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## FACE MASKS TO PREVENT INFECTIOUS DISEASES: AN HISTORICO-ANTHROPOLOGICAL PERSPECTIVE IN THE LIGHT OF THE RECENT PANDEMIC

*ABSTRACT: Much attention has been paid to the role of the surgical mask in helping control the COVID-19 pandemic. Today there is a discussion about whether to continue wearing them or not. In the meantime, different models have been manufactured, in different colours and materials. They have been copied and counterfeited. The mask is nothing new, but its use has changed over the ages, reflecting different purposes. With the miasma theory doctors protected themselves with clothing and a beaked hood that contained aromatic substances to counteract the miasma. With Pasteur's Germ Theory, the use of masks aimed to stop infection spreading during medical care. The Spanish Flu epidemic was the when the general public was advised to wear masks. The onset of antibiotics reduces the interest in masks which has changed significantly since the COVID-19 pandemic.*

*KEY WORDS: Mask - COVID-19 - History of medicine - Prevention - Public health*

### INTRODUCTION

The last two pandemic years have made us very familiar with masks, used as Personal Protective Equipment (PPE) to reduce the risk of infection from COVID-19. In 2003, the SARS epidemic, disposable masks appeared for use in the general population and the disease did not turn into a pandemic as was feared.

Although continued use was seen in Far Eastern populations, the general public in the West was not familiar with them, and there was no interest in producing them on an industrial scale for preventive purposes (Malm *et al.* 2008). The view that infectious diseases had been defeated meant that the COVID-19 epidemic found the world unprepared – although in the scientific world expectation of a pandemic was high –

and lack of the masks as PPE for the population became dramatically known as the emergency unfolded. Because of the shortage, many factories converted production to meet the new needs of the market and health care.

Early in the pandemic, the World Health Organization (WHO) recommended that every person should wear a mask, opening a debate that continues today, when the pandemic is regressing. There is debate on whether to prolong the obligatory use or not. With a huge surge in patient numbers, shortages of healthcare personnel, and limited bed space, the contribution of an efficient surgical mask played a crucial role in reducing the risk of COVID-19 transmission.

Masks, along with social and physical distancing, has helped protect others and reduce viral transmission. However, the use of masks is not a novelty of our times. They were used in the past, albeit for different purposes. This article explores the main stages in the development of masks through history in reassessing past epidemics and societal responses to them (Galassi *et al.* 2021, Lippi *et al.* 2022). It relates their introduction and use to past theories on the spread of infectious diseases, with particular reference to the birth of the Germ Theory of infection.

## HISTORY

Covering the nose and mouth had been part of traditional sanitary practices since antiquity. Today, it is recommended the use of soaked cloth in water placed on the face to prevent toxic chemicals or smoke from entering the lungs.

The oldest examples of the use of protective masks are reported for use when processing of harmful substances such as metals. Pliny the Elder (23–79 CE), for instance, reported seeing people using animal-bladders as masks to filter dust while crushing the toxic mineral which used at the time as a pigment in decorations.

*Persons employed in the manufactories in preparing minium protect the face with masks of loose bladder-skin, in order to avoid inhaling the dust, which is highly pernicious; the covering being at the same time sufficiently transparent to admit of being seen through* (Plinii 1906, 1909).

By the early 14<sup>th</sup> century, when the Black Death spread all over Europe, it was believed that the disease was caused by miasmas and was carried by the air.

Otherwise, it was not clear how people could, as a group, become sick with the same disease. Believing that the cause was unhealthy smelling air, aromatic fires were lit, and doctors used a mask with a long beak. In the beak was an aromatic sponge, soaked in strong smelling substances, to neutralise the effects of miasmas (Mussap 2019). This mask served as a filter preventing miasmas from entering into contact with the doctor who also covered himself from head to toe, used high-heeled shoes, a ruff, hat and gloves. He approached the patient using a long wand. These masks were used only by doctors (Lippi *et al.* 2020).

A basic form of contagion theory dates back to the Middle Ages. Isidore of Seville (c. 560–636) (Isidore de Seville 1960), who mentioned "plague-bearing seeds" (*pestifera semina*), and later Tommaso del Garbo (c. 1305–1370) of Bologna mentioned Galen's "seeds of plague" (Galen 1970, Strohmaier 1966), but these sporadic citations do not constitute the basis of a theory (Nutton 1983).

