Face Mask: An essential tool to fight the invisible enemy

Puya Dehgani-Mobaraki[1], Asiya Zaidi[2], Joshua Michael Levy[3], and Massoud Dehgani-Mobaraki[4]

[1]President and Founder, " Naso Sano" Onlus
[2]Mahatma Gandhi Memorial Medical College
[3]Emory University School of Medicine
[4]Co-founder , Association Naso Sano

June 1, 2020

Dr. PUYA DEHGANI-MOBARAKI (Orcid ID: : 0000-0001-8339-1868)

Article type: Letter to the Editor

Title Page

Face Mask: An essential tool to fight the invisible enemy

Dr. Puya Dehgani – Mobaraki , MD, MS (ORL) [Corresponding author]

Founder and President , Association "Naso Sano" onnulus

(A no-profit voluntary organization that proposes solidarity in research and treatment, focusing mainly on the prevention of diseases involving the nose and the sinuses. Based in Corciano and the Umbria region)

Consultant, Department of Otorhinolaryngology and Head Neck surgery | Centro Regionale di Fibrosi Cistica, Gubbio-Gualdo Tadino Hospital, Usl Umbria 1, Italy.

Corresponding author:

Email: dehganipuya@gmail.com

Phone: +393293161405

Dr. Asiya Kamber Zaidi M.D, MS(ORL)

Member, Association "Naso Sano"

Senior Registrar , Mahatma Gandhi Memorial medical college, Indore, M.P, India

EAACI member : EAACI20346

Dr. Joshua Michael Levy M.D, MPH

Member, Association "Naso Sano"

Department of Otolaryngology-Head and Neck Surgery, Emory University School of Medicine, Atlanta, GA, United States.

Dr. Massoud Dehgani-Mobaraki M.D

Co-Founder, Association "Naso Sano"

(A no-profit voluntary organization that proposes solidarity in research and treatment, focusing mainly on the prevention of diseases involving the nose and the sinuses. Based in Corciano and the Umbria region)

Face Mask: An essential tool to fight the invisible enemy

Over the past few months, an increasing volume of information has helped increase awareness regarding the transmission and clinical characteristics of SARS-CoV-2. Following pandemic declaration by the World Health Organization(WHO),global authorities and international scientific societies immediately took measures to reduce the transmission and subsequent morbidity associated with COVID-19. These measures, however, were not sufficient to limit the contagion, which drastically increased in the critical periods of March-April 2020, bringing initially Iran followed by Italy and Spain to their knees. Thereafter, the contagion spread rapidly to France and the United Kingdom, as well as overseas to the USA and worldwide.

The identified routes of COVID-19 virus spread are respiratory aerosols, spray droplets, and physical contact. Many nations disseminated heterogeneous messages regarding self-protective measures,such as the importance of face coverings,hand hygiene and SARS-CoV-2 testing. Moreover,the possibility of contact tracing through geosocial applications and public service platforms has been met with variable interest.[1] Universal acceptance of these precautions could be extremely crucial,especially in the upcoming months as several nations proceed with the reopening of commercial establishments and educational activities.

The mechanics of relative protection offered by masks:

Airborne diseases caused by viruses transmitted through droplets are crudely divided into two large categories based on droplet size:

1. **Aerosols:** Droplets<10 μm diameter reaching the alveoli where the gaseous exchange occurs. The N95 masks are designed to filter out 95% of droplets smaller than 0.3 μm.

2. **Spray Droplets** : Droplets>10 μm diameter (up to 0.1 mm or more) are the larger spray droplets that get trapped in the posterior nasal cavity and the nasopharynx.

A study published in *Human Cell Atlas* (HCA) by Sungnak et al. on nasal expression of ACE-2 protein suggests that SARS-Cov-2 virus infects cells in the posterior nasal cavity allowing viral attachment and host cell entry. Additionally, nasal epithelial cells, specifically goblet/secretory cells and the ciliated cells, display the highest ACE-2 expression out of all the epithelial cells.[2] A simple physical barrier could effectively block this route of transmission.

As per Xie et al. on exhalation,droplets>0.1 mm in size,depending on the size,humidity and temperature might either evaporate or fall upon a surface within a 2 metres range.However, *coughing or sneezing* could propel these droplets as projectiles with a "muzzle velocity" of 50 meters/second (for sneezing) and 10 m/s (for coughing),traveling distances as far as 6m away.In such cases,the much-recommended advice of maintaining a 'safe social distance' of 6 feet in social gatherings may not suffice.[3]The *Partial filtering* offered by masks in such situations would be better than no protection at all.

As per the ARIA-MASK study group,the COVID-19 pandemic has coincided with the seasonal/spring allergy season. Hence sneezing, a common symptom in patients with Allergic rhinitis could end up being a potential source of rampant disease spread.A face mask would not only protect the wearer from allergen exposure and direct air currents over the nose but would also offer protection to the people around as these droplets released following a sneeze shall be contained within the mask.

