The unforeseeable global crisis of the spread of coronavirus disease 2019 (COVID-19) has caused almost all affected countries to adopt a range of protective measures as recommended by the World Health Organization. However, the speed, type and level of adoption of these protective measures have been remarkably different. Social distancing and quarantine were the main measures adopted in addition to observing basic hygiene. Based on the available evidences, WHO continues to recommend wearing of face masks for healthcare workers and for those people caring for COVID-19 patients. However, some countries and organisations have recommended, and some have even made it mandatory, for their citizens to wear face masks. Particularly in low- and middle-income countries, protecting by wearing face masks is viewed as an affordable yet proactive preventive measure to avoid and slow down viral spread based on the experience of other affected countries. However, the wearing of face masks is controversial due to shortages in their stocks and uncertainty.
around the quality of masks, as well as their efficiency as a protective mechanism. Masks should be used based on appropriate use and management guidelines. This paper discusses the wearing of face masks from the perspective of low- and middle-income countries, particularly in Africa; and then makes some recommendations that will greatly inform policy makers on epidemic mitigation strategies throughout the African continent.

**Keywords**
COVID-19 outbreak, Face masks, protection, SARS-CoV-2 spread, public health

This article is included in the Coronavirus (COVID-19) collection.

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The novel situation
The outbreak of the coronavirus disease 2019 (COVID-19), an acute respiratory disease of viral infectious origin, is caused by an emerging variety of the highly contagious SARS (SARS-CoV-2). The virus is also suspected to be airborne and as such, critical preventive measures are being adopted around the world. As the pandemic is fast spreading in African countries, there is concern over the kind of measures and strategies that these countries can adopt to ensure that they overcome the crisis and at least avoid dramatic scenarios. A resume in Figure 1 shows the evolution of COVID-19 cases in some Africans countries, marked by the spread of the virus. The severity and impact of SARS-CoV-2 has forced low- and middle-income countries to implement more affordable but proactive preventive measures based on the experience of affected countries, particularly industrialized countries, to date. However, measures such as a total lockdown and physical distancing, while practical in containing and controlling the spread the virus, may not be applied to the letter in these countries due to their severe socio-economic impacts. Additionally, physical distancing is a luxury for the teeming urban poor populations who live in African cities and informal settlements.

The first preventive measures to be adopted in almost all countries have been the banning of all forms of public gatherings; the isolation of positively confirmed and suspected cases; and physical distancing. The general public has been required to observe basic hygiene including the frequent washing of hands with soap and water; use of alcohol-based sanitizers; coughing and sneezing into a tissue or the bent elbow; staying at home when ill; and cleaning surfaces regularly. The wearing of face masks that cover nose and mouth is now part of the measures being adopted by some African governments such as Nigeria, Morocco, Tunisia, Ghana and Kenya among others.

The World Health Organization does not recommend the wearing of masks, except for healthcare workers and those already infected with the virus. However, researchers in the UK and Hong Kong argue, “Absence of evidence of effectiveness should not be equated to evidence of ineffectiveness,” especially as we are facing a novel situation with limited alternative prevention measures. The US Centers for Disease Control and

![Total confirmed COVID-19 cases](https://www.iflscience.com/health-and-medicine/why-the-who-is-now-using-the-phrase-physical-distancing-instead-of-social-distancing/)

Figure 1. COVID-19 evolution in some spread virus Africans countries. (European Centre of Diseases Control CDC, May 09, 2020) This figure was reproduced under the terms of the Creative Commons Attribution 4.0 International license (CC-BY 4.0).
Prevention (CDC) and Food and Drug Administration (FDA) have revised their guidelines regarding face masks. The CDC now recommends a “face covering” in public areas, while medical institutions were issued an emergency protocol by the FDA indicating that the N95 masks, which are essentially for single use, to be sterilized with use of “vaporized hydrogen peroxide gas plasma”.

As we receive these conflicting messages regarding face masks, muddling of information and a change in advice, we ask questions such as “How can a cloth face mask protect us? If we wear them, are we still at risk of transmission? How are different African governments responding to this and what are their recommendations?

