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### Review Article

## The Non-Pharmaceutical Interventions to Control the Spread of Covid-19

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### ABSTRACT

The COVID-19 pandemic is considered the most crucial global health problem of the 21<sup>st</sup> century and the greatest challenge that affects humans globally. In late December 2019, a new infectious respiratory disease emerged from Wuhan city of Hubei province in China. Since then, it has since spread around the world, thus declared a pandemic on 11<sup>th</sup> March 2020 by the World Health Organisation. The outbreak of the novel coronavirus has become a clinical threat to the common population and healthcare workers worldwide. The intensity and speed with which it struck were almost unimaginable as it turns out to have infected over 327,793,472 people and caused more than 5,539,108 deaths globally as of the 17<sup>th</sup> of January 2022. Likewise, in Nigeria, as of 17<sup>th</sup> of January 2022; 250,929 confirmed cases, 3,103 deaths, and 224,052 recovered had been reported by NCDC, 2022. At the time of writing this review, no approved antiviral chemotherapy is available instead, use of some recommended vaccines by WHO. Therefore, non-pharmaceutical interventions are adopted by the national government as possible preventive measures to mitigate the spread of the virus globally. These measures include total lockdown, wearing of face mask in public, regular handwashing with soap and water, use of alcohol-based hand sanitizers, maintaining social and physical distance and coughing or sneezing into the elbow, and general enlightenment.

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## INTRODUCTION

The coronavirus belongs to a family of viruses that may cause various symptoms such as fever, lung infections, and difficulty breathing (Wan *et al.*, 2020). These viruses are common in animals worldwide, but very few cases have been known to affect humans. The World Health Organization (WHO) used the term 2019 novel coronavirus to refer to a coronavirus that affected the lower respiratory tract of patients with pneumonia in Wuhan, China, on 29 December 2019 (Wang *et al.*, 2020). WHO announced that the official name of the disease caused by the 2019 novel coronavirus is Coronavirus disease 2019 (COVID-19) and was declared a pandemic on 11<sup>th</sup> March 2020 (WHO, 2020).

The novel coronavirus was renamed Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) by the International Committee on Taxonomy of Viruses. This virus was found to have 86.9% nucleotide similarity to bat coronavirus and hence, is suspected of developing from bats (Lu *et al.*, 2020; Wan *et al.*, 2020; Zhu *et al.*, 2020). The COVID-19 pandemic is considered the most crucial global health problem of the 21<sup>st</sup> century and the greatest challenge that affects humans globally (Zhu *et al.*, 2020).

About 210 countries and territories have been infected with major outbreaks in China, South Korea, the USA, Italy, Iran, Japan, etc., tolling millions of cases and thousands of deaths worldwide (Zhu *et al.*, 2020). As of the 17<sup>th</sup> of January, 2022 there are 327,793,472 cases of confirmed infections 5,539,108 deaths globally (ECDPC, 2022). Likewise, in Nigeria as of 17<sup>th</sup> of January 2022; 250,929 confirmed cases, 3,103 deaths, and 224,052 recovered had been reported by NCDC, 2022.

The outbreak of COVID-19 raised intense attention not only within China but internationally (Geo *et al.*, 2020). Due to the

rapid spread of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) through human-to-human transmission, which necessitate adequate knowledge on how to prevent the spread of this novel virus in communities and globally by following precautionary measures, because the case currently continues to rise globally (WHO, 2020).

Treatment of COVID-19 Coronavirus disease is a global challenge, particularly in the rapid increase of critically ill patients with pneumonia and the absence of definitive treatment or curative vaccine worldwide (Lai *et al.*, 2020). Presently no vaccine or specific antiviral drug regime is. Currently, no vaccine or specific antiviral drug regime is. used to treat critically ill patients. The management of patients mainly focuses on the provision of supportive care, like using ventilation, oxygenation, fluid management, and strict adherence to possible preventive measures like social or physical distance, lock down, wearing of face mask, washing hands with soap regularly, use of alcohol-based hand sanitizer, etc., the combination treatment of low-dose systematic corticosteroids and anti-viral and atomization inhalation of interferon have been encouraged as part of critical COVID-19 management (Liu *et al.*, 2020).

