Face masks for the public during the covid-19 crisis

Trisha Greenhalgh and colleagues argue that it is time to apply the precautionary principle

The precautionary principle is, according to Wikipedia, “a strategy for approaching issues of potential harm when extensive scientific knowledge on the matter is lacking.” The evidence base on the efficacy and acceptability of the different types of face mask in preventing respiratory infections during epidemics is sparse and contested. But covid-19 is a serious illness that currently has no known treatment or vaccine and is spreading in an immune naive population. Deaths are rising steeply, and health systems are under strain. This raises an ethical question: should policy makers apply the precautionary principle now and encourage people to wear face masks on the grounds that we have little to lose and potentially something to gain from this measure? We believe they should.

Evidence and guidelines

Evidence based medicine tends to focus predominantly on internal validity—whether primary research studies were “done right”—using tools to assess risk of bias and adequacy of statistical analysis. External validity relates to a different question: whether findings of primary studies done in a different population with a different disease or risk state are relevant to the current policy question. We argue that there should be a greater focus on external validity in evaluation of masks.

A rapid search of the literature on the wearing of masks by the general public during epidemics or pandemics by a team at the University of Galway (E Toomey, personal communication, 29 March 2020) found five peer reviewed systematic reviews:

- A 2007 systematic review and expert panel deliberation, asymptomatic individuals.
- A 2010 systematic review of face masks in influenza epidemics, which included standard surgical masks and respirator masks and found some efficacy of masks if worn by those with respiratory symptoms but not if worn by asymptomatic individuals.
- A 2011 Cochrane review covering physical interventions from SARS was not set out in the paper (so we assume it was expert opinion on the panel).
- A 2020 systematic review and expert panel deliberation, which acknowledged the difficulties in interpreting evidence and stated: “With the exception of some evidence from SARS, we did not find any published data that directly support the use of masks … by the public.”

Two further systematic reviews have since been released as preprints. Xiao and colleagues reviewed non-pharmaceutical measures for prevention of influenza. They identified 10 randomised controlled trials published between 1946 and 2018 that tested the efficacy of face masks (including standard surgical masks and commercially produced paper face masks designed for the public) for preventing laboratory confirmed influenza. A pooled meta-analysis found no significant reduction in influenza transmission (relative risk 0.78, 95% confidence interval 0.51 to 1.20; P=0.25). They also identified seven studies conducted in households; four provided masks for all household members, one for the sick member only, and two for household contacts only. None showed a significant reduction in laboratory-confirmed influenza in the face mask arm. The authors concluded: “Randomized controlled trials of [face masks] did not support a substantial effect on transmission of laboratory-confirmed influenza.”

