# RECENT TYPES AND FUNCTIONS OF FACEMASKS

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**ABSTRACT**

Face masks are the personal protective equipment which prevents the entry of toxic chemicals, microbes into our body. It acts as an effective barrier against infectious diseases. A respirator is the special type of equipment which protects the wearer from inhaling toxic chemicals, dust and airborne particles. Personal protective equipment (PPE) used by the health care providers are designed to protect the skin and the mucous membrane of eyes ,and nose which can reduce the risk of exposure to blood borne pathogens. The US Center for Disease Control and Prevention (CDC) has suggested the use of standard surgical masks, cloth masks, and extended type of respirators in pandemic conditions. The recent types of face masks are N95,99, FFP1,2, surgical masks, single, double-layered masks, cloth masks etc. The filtration efficacy of each mask varies according to the manufacturer, as when compared with N95 masks of about 90 % and surgical masks only with 90%. Many studies have discussed the different types of face masks being used by healthcare providers, professionals, and people in the community. A review with valuable information about the recent types, functions of face masks were collected using the recent articles searched from pubmed, google scholar, core, cochrane etc, which are dated from 2000-2020. The aim of the present study to review about the recent types and functions of face masks used by the community people and health care providers.

**KEYWORDS :** Centre for Disease Control and Prevention (CDC), facemasks, N95 respirators, surgical masks, types.

## INTRODUCTION

Face masks are the personal protective equipment which prevents the entry of toxic chemicals, microbes into our body. It acts as an effective barrier against infectious diseases. The recent outbreak of COVID-19, infectious disease from Wuhan China, has been a pandemic worldwide. The transmission of this novel coronavirus is mainly through respiratory droplets (Liu and Zhang 2020). Personal protective equipment (PPE) includes face masks, goggles, face shields, gloves etc. It is mainly used by the health care workers in hospitals,which are found to be designed to protect the skin and the mucous membrane of eyes and nose can reduce the risk of exposure to blood borne pathogens (P et al. 2019, Swetha and Brundha 2017). As the viral infection is mainly transmitted through the nose, so it is the responsibility of each and every individual to protect themselves by wearing face masks, respirators as personal protective equipment. A respirator is the special type of equipment which protects the wearer from inhaling toxic chemicals, dust and airborne particles. It was first developed for occupational exposure workers who are working under harmful gases and volatile oils (Brundha and Visha 2019). It consists of has two specific features, one with

the effective filtering system which prevents the passage of noxious substances and microorganisms from entering inside the respiratory tract, and second one it consists of a tight close-fitted design by which air does not leak from the sides of face masks (Abd-Elsayed and Karri 2020). The US Centers for Disease Control and Prevention (CDC) has suggested the use of effective and standard surgical masks, cloth masks, and extended use or reuse type of respirators in pandemic conditions.

The recent types of face masks are N95, 99, FFP1,2, surgical masks, single, double-layered masks, cloth masks etc (Li et al. 2020). N95 masks are the standard respirators approved by the National Institute of Occupational Safety and Health (NIOSH), are close fit and tested with high filtration efficacy of at least 95% of airborne droplets. The filtration efficacy of each mask varies according to the manufacturer, as when compared with N95 masks of about 95% and surgical masks only with 90% (Gralton and McLaws 2010, Shreya and Brundha 2017). Many studies have also discussed the different types of face masks being used by healthcare providers, professionals, and people in the community (Leung, Lam, and Cheng 2020, Kumar, Ashok Kumar, and Brundha 2016). But only limited studies have reported the function of face masks. A recent systematic review and meta-analysis done on surgical masks versus N95 respirators among the health care workers stated that there was no significant difference in the efficacy of surgical and N95 masks in preventing influenza-like diseases (Offeddu et al. 2016, Mp, Brundha, and Nallaswamy 2019). The evidence-based study reported that the use of surgical masks reduces disease transmission from patients in hospital care settings. As the primary route of transmission of all infectious disease is through the nose and respiratory tract, it is important to protect ourselves by wearing effective face masks and respirators (Chughtai et al. 2014, Brundha and Haritha 2019). The aim of the present study is to provide an overview of recent types and functions of face masks being used by the public during the pandemic conditions.