## Disease and symptoms of COVID-19

Coronaviruses infect the upper gastrointestinal and respiratory tract of mammals (including humans) and birds. The whole clinical picture of COVID-19 is not entirely known. The occurrence of the illness ranged from mild to severe. SARS-CoV-2 replicates using RNA-dependent RNA polymerases enzyme. This virus can mutate slowly, posing a challenge for its treatment and control. The symptoms of COVID-19 may arise within 2 to 14 days after the

infection. Besides, in some cases, the diseases prevail after 27 days. However, according to Chinese researchers; Li *et al.* (2020) reported 5.2 days as an average incubation period of COVID-19. The duration of the survival of death is 6 to 41 days after infection of the coronavirus, and it depends on the age, health, and clinical conditions of the patients (Wan *et al.*, 2020).

The common signs of infection are fatigue, muscle pain, sneezing, sore throat, dry cough, high fever, respiratory problems, etc., with some severe cases showing pneumonia, serious respiratory syndrome, kidney failure, and even death (Ren *et al.*, 2020, Hui *et al.*, 2020, Huang *et al.*, 2020). The COVID-19 risk is greater in older people, kids, and patients with other health problems like cancer, heart diseases, lung diseases, and diabetes. The pathological conditions of coronavirus include greater counts of cytokines, chemokines, leukocytes, and high levels of plasma pro-inflammatory cytokines and C-reactive protein. The chances are greater of COVID-19 if there is shortness of breath, dry cough, and a person comes in contact with a COVID-19 patient or travelled with COVID-19 affected areas around the globe. Under such a situation, the clinical test for COVID-19 is a must. However, some persons recover easily, some can even contract the virus and recover without any medication, while others may take some time depending on the health conditions and the age of the patients (Carlos *et al.*, 2020).

### **Transmission of COVID-19**

During the last few decades, it was observed that coronaviruses could infect rats, mice, cats, dogs, horses, turkeys, cattle, and pigs. Occasionally, these animals may communicate coronaviruses to humans. The coronavirus is spread by sneezing, cough droplets, and contact. Usually, this virus enters the body through the mouth, nose, and eyes (Transmission of Novel Coronavirus (2019-nCoV), 2020).

It has been reported that the virus may infect a person at a distance of about a 6 feet (1.8 m) radius. The virus can survive for 2 hours to a few days in cough and sneezing droplets lying on the surface or ground. An infection may result from touching an object or surface which already has a virus, but it is not the major cause of the infection. The cellular infection model is very similar to SARS-CoV. The main target of this virus is the lungs, and the virus spikes (binding domains) get attached to the cell receptors of the lungs. These are known as angiotensin-converting enzyme 2 (ACE2) receptors (Jaimes *et al.*, 2020; Wan *et al.*, 2020).

Belouzard *et al.* (2009) reported that a proteolytic cleavage occurs at SARS-CoV S protein at position (S2'), interceding the membrane fusion and viral infectivity. The chances of the infection may arise if a person comes in contact with the infected person. The patients' data in the different countries at different times were analysed, and efforts were made to find out the routes of transmission globally. Consequently, the routes of COVID-19 pandemic transmission are most likely contact with an infected person, touching objects that are being infected with the droplet of the virus on some surfaces (Wan *et al.*, 2020).

### **Non-pharmaceutical interventions for the control of COVID-19**

The aim of this review article was limited only to the non-pharmaceutical measures to prevent the spread of COVID-19. Prevention and management are critical issues in the control of COVID-19. Therefore, there is a great need for the collective efforts of the public and the government. Regular and proper care of the homes and hospitals is critical to control this calamity. Some crucial suggestions may include avoiding travel and collection at a particular place to prevent the spread of the coronavirus.