A preprint of a systematic review published on 6 April 2020 examined whether wearing a face mask or other barrier (goggles,
Arguments may have been internally valid in the trials that
The first argument can be challenged on the grounds that
workers need them more, and public buying could lead to major
Finally, they argue that because of the shortage of masks in the
health advice such as hand washing and social distancing.
trials cited above have also shown that wearing a mask might
wearing them most of the time. Thirdly, they point out that the
pandemic, but this advice was updated on 4 April 2020 (box
repeatedly touching their mask, and on all or most people
effect could have a major influence on transmission.
that people are unlikely to wear them properly or consistently,
has a place in severe pandemics, since even a partial protective
effectiveness. Secondly, they argue that trials have shown
they are effective. Secondly, they argue that trials have shown
acknowledges that the wearing of masks by the general public
for healthcare workers.
no true control arm with no masks.
"found that cloth masks were the least effective, but
trial of cloth masks versus surgical masks versus
makers. The World Health Organization, for example,
described above has been inconsistently interpreted by policy
makers. The World Health Organization, for example,
recommends masks only for those with symptoms suggestive of
covid-19, stating that masks should otherwise be reserved
for healthcare workers. However, elsewhere WHO
acknowledges that the wearing of masks by the general public
has a place in severe pandemics, since even a partial protective
effect could have a major influence on transmission.
The US Centres for Disease Control and Prevention originally
advised the public against wearing masks during the covid-19
pandemic, but this advice was updated on 4 April 2020 (box
)
Box 1: CDC advice on use of face masks by the general public
Cover your mouth and nose with a cloth face cover when around others
You could spread covid-19 to others even if you do not feel sick
Everyone should wear a cloth face cover when they have to go out in
public—for example, to the grocery store or to pick up other necessities
Cloth face coverings should not be placed on children under age 2 or on
anyone who has trouble breathing or is unconscious, incapacitated, or
otherwise unable to remove the mask without assistance.
The cloth face cover is meant to protect other people in case you are
infected
Do not use a face mask meant for a healthcare worker
Continue to keep about 6 feet (2 m) between yourself and others. The cloth
face cover is not a substitute for social distancing
None of the studies mentioned above tested the makeshift cloth
masks that CDC has recommended. To our knowledge, there are
no trials of cloth masks in the general public. A three arm
trial of cloth masks versus surgical masks versus "standard
practice" in preventing influenza-like illness in healthcare staff
found that cloth masks were the least effective, but "standard
practice" usually involved a surgical face mask and there was
no true control arm with no masks.
Various authors have justified not wearing masks on four main
grounds. Firstly, they claim that there is limited evidence that
they are effective. Secondly, they argue that trials have shown
that people are unlikely to wear them properly or consistently,
which is important since prevention depends on people not
repeatedly touching their mask, and on all or most people
wearing them most of the time. Thirdly, they point out that the
trials cited above have also shown that wearing a mask might
make people feel safe and hence disregard other important public
health advice such as hand washing and social distancing.
Finally, they argue that because of the shortage of masks in the
current crisis, the public should not wear them since healthcare
workers need them more, and public buying could lead to major
supply chain problems.
The first argument can be challenged on the grounds that
absence of evidence is not evidence of absence. The second two
arguments may have been internally valid in the trials that
produced them, but we have no evidence that they are externally
valid in the context of covid-19. "The public" here are not
volunteers in someone else's experiment in a flu outbreak—they
are people the world over who are trying to stay alive in a deadly
pandemic. They may be highly motivated to learn techniques
for most effective mask use.
There are good reasons why the public is likely to comply more
closely with mask advice and wider infection control measures
now than the research participants were in the published trials.
These reasons include the fact that SARS-CoV-2 is both more
contagious and more serious than the medical scenarios in the
studies on which the conclusion not to use masks was based.
Similarly, if SARS-CoV-2 vaccination were available and
affordable, it might be used more widely and be more acceptable
than flu vaccination.
Substantial indirect evidence exists to support the argument
for the public wearing masks in the covid-19 pandemic. The virus
has been shown to remain viable in the air for several hours
when released in an aerosol under experimental conditions,
and such aerosols seem to be blocked by surgical masks in
laboratory experiments. Individuals have been shown to be
infectious up to 2.5 days before symptom onset, and as many
as 50% of infections seem to occur from presymptomatic
individuals. Community prevalence of covid-19 in many
countries is likely to be high. Modelling studies suggest that
even a small reduction in community transmission could make
a major difference to demand elsewhere in the system (eg, for
hospital bed space and ventilators).
The suggestion that the public should not wear masks because
healthcare workers need them more is valid up to a point, but
it is surely an argument for manufacturing more masks, not for
denying them to populations who could potentially benefit
from them. Until such masks are available in sufficient numbers,
cloth masks (washed frequently) as recommended by the CDC
(box 1), may be a substitute. Additional research is urgently
needed to identify how best to overcome problems of poor
filtration and moisture retention that have been described. Such
studies could determine, for example, the optimum nature of
fabric, thickness (how many layers?), the nature of the outer
water repellent layer, closeness of fit, and duration to be worn
before washing.
Precautionary principle
Anecdotal evidence is rightly viewed as methodologically
suspect, but as we contemplate using the precautionary principle,
we should not ignore such evidence entirely. We should, for
example, take account of the high rates of infection (and
substantial mortality) among healthcare and other frontline staff
in settings where there are shortages of masks compared with
settings where these staff were better and more consistently
protected. We might come to regret dismissing as anecdote
the story of a choir practice with 60 people, of whom 45 are
known to have developed covid-19 and two so far have died.
Some indirect evidence for the benefits of masks is emerging.
For example, a longitudinal ecological study from Hong Kong,
conducted before and after the introduction of a range of
non-pharmaceutical measures including masks for the public,
suggested that these seemed to help to contain the pandemic
(changes were statistically significant for masks and social
distancing measures combined, though the effect of masks alone
cannot be isolated out). There is also analogical evidence from
the behaviour of viruses with a similar chemical make-up.
Given these indirect and circumstantial findings and the
seriousness of this outbreak, there is a moral argument that the
public should be given the opportunity to change their behaviour in line with the precautionary principle, even when direct, experimental evidence for benefit is not clear cut. Unlike in Australia and the US, where most trials were done, mask wearing has become normalised in some Asian countries, partly as a protection against polluted air and perhaps also as a response to the SARS and MERS outbreaks. In Japan, Hong Kong, South Korea, and China, for example, mask wearing is now the norm.

Another argument for using the precautionary principle is that the world may pay a high price for covid-19 and the “collateral damage” risks becoming higher than the direct damage from the virus. The dangers include increased suicide rates because of isolation and economic hopelessness among poorer people losing their income or in small companies, civil unrest in some countries when they consider lockdown, as was seen with Ebola, people losing their access to their regular medication, thwarting automatic systems under the pretence of controlling covid-19, and domestic violence and family disputes—the list is long. There are, of course, important counterarguments, including the possibility of a false sense of security and reduction in compliance with other infection control measures.

We propose two hypotheses that we believe should be urgently tested in natural experiments. The first is that in the context of covid-19, many people can be taught to use masks properly and will do this consistently without abandoning other important anti-contagion measures. The second is that if political will is there, mask shortages can be quickly overcome by repurposing manufacturing capacity—something that is already happening informally.

In conclusion, in the face of a pandemic the search for perfect evidence may be the enemy of good policy. As with parachutes for jumping out of aeroplanes, it is time to act without waiting for randomised controlled trial evidence. A recently posted preprint of a systematic review came to the same conclusion. Masks are simple, cheap, and potentially effective. We believe that, worn both in the home (particularly by the person showing symptoms) and also outside the home in situations where meeting others is likely (for example, shopping, public transport), they could have a substantial impact on transmission with a relatively small impact on social and economic life.

**Key messages**

The precautionary principle states we should sometimes act without definitive evidence, just in case

Whether masks will reduce transmission of covid-19 in the general public is contested

Even limited protection could prevent some transmission of covid-19 and save lives

Because covid-19 is such a serious threat, wearing masks in public should be advised

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