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The face mask – its role in prevention of COVID-19

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ABSTRACT

The novel coronavirus disease (COVID-19) is causing huge morbidity and mortality throughout the world. Wearing face masks is an important strategy for its prevention, along with hand washing, using alcohol-based sanitizer and physical distancing. In the absence of AGPs (Aerosol Generating Procedures), health workers providing direct care to COVID-19 patients should wear a medical mask. In settings where AGPs are performed (e.g. COVID-19 intensive and semi-intensive care units), health workers should wear respirator masks (N95 or FFP2 or FFP3 standard). Respirators can be reused up to five times assuming there is no soiling and minimal to no viral contamination of the mask. Cloth face masks are advised in public settings. It is crucial to wear, remove and dispose of masks appropriately for maximum protection. With disposable masks becoming an impending threat to nature, reusable LEAF masks with long lasting filters offer a promising solution to protect our environment.

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INTRODUCTION

A novel coronavirus (SARS CoV-2) was first recorded in Wuhan, China in December 2019. It has since spread rapidly throughout the world, with cases in every country causing huge morbidity and mortality; more than 1.5 million deaths have been recorded in 2020. The coronavirus disease it causes (COVID-19) was declared a pandemic by the World Health Organization (WHO) on 11 March, 2020.[1] COVID-19 causes symptoms including fever, cough, breathing difficulties and other respiratory problems. The disease spreads from person to person through respiratory droplets, expelled when a COVID-19 patient coughs, sneezes or speaks. Droplets may land on surfaces around the patient and people can become infected by touching their eyes, nose or mouth after touching these surfaces.[2] Viable virus particles have been isolated from specimens of asymptomatic individuals, suggesting that such people may transmit the virus to others.[3] In settings where Aerosol Generating Procedures (AGPs) are performed, airborne transmission of SARS CoV-2 may be possible.

The preventive strategies for COVID-19 are frequent hand washing, using an alcohol-based sanitizer, wearing face masks and physical distancing. Face masks can be used either to protect healthy people (worn to protect oneself when in contact with an infected individual) or for source control (worn by an infected person to prevent onward transmission).[4]

USE OF FACE MASKS IN HEALTH CARE SETTINGS TO PROVIDE CARE TO SUSPECTED OR CONFIRMED COVID-19 CASES

Medical masks are defined as surgical or procedure masks that may be flat or pleated. They are affixed to the head with straps that go around the ears or head. The performance characteristics of such masks are tested according to a set of standardized test methods aiming to balance high filtration, adequate breathability and, optionally, fluid penetration resistance.[5,6]

Filtering facepiece respirators (FFR) – most often just called respirators – similarly offer a balance of

filtration and breathability. The test methods for measuring filtration efficiency vary by type of aerosol (e.g. sodium chloride, dioctyl phthalate or paraffin oils).[7] Medical masks filter droplets with a diameter up to 3µm, whereas respirators filter the much smaller 0.075 3µm solid particles. In the U.S., N95 FFRs filter at least 95% sodium chloride particles.[4]

Universal masking in health facilities is defined as the requirement to wear a mask by all health workers and anyone entering the facility, regardless of the activities undertaken. Targeted continuous medical mask use is defined as the practice of wearing a medical mask by all health workers and caregivers working in clinical areas during all routine activities throughout the shift. In these conditions, masks are only changed if they become soiled, wet or damaged or if the health worker/caregiver removes the mask for essential activities (e.g. for eating, drinking or caring for a patient who requires droplet/contact precautions for other reasons).