Public enlightenment on the preventive measures to prevent the spread of coronavirus globally (Ren *et al.*, 2020). Guidelines are available for healthcare providers, medical staff, researchers, and public health individuals (Jin *et al.*, 2020).

The non-pharmaceutical measures against COVID-19 are the most important strategies to control the spread of the virus in the communities. Several countries have taken different public health measures to reduce or delay the community transmission of COVID-19. Since there is no vaccine and specific antiviral drugs so far, non-pharmaceutical interventions or measures are considered an effective tool to mitigate or prevent the spread or impact of the coronavirus globally (Gao *et al.*, 2020). Non-pharmaceutical interventions or measures are essential in controlling the spread of COVID-19; these interventions include hand hygiene (regular hand washing with soap and running water and use of alcohol-based hand sanitizer), respiratory etiquette (wearing of face mask and sneezing into the elbow), social distancing, environmental cleaning using disinfectant, school closures, travel restriction, public information campaigns, contact tracing, and quarantine. Moreover, an infection prevention control measure is similarly important for health care providers using personal protective equipment like a facemask, N95 facemask, face shield, safety goggle, gown, apron, hand gloves, head, respectively (Chen, 2020). The non-pharmaceutical measures below have helped in reducing the spread of COVID-19.

### **i. Social distancing**

Social distancing refers to policies that deliberately increase physical space between people (John Hopkins Medicine, 2020). Such

policies come in many forms, including banning large gatherings, encouraging people to work from home, and closure of non-essential stores such as restaurants and cafes. These policies were implemented across a community or targeted specific at-risk groups such as the elderly and those with pre-existing health conditions. The primary objective of social distancing is to prevent transmission, thereby flattening the peak of the disease. In the short term, this will ease pressure on the health care system while it provides time for new treatments and vaccines to be developed (Anderson, 2020).

Several studies have been carried out to analyze the impact of social distancing on disease outbreaks (Chen, 2020). For example, a systematic review of workplace social distancing found the policy reduces the influenza attack rate (i.e., the proportion of individuals in a population who contract the disease) by 23% in the general population (Ahmed *et al.*, 2018). This is supported by an earlier study which found working-from-home was 'moderately effective' in reducing influenza transmission by 20-30% (Rashid, 2015). Further, during the 1918-19 influenza pandemic, social distancing in Sydney, Australia, is estimated to have reduced the attack rate by nearly 40% (i.e., from 60% to 37%), indicating 22% of the population were spared infection (Caley *et al.*, 2008).

One approach to social distancing is banning mass events (e.g., music festivals or large spectator sporting events). While often seen as a logical element of containment strategies, the evidence suggests that this intervention is most effective when implemented with other social distancing measures (Markel *et al.*, 2007; Ishola and Phin, 2011). This is because contact time at such events is relatively short compared to the

time spent in schools, workplaces, or other community locations such as restaurants. As with different containment strategies, the earlier bans on mass gatherings are enforced, the more significant their impact is (Ferguson, 2020). Several challenges are associated with social distancing. Salient examples include reduced economic activity caused by closures and reduced social interaction (OECD, 2020), neglect of vulnerable populations (e.g., the elderly), and psychological damage such as acute distress disorder, anxiety, and insomnia (Brooks, 2020).

#### **ii. Use of facemask**

Healthy people should wear a mask only when taking care of a person with suspected COVID-19 infection, in public places, worship places, etc—wearing a mask while coughing or sneezing prevents the spread of microbes in the droplet within the community. Face masks are effective only when used and disposed correctly after use, and used in combination with frequent hand-cleaning with alcohol-based hand rub or soap and water. Most face masks are single-use, while some are washable (Chen, 2020).

