S6. Acceptability, feasibility, and equity. List of references

Betsch C, Korn L, Sprengholz P, et al. Social and behavioral consequences of mask policies during the COVID-19 pandemic. Proc Natl Acad Sci 2020; 202011674. https://doi.org/10.1073/pnas.2011674117

Chan EY. Moral foundations underlying behavioral compliance during the COVID-19 pandemic. Personality Individ Dif 2020; https://doi.org/10.1016/j.paid.2020.110463

Chu DK, Akl EA, Duda S, et al. 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. Lancet 2020. https://doi.org/10.1016/S0140-6736(20)31142-9

Galasso V, Pons V, Profeta P, et al. Gender differences in COVID-19 attitudes and behavior: panel evidence from eight countries. PNAS 2020; 117:27285-91. www.pnas.org/cgi/doi/10.1073/pnas.2012520117

Haischer MH, Beilfuss R, Hart MR, et al. Who is wearing a mask? Gender-, age-, and location-related differences during the COVID-19 pandemic. PLoS ONE 2020; 15(10):e0240785. https://doi.org/10.1371/journal.pone.0240785

Imperial College London, YouGov. Covid 19: Insights on face mask use Global review, 2020. https://www.thecompassforsbc.org/sbcc-tools/covid-19-insights-face-mask-use-global-review

Kantor BN, Kantor J. Nonpharmaceutical interventions for pandemic COVID-19: A cross-sectional investigation of US general public beliefs, attitudes, and actions. medRxiv 2020. https://doi.org/10.1101/2020.04.26.20078618

Machida M, Nakamura I, Saito R, et al. Incorrect use of face masks during the current COVID-19 pandemic among the general public in Japan. Int J Environ Res Public Health 2020; 17:6484; https://doi.org/10.3390/ijerph17186484

Mills M, Rahal C, Akimova E. Face masks and coverings for the general public: behavioural knowledge, effectiveness of cloth coverings and public messaging. The Royal Society 26 June 2020. https://royalsociety.org/topics-policy/projects/set-c-science-in-emergencies-tasking-covid/

Naylor G, Burke LA, Holman JA. Covid-19 lockdown affects hearing disability and handicap in diverse ways: a rapid online survey study. Ear Hear 2020; 41:1442-9. https://dox.org/10.1097/AUD.0000000000000948

Pfattheicher S, Nockur L, Böhm R, et al. The emotional path to action: empathy promotes physical distancing and wearing of face masks during the COVID-19 pandemic. Psychol Sci 2020; https://doi.org/10.1177/0956797620964422

Seale H, Dyer CEF, Abdi I, et al. Improving the impact of non-pharmaceutical interventions during COVID-19: examining the factors that influence engagement and the impact on individuals. BMC Infect Dis 2020; 20:607. https://doi.org/10.1186/s12879-020-05340-9

Search strategy

13 May 2020

All articles coded as “Treatment or prevention, Coronavirus infection, and Masks” in the L·OVE COVID-19 database were screened. This database includes systematic reviews and studies, published or ongoing, of any design identified using multiple search strategies (https://app.iloveevidence.com/Covid-19). At the time of the most recent search (13 May 2020), over 100,000 records have been processed for inclusion in this database.

All articles coded as “Infection prevention and control, Infection prevention and control policies, Physical barriers, Use of masks” in the NIPH COVID-19 evidence map were screened. The evidence map includes systematic reviews and studies identified by screening literature searches that are conducted daily or every other day in PubMed and supplemented by regular updates with material retrieved by searches performed by organizations such as WHO, CDC and others. At the time of the most recent search (13 May 2020), 15,404 references had been screened and the map contained 1,779 publications.

PROSPERO8 was searched (13 May 2020) for systematic reviews in progress using the COVID-19 filter and “masks”. The list of COVID-19 trials in the International Clinical Trials Registry Platform (ICTRP) (updated 12 May 2020)9 and ClinicalTrials.gov COVID-19 list of registered studies (13 May 2020) were searched for studies in progress using “masks”. As of 13 May 2020, PROSPERO included 885 records using the COVID-19 filter of which 88 included the word “masks”. Thirty-nine of those were registered in 2020 and were screened. Only two records in the list of COVID-19 trials in the International Clinical Trials Registry Platform (IC-TRP) included the word “masks” when searched 13 May 2020.