Van der Sande et al., in an *experimental simulation* compared the filtering capacity of three different masks, (*i*) home-made (DIY) of cloth, (*ii*) standard surgical masks,(*iii*) FFP2, the European equivalent to an N95 mask. The FFP2(or N95) mask filtered out more than 99% of particles,leading to reduction of aerosol load by **100-fold,** while surgical masks lowered the number by a substantial **4-fold.** [4] It is noteworthy that the N95 masks are effective but expensive too.

Methodologies implemented by various countries :

Several governmental and institutional websites have *Guidelines for Opening Up* for both individual citizens and employers with criteria,preparations and instructions for resuming activities.One hand we have countries like Brazil with a halfhearted lockdown slowly reaching the peak,developing countries like India and Pakistan have extended their strict lockdown,expecting a peak in the next few weeks.Few countries on the other hand,have reached their post peak phase and taking measures to ease the lockdown.In Italy,a gradual reopening of many commercial activities but not schools was announced earlier in May but countries like Germany,Switzerland and Spain have announced to reopen schools even in light of an increasing number of reports indicating children to be as susceptible to SARS-CoV-2 infection as adults but less likely to present with symptoms.Then there are countries like South Korea,Japan,Singapore and even the epicenter of the pandemic-China that seem to have controlled the spread of COVID-19.It is essential to highlight here that one of the major guidelines these countries followed to contain the spread of the disease was: Mandatory use of protective masks/covers in public.In Beijing,a study of community transmission found that "consistently wearing a mask in public was associated with a 70% reduction in the risk of catching SARS".Singapore has installed face mask vending machines with an aim to distribute over 5 million masks to its residents for free.Hong Kong,learning through experience,has announced plans to distribute at least 8 million masks with two each to kindergarten and primary pupils under the Hong Kong's free mask scheme:**CuMask+** .The name stands for the chemical symbol for copper,Cu (key filtering component) and also for "see you".These masks are environmentally sustainable and can be washed 60 times. A systematic analysis in the Cochrane Review found strong evidence during the 2003 SARS epidemic in support of wearing masks.[5] In countries like the United Kingdom,public has been advised to wear face coverings under the government's lockdown easing plan.The United States official guidelines on *Opening America "s* trongly considers" using face coverings while in public and particularly when using mass transit. Similarly,In Italy,places like Lombardy have made face masks compulsory while venturing out. Other regions,including Tuscany and Umbria are distributing free surgical masks to the public.In Germany,wearing a mask has been mandatory in shops and when using public transportation.In other countries such as Spain,the use of masks is compulsory on public transport with no obligation for children to wear them.In France however,kindergarteners are not expected to wear masks unless symptomatic.In India,wearing simple face-covering in public is mandatory and a geosocial application*Aarogya Setu* helps in contact tracing.

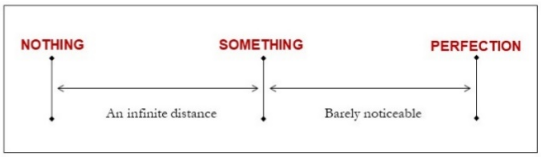
Measures to contain the disease spread require two things:

1. Limiting the contacts of positive cases via physical distancing,efficient contact tracing and adequate quarantine.

2. Reducing the probability of transmission per contact by wearing masks in public.

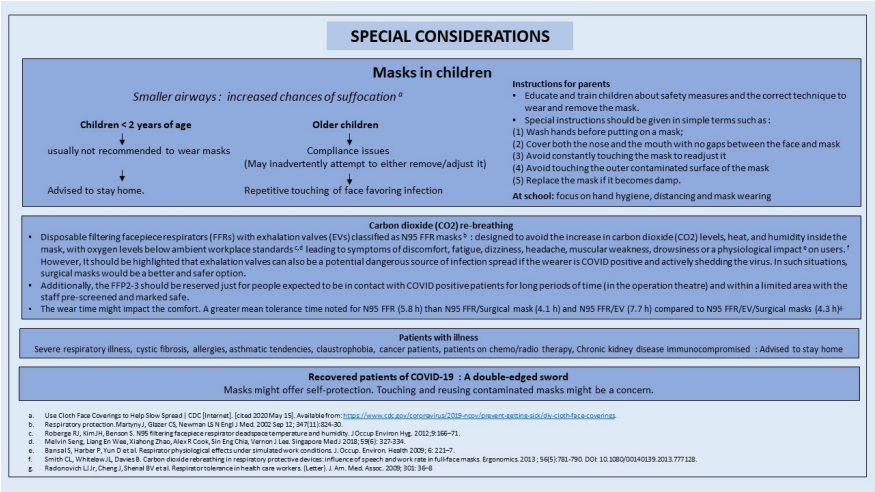
In addition to hand hygiene and physical distancing,guidelines for mandatory mask-wearing in public could prove to be a simple,effective and accessible way,to prevent disease transmission from asymptomatic carriers to healthy individuals.