As the coronavirus is highly contagious, people in the incubation or asymptomatic stage can shed the virus and on releasing it into the air, can then transmit the infection. Due to the cough mechanism, the air is expelled very quickly and allows the ejection of the foreign germ including virion. The speed of this expulsion is 250 m/s or 900 km/h, and can expel nanoscale or micrometric particles (less than 50 µm) up to 6 meters away from the individual, while a sneeze can reach 15.3 m/s, or more than 55 km/h. The coronavirus could thus be transmitted via aerosols and there is even concern that this virus could also be transmitted when people are talking in close proximity.

Empirical evidence that mask can help slow the spread of COVID-19

At the beginning of the epidemic, WHO strongly recommended the wearing of face masks for only infected individuals, their caregivers, and immediate family members. But now, many countries are opting for mandatory face masking to protect against coronavirus. It is being argued, therefore, that the reluctance of WHO to advocate for the widespread use of face masks can be attributed to the fact that the current stock of face masks is primarily being reserved for frontline health care workers.

A systematic review by Barashed et al. found that face masks significantly protect against respiratory infections at mass gatherings (RR = 0.89, 95% CI 0.84–0.94)11. A systematic review of random controlled trials (RCTs) of face masks in influenza also revealed that face masks are protective for influenza-like illness14. Also, a cluster-randomized trial in households over two seasons showed that mask has 74% protection against respiratory diseases (0.26, 95% CI 0.09–0.77)15. Yan et al.’s mathematical modelling of the effectiveness of respiratory protective devices in reducing influenza outbreak found that influenza outbreaks would be eliminated if four-fifths of the population wear face masks16.

There are several types of face masks being used during this epidemic. The surgical masks, the lightest and cheapest ones, prevent the projection of droplets emitted outward by a sick person thus limit the transmission of several diseases (flu, rhinovirus, coronavirus among others). The Filtering Face Piece Particle (FFP) or N95 breathing masks are much more developed and have several layers of protection and filtration. With three performance classes FFP1, FFP2 and FFP3 for bio-aerosol filtration percentages of 80%, 94% and 99%, respectively. These masks are primarily reserved, in an area of active virus circulation, for health care workers especially in this time of shortage. These masks protect from the inside than from the outside. Nevertheless, they are more uncomfortable because they are thicker than surgical masks.

With the current shortage of face masks, and the dire need for people to move around to either respond to the crises or earn a living, non-medical face masks made from various textiles (including homemade ones) are being considered and promoted. These masks have not been proven to be effective according to current standards (European standard EN 149). Therefore, they are not recommended to be used in healthcare settings. However, various textiles with small mesh can offer significant protection (approximately 70% to 73% effectiveness against 0.02 µm particles). According to Davies et al., looking at homemade masks for protection during an influenza epidemic, dishtowels were found to be 73% effective at blocking 0.02 micron bacteriophages. Scientists around the word are struggling to adapt their research to find solution to the many problems raised by the COVID-19 pandemic including the problem of face masks shortage. Many scientists are, thoroughly, collaborating with manufactures in the textile industry, and searching for innovative material to find an alternative to surgical masks and FFPs.

Around the world, several countries have imposed the wearing of protective masks on their population in an attempt to circumvent the spread of viruses such as the Czech Republic, Slovakia, Bosnia-Herzegovina, China, Hong-Kong, South Korea, Japan, Thailand, Taiwan, Australia, and Germany. Yet, there are many other countries that have not considered this measure necessary. Countries that applied a strict physical distancing and compulsory use of face masks in public places have demonstrated a significant reduction in coronavirus infections, such as China and Hong-Kong. They have also witnessed a decrease in the number of secondary infections compared to other countries that applied this measure later, as can be noted also by following the daily confirmed cases of the virus (SARS-CoV-2) spread (Figure 2).