## RECENT TYPES OF FACE MASKS

### N95 respirators

N95 respirator is a protective device, approved by National Institute for Occupational Safety and Health (NIOSH), designed with high filtering efficiency which protects the wearer from airborne infectious particles and liquid contaminating the face. It is made up of valve type with a close facial fit and seal which allows the wearer to be more comfortable with the ease of breathing. A recent study has reported that N95 respirators, found to block at least 95 percent of very small (0.3micron) airborne test particles. The filter of the N95 mask is made up of millions of microfibers of polypropylene layered on top of each other permanently electrostatically charged. It is mainly used by healthcare providers and people who are seriously ill. Previous studies have reported that these respirators are effective against respiratory diseases and influenza viral infection (Long et al. 2020, Brundha, Pathmashri, and Sundari 2019).

### FFP (Filtering Facepiece Particle) respirators

FFP (Filtering Facepiece Particles), a protective mask certified by the European Union , serves to protect against the dust particulates and various viruses in the air. It is made up of a fabric which filters the impurities present in the air. It is classified into three types based on its filtering efficiency, as FFP 1,2,3. Among all the three types of respirators FFP 3 type is found to provide the highest level of filtering efficacy of liquid and solid aerosols. It also provides greater control over the bacterial and viral infection. They are often used by healthcare professionals when handling hazardous pharmaceutical chemicals and toxic gases (MacIntyre et al. 2009).

### Surgical masks

Surgical masks are the disposable type equipment which acts as a physical barrier between the mouth and nose against infections. It is effective in blocking the large droplets which are transmitted by cough,

sneezes through contact . It is also called as the medical or procedure masks, mainly used by the health care workers. It is generally made up of three or four layers, in which the efficacy of filtration up to 1 micron of microbes and respiratory droplets. Based on its filtering barrier ,surgical masks are classified into three types: low barrier type, moderate barrier and high barrier type. It is made up of a single layer of non woven fabric or pulp tissue paper, generally used by the people working in industries. It can be used only for a single time and can be disposed. It provides only less protection against infectious particles in the air. The design of surgical masks includes, loose-fitting design placed by strings with looping around the ears or tied behind. A previous study has been reported that surgical masks potentially contribute to contamination of surgical wounds and protection against infectious airborne microorganisms. The insufficient tension over strings on the masks causes venting,which leads to the leakage of air from the side of the surgical masks. Previous study has reported that wearing surgical masks by the health care workers helps to prevent postoperative surgical wound infection (Lipp and Edwards 2002, John and Brundha 2016).

**Cloth masks**

It is most commonly used by the developing countries, as the people prefer to need a cheap, washable and reusable type of cloth mask. Cloth masks are made up of cotton vest fabric, which can be more economically affordable by the people in the community. The Centre for Disease Control and Prevention has recommended the community to use the cloth masks during the pandemic conditions (Timothy, Samyuktha, and Brundha 2019).

**Dust masks**

A dust mask is a flexible type which holds over the nose and with rubber straps, considered as personal (Harsha and Brundha 2017, Ravichandran and Brundha 2016) comfort against non-toxic nuisance dust. It offers only less protection against infectious particles when compared to other effective face masks. It is most commonly used by occupational and laboratory workers (Eikenberry et al. 2020).

**Functions of facemasks**

Surgical masks are made up of three layers, an innermost layer made of absorbent material which absorbs the moisture from the breath of the wearer, the middle layer has melt-blown material, acts as a filter and the outermost layer will repel the liquid from contacting the face. A previous study reported that surgical masks used during the peri operative procedures , found to prevent the wound contamination from the patients. N95 respirators are effective to protect the human respiratory system against the effective airborne aerosol particles, which are of biological origin like viruses, bacteria, fungal spores, pollen grains etc. It provides 99% of effective filtration against aerosol-generating procedures (Agps) in hospitals during the surgical procedures, such as tracheal intubation, non-invasive ventilation, tracheostomy, cardiopulmonary resuscitation, manual ventilation. So before doing these surgical procedures, N95 / FFP2 masks are worn along with other personal protective equipment such as gloves, face shield and safety goggles. Many clinical studies have reported the effective use of face masks prevents the spread of influenza in the community (Cheng, Lam, and Leung 2020).