#### **iii. Hand hygiene**

The hand serves as an important vehicle in the transmission of coronavirus. Frequent touching of the mouth, nose, or eye could recklessly bring the virus in contact with the mucosal surfaces. Hence the most important measure to control the spread of COVID-19 infection is frequent handwashing with soap and water or the use of alcohol-based hand sanitizer. If hands are not visibly dirty, they should preferably be sanitized with alcohol-based sanitizer for 20 to 30 seconds (Zhou *et al.*, 2020). However, if hands are visibly dirty, they must wash with soap and running water for 40 to 60 seconds (Wu, 2020). Hand wash can protect a person from contracting this highly infectious virus and subsequently prevent

the spread of the virus to others. Indirect modes of transmission of COVID-19 are through fomites. Surfaces may get contaminated with infected hands or spills from respiratory droplets. An appropriate disinfection technique with 1.0% hypochlorite solution or 70.0% alcohol can limit the spread of infection (Lai *et al.*, 2020).

Contact precaution prevents direct or indirect transmission from a contaminated surface, fomites, or instruments. Personal protective equipment (PPE) such as masks, gloves, gowns, and goggles are necessary for preventing infection of health care workers. Dedicated instruments (stethoscope, thermometer) should be used for each patient; however, in case of sharing, each instrument must be disinfected with alcohol or hypochlorite solution. Health care workers must avoid touching their mouth, nose, or eye; frequent hand washing and proper training on donning and doffing of PPE are very important to prevent the spread of infection among them (Lai *et al.*, 2020).

#### **iv. School closures**

School closures aim to decrease the number of contacts by school children and thus reduce transmission of the disease throughout the community. There are two types of school closures: proactive school closures before any infection are associated with a school; and reactive school closures in response to a student, parent, or staff member falling ill. School closures, either proactive or reactive, reduce COVID-19 transmission, but with a wide range of effectiveness varying between pandemics, cultures, and settings (e.g., rural or urban), depending on the level of transmission in schools and on the timing of the decision. School closures can, at best, reduce the peak attack rate by approximately 40% (Ferguson, 2020).

In addition, several studies suggest that measures to reduce out-of-school contacts should be implemented alongside school closures. Finally, school closures may need to be maintained throughout the epidemic (Brook, 2020). Several factors modify the effectiveness of school closures. School closures are most effective for infections with a limited rate of spread when they are implemented in the early phases of an outbreak (Chen, 2020).

#### **v. Environmental hygiene**

The evidence to date suggests COVID-19 is primarily spread from person-to-person via small respiratory droplets (GAVI Alliance, 2020). The disease may also be transmitted through fomites, objects that can carry infections. To reduce the risk of transmission through fomites, policymakers may require public and private spaces where infected individuals are likely, or known, to have frequented be cleaned and/or disinfected (e.g. schools, markets, offices, worship places, etc.). This process is referred to as environmental decontamination (ED) and results in contamination levels that do not harm the health of individuals. Given that the causing virus-causing COVID-19 can remain on surfaces for an extended period, cleaning and disinfectant can reduce contamination levels, theoretically, ED can reduce transmission rates (GAVI Alliance, 2020).

The spread of COVID-19 has led countries to implement various ED policies. This is evidenced by the number of governments with online resources dedicated to best practice environmental and disinfection practices (CDC, 2020).

In addition to environmental hygiene, individuals are encouraged to enhance their personal hygiene through handwashing, sneezing or coughing

practices, and the use of protective facemasks. Various studies have shown these non-pharmaceutical interventions can protect individuals by reducing their risk of getting infected with COVID-19 (GAVI Alliance, 2020).

#### **vi. Travel restrictions**

To prevent or delay the entry of COVID-19 into a country, it is common for policymakers to implement several travel restrictions or total lock down. Screening, for example, is common in airports during a disease outbreak and may include thermal scans to identify passengers with a high external body temperature as well as health questionnaires to detect symptoms and possible exposure (by providing information on travel history). Other restrictions include bans on (or advice to restrict) non-essential travel, voluntary or legally mandated isolation upon arrival into a new country as well as border closures. (Ferguson, 2020).

#### **vii. Contact tracing and quarantine**

Contact tracing aims to identify, list, and closely watch people who have been in contact with an infected person, even if they do not display symptoms. This helps the traced persons to get care and treatment early and prevents further transmission of COVID-19 (WHO, 2020). Quarantine (i.e., isolation) can be spent at home, in a hospital, or specifically equipped quarantine centers.