Usage and availability of face masks in African countries

As African scientists and researchers, we believe that widespread wearing of masks should be encouraged and made mandatory in all public spaces in Africa. Face masks should also be made available free of charge or at a low and controlled price. To meet this demand, it is prudent for the relevant government ministries, private sector and individuals to invest in innovating ways through which we can meet the demand for face masks. The US Centers for Disease Control and Prevention (CDC) and Food and Drug Administration (FDA) have revised their guidelines regarding face masks and CDC now recommends a “face covering” in public areas. In this context, strict measures on use of face masks are emerging in several African countries.
Morocco was the first country to advocate for and impose the wearing of face masks. The Moroccan government decided that it was mandatory to wear medical masks in public spaces, the workplace, and for anyone allowed to go out during the coronavirus outbreak\(^{25}\). Those who fail to comply face prison sentences of up to three months and a fine of up to 1,300 dirhams. The face masks are to be sold at a subsidized price of 0.8 dirhams ($0.08) per unit. This has stimulated local production of masks with a daily production capacity of 3 million and a possibility to increase it to 6 million\(^{26}\).

The Tunisian government, through the Ministry of Health and in collaboration with the Ministry of Industry (Textile Industry) have committed to manufacture approximately 30 million units of reusable face masks\(^{27}\). The wearing of these masks will be mandatory after the lockdown and once outside the home\(^{27}\).

However, the same cannot be said of most African countries. For example, in Nigeria, once, the discovery of index case of coronavirus (COVID-19), the prices of mask went from ₦50 ($0.14) to ₦350 ($0.98). This enormous price increase of approximately 600%\(^{28}\) was caused by a sudden high demand and dwindling supplies and the propensity of sellers to maximize profits. The shortage in supply and the high price can be attributed to its very low utilization in the country, perhaps 1 per 1000 people. This is despite the fact that the Nigeria Centre for Disease Control’s (NCDC) advises the use of face masks to slow the spread of coronavirus and guidelines on the use of face masks to prevent coronavirus infection\(^{29}\).

In Kenya, the wearing of face masks was made mandatory after cases were over 80 with the country going on a partial lockdown\(^{30}\). The cost of the masks is no different from other African countries. To support in the fight against COVID-19, the Kenyan Ministry of Industrialization is calling upon local industries to assist in the production of masks. This is supplying the government with approximately 5000 masks per day\(^2\). Despite this effort, the demand is still high and this policy has become difficult to implement.

It is a challenge to meet the demand for face masks in Africa because there are limited resources to invest in their manufacturing. But it is also an opportunity to create new work opportunities.

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\(^{29}\)https://www.standardmedia.co.ke/article/2001366398/rivatex-starts-mass-production-of-face-masks
for thousands of people who are now jobless due to the outbreak.

To seize this entrepreneurial opportunity, governments are already requesting and could support local SMEs (small and medium-sized enterprises) to produce face masks.

In ensure the production of masks meets demand, each African country could offer more opportunities for research and development and facilities, by sustainable funding and structures, to its young leaders and researchers to take initiatives to find alternatives to the current materials being used to manufacture the masks. In this context, we can promote innovative textiles made from green plant waste, such as bamboo and banana leaves. Bamboo gives a natural fibre with amazing properties and is even more absorbent than bio-cotton\textsuperscript{31}. This fibre makes it possible to produce breathable, non-deformable textiles, soft to the touch and anti-UV and antibacterial\textsuperscript{32}. As for the banana leaves, the resulting tissue is silky, flexible and wicks away moisture\textsuperscript{31}.

Currently there is a surge in the production of homemade face masks as families struggle to protect themselves from infection in public places where it is difficult to exercise physical distancing protocols. However, are these masks effective? Are there standards for homemade face masks? It is crucial to promote standards for homemade masks, which will achieve maximum protection whilst maintaining breathability.

**Toward standardizing homemade facemask for maximum protection**

Homemade mask from various textile materials can slow the transmission of coronavirus by blocking outgoing virions from coughs or sneezes of infected individuals. But its ability to protect the wearer from extrinsic infection totally depends on the consistency and quality of the fabric used.

The fabric that is mostly recommended as a standard is the 100% cotton plain-weave. The CDC recommends a double layer 100 percent cotton fabric with high thread count\textsuperscript{34}.

