**Introduction**

As of April 10, 2020, a total of 6412 cases and 199 deaths were confirmed by MOHFW in the country.[1] Evidence suggests that the COVID-19 virus is transmitted through close contact between people and via droplets. Airborne transmission may occur during aerosol-generating procedures such as tracheal intubation, tracheotomy, cardiopulmonary resuscitation, and bronchoscopy;[2] thus, the WHO recommends additional airborne precautions for such procedures. The incubation period for COVID-19 varies between 5–6 days and 14 days. In few of the reports, presymptomatic transmission has also been documented.[3–8] This clearly indicates that people infected with COVID-19 could transmit the virus even before symptoms develop in them.

Wearing a mask is one of the recommended preventive measures that can reduce the transmission of COVID-19. However, the use of a mask alone is insufficient; optimum compliance with hand hygiene practices and social distancing is evenly critical to prevent human-to-human transmission of the virus. The fear created by COVID-19 has led to a panic buying spree by lay people and stocking masks including N95 at home. As a result, the health-care institutes are facing severe shortages of personal protection equipment.

Wearing a mask is one of the recommended preventive measures that can reduce the transmission of COVID-19. But due to panic buying and increased demands, the health institutes are facing severe shortages of these PPEs. This article reviews the types of masks available, the feasibility of reusing them and the dos and don'ts of each suggested method.

**Abstract**

The COVID-19 virus is transmitted through close contact between people, via droplets and possibly via airborne transmission. Wearing a mask is one of the recommended preventive measures that can reduce the transmission of COVID-19. But due to panic buying and increased demands, the health institutes are facing severe shortages of these PPEs. This article reviews the types of masks available, the feasibility of reusing them and the dos and don'ts of each suggested method.

**Keywords:** COVID-19, mask, personal protection equipment

**Alternatives to Single-Use N95 Respirators**

- Surgical masks were found to be equally efficacious as N95 masks in a hospital setting if they were worn regularly, with adherence to proper standards of wearing and removing them, and coupled with adequate hand hygiene measures.[13] MOHFW[14] has also advocated the use of surgical masks (a 3 layerd mask which is disposable and fluid-resistant) by
  - Health care workers
  - If a person develops cough or fever

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Table 1: Characteristics and key differences between different types of masks

<table>
<thead>
<tr>
<th>Cloth Mask (3 layer)</th>
<th>Single-layer mask</th>
<th>Surgical/Medical Mask(^a)</th>
<th>Respirator mask(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make</td>
<td>Cotton fiber</td>
<td>Single layer of nonwoven fabric or wood pulp tissue paper</td>
<td>Made up of three layers with pleats</td>
</tr>
<tr>
<td>Effectiveness against virus particles</td>
<td>50%-60%(^{[11]})</td>
<td>No</td>
<td>Protects the patient (75%-80%) but no self-protection</td>
</tr>
<tr>
<td>USE</td>
<td>Multiple</td>
<td>Single</td>
<td>Single</td>
</tr>
<tr>
<td>Applications</td>
<td>Asymptomatic General Public. Not to be used by any health care worker in a hospital setting</td>
<td>Food industry</td>
<td>HCP at low risk or symptomatic patient</td>
</tr>
<tr>
<td>Alternative</td>
<td>Surgical mask</td>
<td>Not available</td>
<td>N95, 3 layered cotton mask.</td>
</tr>
<tr>
<td>Reprocessing</td>
<td>Wash with Soap and Water, dry and reuse</td>
<td>No quality evidence</td>
<td>No quality evidence</td>
</tr>
</tbody>
</table>

\(^a\)Most surgical masks have three layers, an outer layer that repels fluids, a middle layer that acts as a barrier to microbes and an inner layer to absorb moisture. It does not offer a tight fit and *there is enough space for the air to leak from all the sides of the mask*. \(^b\)Respirator Mask\(^{[13]}\) has an air filtering system that halts movement of microbes from entering inside the respiratory tract, and a tight fit, *does not allow the air to leak from the sides into the nose and mouth*, ‘Grades of Respirator Masks: N stands for ‘not oil resistant’. N is further divided into N95, N99, N100 depending on the filtration efficacy. N95 means that this mask can filter off at least 95% of particles which are >0.3 microns, while N99 means it can filter off 99% of these particles, \(^c\)The European Union classifies respirator masks into FFP1 (P1), FFP2 (P2) and FFP3 (P3) where FFP stands for Filtering Face Piece. N95 is roughly equivalent to FFP2 and N99 is roughly equivalent to FFP3 masks. N95 and other respirator masks are also available with a valve (not suitable for patients) and without a valve. HCP – Health care personnel; UV – Ultraviolet