**Effective in disease control and prevention**

The world health organisation WHO, has recommended the community to wear the standard surgical masks during the spread of the epidemic, pandemic disease conditions. It has been found that high filtration surgical masks are effective against the droplet infection and contamination of surgical wounds during the operative procedures. Face masks are recognised as the potential tool, which can be used by the general public to protect against the community spread of recent pandemic diseases (Rebmann, Carrico, and Wang 2013, Preethikaa and Brundha 2018). The meta-analysis study done among the healthcare

workers reported that the use of N95 masks reduces the effective transmission of aerosol by 95%, whereas surgical masks have 75% of protection against respiratory infection. The healthcare workers are highly involved in high risk procedures (Harsha and Brundha 2017) in hospitals, and are provided an adjuvant N95 respirators with ventilators which can prevent them from the transmission of Severe Acute Respiratory Syndrome (SARS). Previous studies have also reported that the effective use of surgical masks prevents the transmission of blood borne pathogens like HIV, Hepatitis viral infection (Bałazy et al. 2006, Kalaiselvi and Brundha 2016).

**Prevention of respiratory diseases**

The clinical features of recent COVID-19 infection found to be flu-like symptoms with a sore throat, cold, pneumonia, severe acute respiratory syndrome (SARS) (Bai et al. 2020). Chronic obstructive pulmonary disease (COPD), which is a prototype of chronic bronchitis results in obstruction of the airway in the lungs (Saivignesh and Brundha 2019). It is highly prevalent among adults who are exposed to smoking, air pollution etc (Shanmugananth et al. 2019, Nivetha, Arul, and Kothai 2019). Pneumonia is the other serious infection, induced by entry of toxic microbes, bacteria or viruses(Brundha 2015) mainly affects the parenchyma of the lungs. Dyspnea also called shortness of breath results in inflammation of lungs due to the toxic chemicals (Simon et al. 2020, Hannah et al. 2019). Acute respiratory distress syndrome (ARDS) and bronchitis are the two main airborne diseases caused due to high expression of pro-inflammatory cytokines in the lungs (Hagawane, Gaikwad, and Kshirsagar 2016, Khudhair, Hameed, and Mekhlef 2017). As the primary route of these disease transmission is through the nasal cavity (Ferdioz and Brundha 2016) via respiratory tract , so the effective use of various respirators and masks may prevent or reduce the chance of respiratory infection.

**Advantages of facemasks**

N95 masks are valve type respirators,provides 95% protection level against airborne viruses. These respirators provide more comfort with ease of breathing (Hannah et al. 2019). It offers long term durability. Apart from face masks and respirators, face shields are now being used , made up of a clear plastic barrier which covers the face and protects against the droplet infection. Respirators with extended reuse type were recently introduced by the CDC to prevent transmission of viral diseases (Perencevich, Diekema, and Edmond 2020, Prashaanthi and Brundha 2018). The CDC has recommended the public people to wear the cloth masks during the pandemic conditions, as it is more affordable and comfortable to use by the people. The protocol of wearing facemasks is simple and proper hygienic measures can be easily taken. Public mass wearing is a program recently introduced by the WHO, stated that face masks are a low cost adjunct which acts as an effective source of controlling the disease during the pandemic conditions (Khan and Parab 2020).

## CONCLUSION

Face masks are the effective barrier which protects us against infectious diseases. The US Center for Disease Control and Prevention (CDC) has recommended to use the standard surgical masks, cloth masks, and extended use type of N95 respirators in pandemic conditions for the benefit of people worldwide. The future scope of the present study is to gain better knowledge in understanding the recent types and functions of face masks. This review thus highlights the recent types and functions of face masks used by the general public people and health care (Balaji, Brundha, and Path 2016) providers during the diseased conditions (Shenoy and Brundha 2016).

## AUTHOR CONTRIBUTIONS

L.Akshayaa, contributed to the data acquisition and drafting of the manuscript. Dr.M.P.Brundha, contributed to the design, editing and critical revision of the manuscript. Dr. Ezhilarasan D, contributed to the supervision and proof reading of the manuscript.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

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