Many Renaissance doctors suggested distancing and washing the mouth and hands with vinegar. Marsilio Ficino (1433–1499) suggested to

*flee the conversation, ... and when you converse, stay two arms away from your companion; in the open place, and when it is suspicious, stay at least six arms away and in the open and make sure that the wind does not come back from him you ...*  
(Ficino 1481).

In 1545, Girolamo Fracastoro (1478–1533) was appointed physician-in-chief to the Council of Trent, during which a severe epidemic of typhus spread. In 1521 he had already published the poem *Syphilis Sive de Morbo Gallico*, in which he introduced the use of the term "syphilis" for this terrible and inexplicably transmitted disease (Fracastoro 1911). Because of the typhus epidemic the Council moved to Bologna. It lasted until 1549. Thus, Fracastoro had a privileged position to observe and understand the method of spread of the disease. He postulated, with brilliant intuition, the existence of living and invisible bodies, *seminaria contagiorum*, characterised by specificity for individual affections, which also had the peculiarity of presenting "sympathy" for those individuals in whom they found a suitable constitutional ground for taking root (Fracastoro 1546). Furthermore, according to Fracastoro, the contagion would have occurred directly or by means of an intermediary agent, who could

transmit the disease sooner or at a later date. Transmission could be achieved remotely through air and water. The causes of the contagion were not ascribed to occult elements. These invisible contagious seeds had an affinity for the lung and, according to Fracastoro, they were only located there. Fracastoro's views had little effect on subsequent medicine thought. He was not a professor with many students, but a cultivated local physician.

In the following centuries, thanks to the use of the microscope, experimental exploration of the world of microorganisms developed. Botanists and zoologists tried to classify the world of the invisible living organisms (Pesapane *et al.* 2015).

The face masks used today in both health care and community settings can be largely traced back to the new understanding of contagion based on germ theory was applied to surgery. In 1861 Louis Pasteur (1822–1895) demonstrated the presence of bacteria in the air, making people aware of the dangers of breathing in harmful pathogens. A few years later, in 1867, the British surgeon Joseph Lister (1827–1912) postulated that they could be responsible for wound disease, suggesting eliminating them with antiseptic substances (Kreuder-Sonnen 2016).

With the development of asepsis, in the 1880s, a new generation of surgeons devised the strategy to stop germs from entering wounds, sterilising surgical tools and wearing surgical gloves during operations, to reduce the risk of infection (D'Abramo, Neumeyer 2020).

In 1897, Carl Georg Friedrich Wilhelm Flügge (1847–1932), a prominent German bacteriologist and hygienist, established the droplet theory of infection, based on the idea that microorganisms in droplets expelled from the respiratory tract are a means of transmission. He demonstrated that even during "quiet speech", minute droplets, which now bear his name, are sprayed into the air (Flügge 1897, Thomas 2012).

That same year, the German-Polish-Austrian surgeon Johann Freiherr von Mikulicz-Radecki (1850–1905) proposed that one layer of gauze could serve as what is now known as a surgical mask (Flügge 1899). But in 1898, W. Huebner encouraged wearing masks made of two layers of gauze during operations (Mikulicz 1897).

As new infectious epidemics have occurred, medical researchers have continued to develop different kind of masks. During the early years of the 20<sup>th</sup> century, the Chinese-Malaysian epidemiologist Wu Lien-teh (1879–1960) succeeded in isolating and culturing the bacterium responsible for the pneumonic plague that had broken out in northern China. He developed a mask from layers

of gauze enveloped in cotton, which could be hung on the ears through secure ties (Hübner 1898).

In the early twentieth century, the Chicago physician Alice Hamilton (1869–1970), a leading expert in the field of occupational health and a pioneer in the field of industrial toxicology, published a paper about the transmission of scarlet fever in healthcare settings. She had patients, that she knew were infected with scarlet fever, cough and sneeze into Petri dishes so she could study if viral particles were present. After proving that they were in fact present in respiratory droplets, she suggested that surgeons and nurses wear masks to prevent transmission (Lee *et al.* 2014).