In the absence of AGPs, health workers providing direct care to COVID-19 patients should wear a medical mask in addition to other Personal Protective Equipment (PPE) that is part of droplet and contact precautions. AGPs include tracheal intubation, non-invasive ventilation, tracheotomy, cardiopulmonary resuscitation, manual ventilation before intubation, bronchoscopy and sputum induction induced by using nebulized hypertonic saline and autopsy procedures. In care settings for COVID-19 cases where AGPs are performed (e.g. COVID-19 intensive and semi-intensive care units), health workers should wear a respirator mask (N95 or FFP2 or FFP3 standard, or equivalent).[4]

The following potential harms and risks should be considered when adopting the approach of targeted continuous medical mask use:

1) Self-contamination due to manipulation of the mask by contaminated hands.[8,9]
2) Self-contamination that can occur if medical masks are not changed when wet, soiled or damaged.
3) Possible development of facial skin lesions, irritant dermatitis or worsening acne when used for long hours.[10-12]
4) Uncomfortable to wear.[13,14]
5) False sense of security, potentially leading to less adherence to other known preventive measures such as physical distancing and hand hygiene.
6) Potential risk of droplet transmission and of splashes to the eyes, if mask wearing is not combined with eye protection.
7) Difficulty in wearing masks for vulnerable populations such as children; those with developmental disabilities or mental health disorders; and the deaf and hard of hearing.
8) Difficulty in wearing masks in hot and humid environments.

Roberge et al have reported that FFR masks do not impose any important physiological burden during one hour of use in healthy healthcare workers, at realistic clinical work rates; however, the FFR dead-space carbon dioxide and oxygen levels were significantly above and below, respectively, the ambient workplace standards, and the possibility of elevated partial pressure of CO_2 (PCO_2) has been raised as a concern.[15]

GUIDANCE ON THE CORRECT USE OF MASKS

The following list gives information on the correct way to wear, remove and dispose of face masks.

1) Perform hand hygiene before putting on a mask.
2) Ensure that the mask covers the mouth and nose, adjust to the nose bridge and tie it securely to minimize any gaps between the face and the mask.
3) Avoid touching the mask when wearing it.
4) Remove the mask using an appropriate technique. Avoid touching the front of the mask and untie it from behind.
5) After removal or whenever a used mask is inadvertently touched, clean hands with an alcohol-based sanitizer or soap and water.
6) Replace masks as soon as they become damp with a new, dry mask.
7) Avoid re-using single-use masks.
8) Discard single-use masks after each use and dispose of them immediately in a closed bin.[4]
9) Change the face mask after every 6-8 hours of use.

Fig 1 Correct way to wear a face mask

RATIONAL USE OF MASKS IN DIFFERENT SETTINGS

Point of entry facilities

At airports, ports and border crossings, a triple layer medical mask should be worn at low-risk points such as health desks, immigration counters, customs and airport security, and temperature recording stations. Doctors, nurses and sanitary staff at holding areas and the isolation facility of an APHO (Airport Health Authority) have moderate risk of infection, so an N95 mask is recommended.

Hospital settings

In outpatient departments with a respiratory clinic and separate screening area, N95 respirator masks are recommended at triage area, screening area helpdesk/registration counter, temperature recording station, waiting area and doctors' chambers. Sanitary staff should wear N95 masks, while visitors accompanying young children and elderly patients should wear triple layer medical masks. The use of masks for in-patient services is given in Table 1.

Table 1 Rational use of masks in hospital in-patient settings

	Setting	Activity	Risk	Recommended PPE	Remarks
1	Isolation rooms	Clinical management	Moderate	N95 mask, Gloves	Patient masked. No APG.
2	ICU/ Critical care	Critical care Management, Dead body packing	High	Full complement of PPE	APGs performed.
3	ICU/ Critical care	Dead body transport to mortuary	Low	Triple layer medical mask, Gloves	
4	Sanitation	Cleaning frequently touched surfaces/ floor/ changing linen	Moderate	N95 mask, Gloves	
6	Non-COVID treatment areas of hospital	Attending to infectious and non-infectious patients	Risk as per assessed profile of patients	PPE as per hospital infection prevention control practices	
7	Caretaker accompanying the admitted patient	Taking care of the admitted patient	Low	Triple layer medical mask	Practice hand hygiene, maintain a distance of 1m

In the emergency department, N95 masks and gloves are recommended for medical staff attending all emergency cases. A full complement of PPE is recommended for staff attending to severely ill SARS (Severe Acute Respiratory Syndrome) patients.

Health workers in community settings

The use of face masks among health workers in community settings, including Accredited Social Health Activists (ASHAs) and Anganwadi (rural childcare workers) is given in Table 2, below.