By default, Coronaviruses are pleomorphic spherical-shaped particles with bulbous surface knobs\textsuperscript{35}. The size of the viral particle is about 120 nm (0.12 µm) in diameter. SARS CoV-2 virus specifically has a diameter of 60 - 140 nm (0.06 to 0.14 µm)\textsuperscript{36}. However, the virus is highly contagious when it is engulfed within larger molecules of water or mucus membrane droplets emanating from the mouths and noses. These are constantly forcibly released when people living with COVID-19 cough, sneeze or talk. A homemade mask can stop such larger droplets. SARS-CoV-2 is usually transmitted via respiratory droplets of an infected individual measuring from 10-100 microns\textsuperscript{37}. For the 1-micron sized bacteria used in the Cambridge study\textsuperscript{21}, dish towels were found to be 83% effective at blocking these particles, which was higher compared to the other household materials.

According to the New York Times\textsuperscript{38}, Scientists from the Wake Forest University demonstrates that, “Holding fabric options up to a bright light and choosing something that doesn’t let a lot of light show through”. The scientist examined various homemade masks and identified a couple of combinations that represent the best options to be used. One is the to be a double-fold cotton that has a high thread count of not less than 180, the other will be a double-fold mask of cotton with an outer layer of being a regular cotton and an inner layer of flannel. In addition to the cotton fabric, filters could be used which will enhance its efficiency, HEPA furnace filters, vacuum cleaner bags, layers of 600-count pillowcases and fabric similar to flannel pyjamas, have all been determined to be efficient whilst scarves and bandanna material was found to be less efficient, even though it was capable of blocking some particles\textsuperscript{38}.

But what you need is a strike a balance between breathability and filtration, scientists at Cambridge University evaluated the filtration and breathability of various kinds of house-made mask materials\textsuperscript{31}. It was determined that house-made mask made from pillowcases or a cotton T-shirts were the best in terms of filtration and breathability. Children below two years are not supposed to wear face-mask and people who with breathing problems, unconscious, or anyone who cannot remove their mask by themselves.

**Guidelines to wearing face masks**

Some scientific experts believe that wearing face masks creates a false perception of security and may allow people to become more lax in their prevention approach\textsuperscript{39}. In our opinion, any protection is better than no protection at all. Any type of face masks must be used appropriately and in tandem with all other safety protocols, such as physical distancing and frequent washing of hands with soap under running water. The general population must also be educated on how to use the mask appropriately such as washing hands before holding the face masks, not touching the front, and removing it from the straps over the ears to prevent cross infection with the mask.

**Appropriate use and management of face masks\textsuperscript{10}**

It is not sufficient to just wear face masks; they should be appropriately worn and managed after use\textsuperscript{11}. Whether using a medical or a homemade mask, you must ensure that the mask covers your mouth and nose and ensures a good seal around. Always wash your hands before wearing the face mask. You should not touch the facemask when and after it has been worn. When the mask is touched, hands must be washed immediately\textsuperscript{40}.

Besides appropriate use, medical masks disposal is “essential to ensure they are effective and to avoid any increase in the risk of transmission associated with the incorrect use and disposal of masks”\textsuperscript{39} once they are worn. A single-use mask has a protection period of 3 to 4 hours. Immediately afterwards, it must be removed appropriately, disposed appropriately\textsuperscript{40}, and replaced by a new clean one if necessary. They should be removed from behind without touching the front of the mask and properly-disposed quickly into a closed bin. In case there are unintentional touches, or immediately after removal, hands must be cleaned using an alcohol-based hand rub or soap and water if visibly soiled. Recyclable textile masks can be washed and disinfected either with high temperature (≥+ 60 °C) or by hydro-alcoholic
solution. When not in use, they must be stored out of reach to avoid any contamination38,40.

A social scientist perspective
While we remain enthusiastic that we could possibly reduce spread of coronavirus by up to 70% by the use of face masks31, we also have to be realistic in acknowledging that the wearing of face masks is going to be influenced by the historical and cultural values in each region of the world. In China, face masks were first worn in 1910 during the pneumonic plague when the Wu Liande observed that the plague bacteria (Yersinia pestis) was aerosolised and recommended the use of existing surgeons’ masks by all health workers, patients, their immediate contacts and members of the public41. Not only did the deaths decline, but since then, the face masks have since been used as markers of medical modernity in Chini42. Indeed, in the 20th and 21st century, Chinese and other Asian nationals have used face masks to protect themselves from air pollution as well as disease43. However, outside China and some Asian countries, the wearing of masks can attract stigmatization and may lead to those wearing them being avoided.