Population compliance plays a key role when it comes to masks.For example,Vietnam- a densely populated country sharing its border with China, with relatively inferior economic and technological capacity, has had a commendable response to the outbreak. With a total of 288 confirmed cases, 249 recoveries and no deaths, it has set an example for the world. A Habitual mask wearing population,early intervention,vigorous quarantine policies and complete contact tracing has helped Vietnam in effectively combatting COVID-19.There have been many concerns regarding the use of masks by the general population including a false sense of protection,associated stigma,increased chances of infection due to repeated adjusting and rampant causing an eventual shortage of masks for the healthcare workers.[6]



It should be noted that while cotton masks,surgical masks and improperly worn/ill-fitted N95 respirator masks do not offer perfect protection,neither do the tight-fitting NIOSH-approved N95 respirators.However,imperfect protection does not mean no protection at all.In the present scenario, without a specific treatment or a vaccine the goal for countries is to "flatten the curve" and not sudden "total eradication".Therefore,any additional reduction of transmission,however small or partial,would still be significant and achieved using barriers to stop the droplet spread.(N95 masks,surgical masks or even plain cotton masks)

Given the need for the population to "acquire sufficient natural immunity over time", masks might adequately reduce the viral exposure impacting transmission during the early waves, while allowing people enough exposure to start mounting an efficient immune response.[4] Clear guidelines for universal use of personal protective equipment is essential to limit the spread of infection as communities around the world begin to emerge from lockdown. But as the Little Prince said: "The essential is invisible to the eye".



References:

1. Bi Q, Wu Y, Mei S, et al. Epidemiology and transmission of COVID-19 in 391 cases and 1286 of their close contacts in Shenzhen, China: A retrospective cohort study. *Lancet Infect Dis* . 2020; published April 27. https://doi.org/10.1016/S1473-3099(20)30287-5.

2. Sungnak, Waradon & Huang, Ni & Bécavin, Christophe & Berg, Marijn & Network, HCA. (2020). SARS-CoV-2 Entry Genes Are Most Highly Expressed in Nasal Goblet and Ciliated Cells within Human Airways.
3. Xie, X., Li, Y., Chwang, A.T.Y., Ho, P.L. and Seto, W.H. (2007), How far droplets can move in indoor environments – revisiting the Wells evaporation–falling curve. Indoor Air, 17: 211-225. doi:10.1111/j.1600-0668.2007.00469.x
4. van der Sande M, Teunis P, Sabel R (2008) Professional and Home-Made Face Masks Reduce Exposure to Respiratory Infections among the General Population. PLoS ONE 3(7): e2618. Available from:https://doi.org/10.1371/journal.pone.0002618
5. Jefferson T, Del Mar CB, Dooley L, et al. Physical interventions to interrupt or reduce the spread of respiratory viruses. *Cochrane Database Syst Rev* . 2011;2011(7):CD006207. Published 2011 Jul 6. doi:10.1002/14651858.CD006207.pub4
6. Advice on the use of masks in the community, during home care and in healthcare settings in the context of the novel coronavirus (COVID-19) outbreak [Internet]. World Health Organization. World Health Organization; [cited 2020 May 15]. Available from: https://www.who.int/publications-detail/advice-on-the-use-of-masks-in-the-community-during-home-care-and-in-healthcare-settings-in-the-context-of-the-novel-coronavirus-(2019-ncov)-outbreak

Supplement : For further reading

Link to resources for newsfeed regarding the guidelines from countries:

1. Wu J, Xu F, Zhou W, et al. Risk factors for SARS among persons without known contact with SARS patients, Beijing, China. *Emerg Infect Dis* . 2004;10(2):210-216. doi:10.3201/eid1002.030730
2. http://www.salute.gov.it/portale/news/p3_2_1_1_1.jsp?lingua=italiano&menu=notizie&p=dalministero&id=4722
3. The White House. 2020. Opening Up America Again |The White House. [online] Available at: https://www.whitehouse.gov/openingamerica/#guidelines
4. German Mask Regulations, State By State | U.S. Embassy & Consulates In Germany. [online] U.S. Embassy & Consulates in Germany. Available at: <https://de.usembassy.gov/german-mask-regulations-state-by-state/>
5. Linde P. Spanish Health Ministry considering making masks obligatory in public [Internet]. EL PAIS. 2020 [cited 2020May18]. Available from: https://english.elpais.com/society/2020-05-13/spanish-health-ministry-considering-making-masks-obligatory-in-public.html
6. Coronavirus: France mandates masks for schools and transport [Internet]. BBC News. BBC; 2020 [cited 2020May18]. Available from: https://www.bbc.com/news/world-europe-52459030
7. South China Morning Post. 2020. 1.5 Million Hongkongers Apply For Free Mask Scheme In 11 Hours. [online] Available at: <https://www.scmp.com/news/hong-kong/health-environment/article/3083066/coronavirus-hong-kongs-free-mask-scheme-sees> [Accessed 15 May 2020].
8. Singh T. Aarogya Setu App Gets 100 Million Downloads in Just 41 Days of Launch [Internet]. TelecomTalk. 2020 [cited 2020May13]. Available from: https://telecomtalk.info/arogya-setu-app-100million-downloads/270375/
9. Bousquet J, Akdis C, Jutel M, Bachert C, Klimek L, Agache I, et al. Intranasal corticosteroids in allergic rhinitis in COVID-19 infected patients: an ARIA-EAACI statement. Allergy. Forthcoming 2020