- During a visit to a healthcare facility.
- When you have to care for an ill person
- Close family contacts of a suspect or a confirmed case/s undergoing home care.
- N95 – equivalent devices: Respirators not approved by NIOSH, but manufactured under regulatory standards, and in performance are equivalent to N95 masks, e.g., FP2 (Europe), KPN95 (China), or P2 (Australia)
- Reusable N95s and other respirators: Self-contained breathing apparatuses, elastomeric full-face N95s and N100s
- Expired N95 stocks: If stored properly, devices beyond their labeled shelf life usually retain adequate filter performance\(^{[15]}\)
- N95s not certified for medical use: These include respirators certified by NIOSH but not certified by the Food and Drug Administration (FDA) (e.g., those for industrial use) and face covers made from conventional cloth or material used to make N95 filters.

**Reuse or Extended Use of N95 Masks**

Wearing an N95 respirator for hours at a time (i.e., extended wear) and reusing a respirator (i.e., donning and doffing between uses) are practices which can be adopted to ease shortages. With airflow rates consistent with breathing, theoretically, N95 protection should provide effective protection for prolonged hours, as long as the seal between respirator and face remains tight.

NIOSH and CDC guidelines do not include recommendations for reuse of single-use N95 respirators. Ideally, only the manufacturer of the respirators can provide reliable guidance on how to decontaminate their product. 3M, a manufacturer of N95 masks, also does not recommend the use of the following:\(^{[16]}

- Ethylene oxide (associated with release of volatile organic compounds)
- Ionizing radiation (damages the performance of filters)
- High temperature in microwave (melts the metal components resulting in compromise of fit).

Several methods for single-use N95 disinfection have been recommended by third parties:\(^{[12,16]}\)

1. Steam although nontoxic and easily penetrable to porous materials such as N95 filters, may damage polymer fibers in the filter and affect its performance
2. Chemicals could be toxic and incompatible with filter materials
3. Ultraviolet germicidal irradiation (UVGI) may not penetrate multilayered N95 masks, require enclosed space or shielded devices to protect users from ultraviolet (UV) exposure. UV equipment is equally expensive.

Although UVGI, hydrogen peroxide vapors, and moist heat have been most promising, their efficacy needs to be tested against different mask models.

Either reuse or extended use, both methods are associated with risk of mask to hand contamination, which can be decreased by:

- **UVGI**: Effective but requires specialized equipment and trained personnel. Specialized UV equipment is equally expensive.
- **Ethylene oxide**: Not recommended for disinfecting N95 masks, but can be used for reprocessing other types of respirators.
- **Surgical masks**: An alternative option during the COVID-19 pandemic, but not recommended for extended use.

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• Covering N95s with surgical masks or use of face shield to reduce surface contamination
• Avoid touching the inside or outside of the mask while using it
• Hand hygiene before putting the mask and after removing
• Discard respirators when visibly contaminated with potential pathogen sources like body fluids
• Store used N95s in designated areas between reuses. It should be stored in a designated area, located indoors where they cannot become crushed or distorted, in their original packaging or in a breathable container such as a paper bag, in a hazard-free environment (clean air) which is away from direct sunlight and acceptable humidity and temperature.[18]

Any guideline that you adopt should be on the basis of local scenario and the materials available. If given a choice, extended use of N95 masks is preferred over its reuse.[12,16,19]

• The mask to hand contamination risk from N95s is higher by repeated contact (frequent donning and doffing) as compared to by aerosol (spread by breathing through a used mask)
• Use of a surgical mask or a face shield over an N95s during extended use provides extra protection from body fluids
• Decontaminated masks can be worn for patient care activities but not while performing a procedure which generates aerosols[12]
• Mechanical problems like broken straps or poor sealing between the mask and the user’s face appeared immediately after a few uses even in FDA-cleared N95 masks
• Adequate disinfection vs. loss of filter performance although encouraging; is still an understudy.

When Left with No Alternatives, the Following Options May also Be Considered

• Exclude high-risk HCP (old age, pregnancy) from COVID-19 from contact with known or suspected COVID-19 patients
• Convalescent HCP, i.e., Who have recovered from COVID-19 infection may be designated to take care of COVID-19 patients (but this has not yet been confirmed)
• Use only a face shield that covers the entire front, extends to the chin or below and covers the sides of the face
• In a poor resource setting, plan out a make shift isolation room (with the use of exhaust vents and high-speed table fans that provides a high-ventilation-rate and a zone under negative pressure.

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Conflicts of interest

There are no conflicts of interest.

References