Quarantine Facilities

The person who is quarantining, the healthcare staff monitoring them and recording their temperature, and the support staff should all wear triple layer masks. N95 masks and gloves are recommended for healthcare staff who have to undertake a clinical examination of symptomatic persons.

Home Quarantine

The quarantined person should wear a triple layer mask. A designated family member taking care of the quarantined patient should wear gloves while cleaning commonly touched surfaces or handling soiled linen. Whilst some sources have indicated that PPE is not required for other family members,[16] wearing cloth facemasks is likely to reduce likelihood of infection.

The U.S. Centers for Disease Control and Prevention (CDC) recommends that people wear cloth face coverings in public settings and when around people with whom they do not share common household. Cloth face masks should not be worn by children under the age of 2 due to danger of suffocation, by anyone who has difficulty in breathing, or by people who are unconscious, incapacitated or unable to remove the mask without assistance.[1]

Table 2 Rational use of face mask use among health workers in community settings

	Setting	Activity	Risk	Recommended PPE	Remarks
1	ASHAs/ Anganwadi and other field staff	Field surveillance	Low	Triple layer mask. Gloves	Maintain distance of 1m. Carry triple layer masks to distribute to suspect cases as detected.
2	Doctors at supervisory level conducting field investigations	Field surveillance, Clinical examination	Moderate	N95 mask. Gloves	

REUSE OF RESPIRATORS

As coronaviruses lose their viability significantly after 72 hours, the CDC suggests that masks can be re-used up to five times, assuming there is no soiling and minimal to no viral contamination of the mask. Each healthcare worker caring for suspected or confirmed COVID-19 cases should be issued five respirators. They should wear one respirator each day and store it in a breathable paper bag at the end of each shift. The order of FFR use should be repeated with a minimum of five days between each FFR use.[18]

The Indian Health Ministry warns against wearing N95 masks with a valve as this does not prevent the virus from escaping out of the mask. If the person wearing such a mask is infected, SARS CoV-2 can spread through the exhaled air into the atmosphere, which increases the risk of transmission.[19]

SAFE DISPOSAL AND HANDLING OF MASKS

Isolation wards, sample collection centres and labs

Used masks (triple layer mask, N95 mask, etc.) should be discarded in separate yellow colour-coded plastic bags. They should be handed over at the doorstep to the waste collector engaged by the common biomedical waste treatment facility operator and should be incinerated.

Quarantined homes and other households

Used masks should be kept in a paper bag for a minimum of 72 hours prior to their disposal as general waste. It is advised to cut the masks prior to disposal to prevent their reuse.[20]

The Ministry of Health and Family Welfare has indicated that the masks used by patients, care givers and close contacts during home care should be

disinfected using ordinary bleach solution (five per cent) or sodium hypochlorite solution (one per cent) and then disposed of either by burning or deep burial. Furthermore, used masks should be wrapped and kept in a closed bin before being handed over to the sanitary worker. This waste must be treated as domestic hazardous waste and should be incinerated.[21]

Recent advances

The LEAF mask is the world's first U.S. FDA (Food and Drug Administration) registered transparent mask. It has N99-standard air filtering abilities as well as a self-purifying feature. It comes in three variants:

1) LEAF HEPA has the N99+ HEPA (High Efficiency Particulate Air) filtration and is ultra-lightweight.
2) LEAF UV contains UV-C sterilization built into the filter housing destroying pathogens at the DNA level and active-carbon filtration to eliminate odour and organic substances.
3) LEAF PRO adds active ventilation and air quality sensing.

Indiscriminate use of single use masks is posing a serious threat to oceans and marine life by skyrocketing plastic pollution. With disposable masks becoming an impending threat to nature, the reusable LEAF mask, with long lasting filters, offers a promising solution to protect our environment.[22]

CONCLUSION

Considering the possibility of airborne transmission, a facemask should be used even if a person is alone, particularly in an enclosed, poorly ventilated space. It is crucial to wear, remove and dispose of masks appropriately for maximum protection. Facemasks should be worn alongside compliance with hand hygiene, physical distancing and other infection prevention and control measures to prevent human-to-human transmission of COVID-19.

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