Household quarantine is potentially the most effective measure to reduce attack rates of COVID-19 in the community, but only if compliance is high. Voluntary or self-isolation of infected people is moderately effective. The effectiveness of the contact tracing policy depends on numerous factors. First, it depends on whether infected people and their family

members reduce their contact while ill. Another critical factor is when an infected individual becomes infected with COVID-19. Isolation and quarantine are most effective in controlling the disease if the virus shedding starts after the clinical symptoms. (Hellewell, 2020).

Implementation of contact tracing and quarantine measures bear economic costs and are associated with psychological, legal, and ethical issues. First, contact tracing requires substantial resources to sustain after the early phase of the epidemic since the number of infected people and contacts grows exponentially. While there is no apparent rationale for routine contact tracing in the general population, it may be adapted in some circumstances (e.g., an infected person on an aircraft) (Fong, 2020). In addition, isolation is likely to cause distress and mental health problems, requiring additional services such as creating support lines and advice, helping people develop plans, encouraging messages and calls, and maintaining some routine (Lunn, 2020).

#### **viii. Public information campaigns**

Effective communication is crucial, especially during the COVID-19 pandemic, which is a rapidly evolving situation with little knowledge about the disease. Without it, the many unknowns can give space for rumors to develop and panic to set in (WHO, 2020). On the other hand, it is important to balance preventing panic and encouraging action. These pandemic situations prompted the government into action in public campaigns. An important element of campaigns about COVID-19 after the closure of schools, workplaces, markets, etc., is an integrated mass media campaign. This campaign included advertisements in all the native

languages, in newspapers and on television, a dedicated website, a toll-free hotline, short messages, booklets, posters, and stickers. At the local level, town councils and other organizations organized discussion sessions and demonstrations for residents to prevent the spread of COVID-19 globally (Fong, 2020).

#### **Clinical Implications of Non-pharmaceutical measure**

A face mask may get dampened as a result of breathing, and when there is excessive moisture, unfiltered air is inhaled and exhaled around the edge. The risk of spreading pathogens may be increased due to improper use of a mask. There is a theoretical possibility of an airflow obstruction when wearing a mask. Some types of the mask can lead to CO<sub>2</sub> retention (hypercapnia) can occur with side effects (Matuschek *et al.*, 2020).

Prolonged isolation can adversely affect physical and emotional health, altering sleeping patterns, causing depression as well nutritional rhythms (Pietrabissa and Simpson, 2020).

Although, COVID-19 has a negative impact on all elements of health; social, physical and mental. Pharmacotherapy and protective measures such as isolation, wearing masks, maintaining physical distance, space, etc., did not give the expected results. Vaccination has not yet led to herd immunity, so it is still jeopardizing every aspect of human health. Non-pharmacological methods, such as stress and sleep control, physical activity, and contact with nature, are of great importance since they can significantly contribute to staying healthy during a pandemic (WHO, 2021).

## CONCLUSION

The emphasis given by the national governments on non-pharmaceutical intervention strategies has positively reduced the transmission/spread of the virus globally. The measures have proven to be effective not only in slowing but also in curbing the epidemic spread, reducing the peak health care demand, and curbing protecting those most at risk of severe disease from infection. These interventions have also reversed the epidemic growth of the virus, lowering the number of cases and maintaining situations indefinitely nationwide. Although proven to be effective in reducing the transmission, these measures may also interfere with the economic

activities and food security of many nations, as the interventions are only needed for a relatively short term but can be reintroduced if or when case numbers rebound. Also, there is an urgent requirement to educate our new generation for science and technology to fight against any such disaster in the future, if any. Likewise, strong public health infrastructure is mandatory to think proactively for future preparedness, development, and research against emerging and re-emerging infectious diseases. Investment for capacity building is crucial for rapid response through regional and global scientific and political collaboration to fight against future pandemics like COVID-19.

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