However, it was not until 1910 that the use of facemasks became common in hospitals and surgical procedures. In 1918, George H. Weaver (1866–1947) from the Durand Hospital in Chicago, reported that over a 2-year period the incidence of diphtheria contracted by attendants of infected patients was reduced to zero after wearing masks of double thickness gauze. He recommended sterilising masks after the first use, replacing moist masks with sterile ones, and avoiding touching masks when in contact with sick patients (Hamilton 1905, Weaver 1918).

The evidence for the effectiveness of the masks increased but it was especially during the global flu pandemic of 1918, that both medics and members of the public used protective masks. In some American states, mask wearing was compulsory in the workplace and on public transport. It was mainly during the Spanish flu of 1918–1920 that the facemask turned into a means of protecting medical workers and patients from infectious diseases from outside the operating room. But not everybody was persuaded, and an anti-mask movement was formed.

Several studies were conducted over the next few years to determine which type of gauze mask was the most effective; the October 1918 issue of the *Journal of the American Medical Association* was mainly devoted to this problem. In this issue, Brewster C. Doust and Arthur B. Lyon reported the results after testing three types of masks: coarse gauze, medium gauze, and butter cloth. They described undertaking experiments to prove each mask's efficiency or non-efficiency in preventing the dissemination of infectious material from the mouth during the acts of speaking or coughing. They concluded that the coarse gauze was ineffective, and that finer gauze provided better results in terms of preventing the transmission of microorganisms (Weaver 1919).

Further studies were published in the meantime, but in the 1940s, with the use of antibiotics and their rapid

acceptance as a means of controlling infection, attention to surgical masks decreased dramatically (Doust, Lyon 1918).

However, over time, the use of antibiotics showed its limitations as surgery developed more invasive techniques that needed the use of surgical scrubs, gloves, proper gowning, capping and sterile drapes, among other measures (Strasser, Schlich 2020).

In 1958, J. C. Kiser and C. R. Hitchcock patented a mask, which joined the properties of filtration and deflection (Matuschek *et al.* 2020).

Nowadays disposable surgical masks and FFP2 masks are available. It is known that COVID 19 is mostly transmitted via droplets in the air, and that there is a potential risk of airborne transmission in an indoor environment with poor ventilation. As the distance of droplet transmission can extend up to 4 m, the recommended social distancing range of 1–2 m (CDC, 2020; WHO, 2020) may not be enough to prevent contracting the disease. Experience in the use of face masks during the current COVID-19 pandemic has shown that different types of masks or respirators offer different levels of protection. In particular, respirators with greater filtration capacity are associated with higher protection, compared to no mask use. As well as being appropriately vaccinated, constant face mask or respirator use has been shown to reduce the risk of contracting SARS-CoV-2 infection, especially in indoor public settings (Kiser, Hitchcock 1958).

Recent studies have demonstrated that correctly wearing masks contributes to a large degree to reduce the overall risks of COVID 19 infection and enhance general protection from Coronavirus (Wang *et al.* 2021, Baker *et al.* 2020, Leung *et al.* 2020), and even from other respiratory pathogens (such as influenza and RSV).

## CONCLUSIONS

The use of masks in a medical setting has a long tradition. In the Middle Ages doctors would wear a beaked mask and a full set of clothes, gloves, and high-heeled shoes during a plague outbreak. The beak contained aromatic substances that counteracted the miasma that was thought to cause the disease. Following Pasteur's Germ Theory, and Lister's asepsis, masks were developed with more validation and sophistication to prevent infections spreading in the medical setting. Mask wearing for the public was introduced during the Spanish Flu epidemic in the USA. The advent of

antibiotics for preventing infection reduced the interest in masks. This has changed with the COVID-19 outbreak. There is evidence that mask use in indoor public settings reduces the risk of spread of the virus, however few people wear the mask properly, and many do not clean them regularly.

The historical rediscovery of the role of masks through the ages and past societies should stimulate a debate and fruitful reflection within our societies at large and the possibility to use them more often than just during pandemic times.

## CONFLICT OF INTEREST

Nothing to declare.

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