Additional articles were identified by checking the references in retrieved articles and through personal contacts.

27 May 2020

In addition to daily L-OVE updates, checking reference lists of full-text articles that are screened, and articles identified through personal communication, the Cochrane COVID-19 Study Register was screened May 23rd using the term “masks”, which yielded 35 rec-ords and one included study [Matusiak 2020]. Four rapid evidence profiles from the McMaster Health Forum were also screened [McMaster 2020a-d].

27 July 2020

PubMed was searched 27 July 2020 using the COVID-19 filter combined with “masks” and “feasibility” (13 hits), “acceptability” (23 hits), and “equit* OR equal*” (26 hits). In addition to three systematic review [Chu 2020, Mills 2020, and Seale 2020], a survey and online experiment in Germany that focused on social and behavioural consequences of facemask policies during the COVID-19 pandemic was identified [Betsch 2020]. Norwegian surveys of acceptability were identified using a Google search for “munnbind undersøkelsen”.

17 August 2020

The L·OVE COVID-19 database, the NIPH COVID-19 evidence map, and ClinicalTrials.gov were searched again on 17 August 2020. In addition, The Cochrane COVID-19 Study Register and the PubMed database of articles referencing SARS-CoV-2 and COVID-19 were searched using “masks”. The following filters were used for the PubMed search: Clinical Trial or Controlled Clinical Trial or Evaluation Study or Meta-Analysis or Observational Study or Pragmatic Clinical Trial or Preprint or Randomized Controlled Trial or Review or Systematic Re-view. Additional articles were identified by checking the references in retrieved articles and through personal contacts.

As of 17 August 2020, the L·OVE COVID-19 database included 228 articles that were identified as relevant for facemasks for coronavirus infection (90 new articles since 13 May 2020). This included 38 systematic reviews (19 new) and 155 primary studies (37 new) of which 10 were randomised trials reporting data (1 new).

The NIPH COVID-19 evidence map included 87 references (63 new since 13 May 2020).

Searching the Cochrane COVID-19 Study Register using “masks” yielded 168 studies.

The PubMed database of articles referencing SARS-CoV-2 and COVID-19 included 688 references with masks in any field. After applying the filters, 109 references remained.

ClinicalTrials.gov COVID-19 list of registered studies included 122 records with the word “masks” (60 new since 13 May 2020), of which 94 were Interventional.

The searches of PROSPERO and the ICTRP were not updated.

3 November 2020

The L·OVE COVID-19 database, Cochrane COVID-19 Study Register, and PubMed database of articles referencing SARS-CoV-2 and COVID-19 were searched.

The L·OVE COVID-19 database included a total of 63,950 COVID-19 articles, of which 990 were indexed as “Facemasks for Coronavirus infection”. Thirty articles were indexed as “Facemasks for asymptomatic or presymptomatic individuals”. Of which 18 were new and 12 were duplicates). Eighteen were indexed as “Cloth facemasks for Coronavirus infection”, of which six were new and 12 were duplicates.

PubMed included a total of 68,038 COVID-19 articles, of which 1,506 included "mask"[All Fields] OR "masks"[MeSH Terms] OR "masks"[All Fields]. Of those, 240 remained after applying filters (Clinical Trial, Controlled Clinical Trial, Evaluation Study, Meta-Analysis, Observational Study, Pragmatic Clinical Trial, Preprint, Randomized Controlled Trial, Review, Systematic Review), and 85 of those were entered between 17 August and 3 November, of which 3 were duplicates.

The Cochrane COVID-19 Study Register included 1 total of 27,866 articles of which 319 included “masks” in the title or abstract. Of those, 85 were entered between 17 August and 3 November, and 16 of those were duplicates.

In addition, we screened daily L-OVE updates for “Facemasks for Coronavirus infection” and articles identified through personal communication and reference lists.

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