Due to the current health risks in open places, the widespread wearing of face masks may serve as an alert mechanism, so that seeing someone with a facemask becomes a reminder and makes one mindful of possible transmission of the virus. But if all individuals are seen wearing masks in public spaces, it lessens the chance of stigmatization for those who are infected and wearing a mask39. Therefore, people wearing masks to protect themselves to avoid close person-to-person contact, are unintentionally via source control, protecting one another4.

In addition to the historical and cultural principles, the economics of masks are wanting. While in some countries, the production of cheap textile face masks and homemade masks is being encouraged to address shortage, other countries have been found to use narratives that discourage general public from purchasing masks so that they are preserved for health workers43. The hoarding of face masks is also a real challenge, especially in low and middle-income countries where the balance between buying a mask and meeting basic needs in times of this crisis is a tough balance44.

Public health views concern who should be prioritized in wearing of face masks. After health workers on the frontline, the second category of people who must wear masks are those who are sick or with any form of symptoms. This category should be followed by those caring for the sick and then everyone else when in public places. But the real concern about the use of face masks by the general public is that they give individuals an illusion of safety and could undermine other preventive measures such as frequent washing of hands, physical distancing and isolation when having any symptoms. In addition, inappropriate use of masks may result in self-contamination from touching a contaminated mask.

Ultimately, the wearing of masks will reduce rate of community transmission, and also, will be a declaration of shared fate, mutual obligation and civic duty during this pandemic. As Christos Lynteris44, a medical anthropologist, rightly puts it, face masks “are apparatuses of categorical transformation aimed at allowing humanity to persist at the brink end of the world as this is embodied by the spectre of the next pandemic”.

Conclusion
Face masks will certainly not eliminate transmission of the coronavirus, but it is a simple mechanism that protects from unintended transmission from an infected or asymptomatic carrier. As we are facing a novel situation with limited alternative prevention measures4, face masks are a level of protection that African countries should consider alongside other measures such as physical distancing and hygiene measures.

During pandemics, health behaviours have the ability to improve one’s health, and the health of others. The appropriate wearing and management of face masks can increase compliance and self-efficacy, thereby empowering people, especially during a time where panic, helplessness and confusion are prevalent. Furthermore, as the pandemic continues in the African region with rising incidence cases and associated deaths45, health authorities in every country must urgently decide on local mass mask wearing adoption and fulfill preparedness to avoid confusion in the anticipated difficulties that lie ahead4. Facemasks may also play an important and crucial role in preventing future outbreaks of the new emerging coronavirus. Importantly, from an economic point of view, especially for African countries which the World Bank has already predicted going towards their first recession3, implementing a partial lockdown that is complemented with multiple preventive measures such as face masks, physical distancing and hygienic practices, enables millions of populations to attend to their everyday sources of livelihoods, most of which are in the informal sector and have been adversely affected by the coronavirus outbreak. Face masks, being an extra layer of protection, will enable citizens to keep looking for a livelihood at the micro level even as the government addresses the socio-economic (and health security) needs at the macro level. Face masks, previously viewed as a luxury and a marker of medical modernity, then become a necessity to enable African economies and populations to remain resilient through this pandemic.

Data availability
Underlying data
No data are associated with this article

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- The paper addresses the effect of face mask wearing under the COVID-19 outbreak with a focus on African countries, highlighting the difficulties (economic, cultural, social) and challenges.

- The paper is well written and covers most of the issues.

- It remains that most arguments to support the usefulness of face masks to control COVID-19 transmission are based on indirect evidence from previous studies on other viruses.

- The social/cultural hurdles could be discussed further to underline why most African country citizens are not as highly motivated/disciplined as in other countries (mainly in Europe and Asia) and if strict regulations and measures will be able to change this "mental' setting.

Is the rationale for the Open Letter provided in sufficient detail?
Yes

Does the article adequately reference differing views and opinions?
Yes

Are all factual statements correct, and are statements and arguments made adequately supported by citations?
Yes

Is the Open Letter written in accessible language?
Yes
Where applicable, are recommendations and next steps explained clearly for others to follow?
Yes

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**Reviewer Expertise:** genomics, epidemiology, statistics, bioinformatics

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.