Possible preventive measures against the spread of COVID-19- A Review article

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ABSTRACT
COVID-19 is a current sensational and dangerous threat that affects millions of people across the world. As the day progresses the rate of growth of COVID-19 drastically increases. No vaccine or specific antiviral drug are active against corona, therefore, preventing the exposure to the virus is the base of support against its spread across the world. Despite the implementation of preventive measures, the rate of virus-infected cases progressively increases which stimulates our thought process to raise a question, whether the preventive measures that we follow are effective against the spread of COVID-19 infection. Evidence from previous literature obtained from various online tools implies multiple preventive measures that should be followed and also illustrates their mechanism of action against the active spread of COVID-19 infection. According to the results from the evidence, we can identify the gold standard preventive measure among the described preventive measures. The precautionary measure encompasses both pharmaceutical interventions and non-pharmaceutical interventions among which non-pharmaceutical measures are superior in the prevention of the developing pandemic. Among the non-pharmaceutical interventions, social distancing is the paramount to other measures in the mitigation of the spread of viral infection.

INTRODUCTION
Coronavirus disease 2019 is a rapidly growing pandemic. This respiratory illness is caused by an RNA virus belonging to a family Coronoviridae called severe acute respiratory syndrome virus-coronavirus-2(SARS-CoV-2) which commonly affects humans and produce many complications (Richman et al., 2017). In December 2019, there were vast admissions of patients in Wuhan, a city in China with pneumonia of unknown origin. After undergoing many kinds of research, it was found to be a new variant of SARS-CoV virus which rapidly replicated and became the world pandemic (Bogoch et al., 2020). Fever, fatigue, cold, cough, diarrhoea, dyspnea, dizziness, headache, haemoptysis were the common symptoms of COVID-19 (Rothan and Byrareddy, 2020; Din and Boppana, 2020). Recently asymptomatic cases of COVID-19 are also reported all over the world, especially in Tamilnadu. As this strain of the virus is a brand new to the community and medical field, no vaccines are active against COVID-19; however, WHO insisted that the symptoms of this virus can be treated according to the patient’s clinical
Therapeutic interventions in treating COVID-19 include chemoprophylaxis with hydroxychloroquine and its precursor chloroquine which are available drugs recommended by Indian Council of Medical Research, under the Ministry of Health and Family welfare (Rathi et al., 2020). Recently the US government allows the use of an investigational antiviral drug called Remdesivir for treating COVID-19 infection. This drug has an increased rate of recovery from COVID-19 infection.

Prevention is better than cure which is considered as our current most excellent way to win a victory over COVID-19. The best method for preventing the disease is to avoid our exposure to the virus. The contact of a droplet transmits SARS-COV-2 virus from the infected patients, or their fomites (World Health Organisation, 2020) and other modes of transmission are also suggested but as of now human to human transmission is more common. According to their mode of transmission, preventive measures are established which includes the usage of face masks, sanitisers and disinfectants, social distancing, community lockdown, quarantine of suspected individuals and persons from other countries due to their higher probability of transmission of the virus (Ebrahim et al., 2020). China, being the birthplace for COVID-19, now successfully mitigated the spread of COVID-19, after implementation of major non-pharmaceutical interventions. The interventions contain three measures, namely, (1) Restriction of intercity travels (2) Early identification and isolation of suspected cases (3) Social distancing (Lai et al., 2020; Feng et al., 2020). Immunity also plays a part in the prevention of COVID-19 infection. “Boosting our immunity” with immunity enhancing foods is not a promising idea since boosted immunity implies that our immune system works in a high gear which may lead to autoimmune disorders (Desai and Mehrotra, 2020). Instead, we require “Balanced immunity” against the viral infection that maintaining the immunity without letting them decrease. We should plan our diet with balanced immunity, not focusing on only one food that increases immunity. (Campbell, 2020) Traveling also contributes a significant part in the transmission of the COVID-19 infection from one region to another region. Banning different modes of transportation may help in the interruption of transmission of infection. This may lead to the reduced migration of infected people from one region to another region, thus decreasing the spread of disease (Tian et al., 2020). Social distancing, a preventive measure proposed almost by all countries to minimise the exposure of infection. This measure was taken by the countries which mitigated the spread of the viral infection. Two methods do social distancing, Individual social distancing, which includes ways of isolation of suspected cases, quarantine of contacts of the suspected individual, Stay at home measure. Social distancing involving multiple persons which provides for methods of the closure of educational institutions, workplace closure, mass gathering cancellation like national and international sports events.

Hand hygiene is one of the efficient ways against the spread of COVID19. Washing hands with soap water are not possible every time and everywhere, therefore; Hand sanitiser is used over them. Two types of hand sanitisers are available, alcohol-containing sanitisers and alcohol-free sanitisers. Not all sanitisers are effective against COVID-19, alcohol-containing alcohol sanitisers are only effective against most of the viruses and bacteria (Din and Boppana, 2020).

Wearing face masks are also a current method used against virus transmission. Face masks are designed for the prevention of respiratory diseases transmitted from one person to another person through infected droplets. This face mask is also considered as a type of personal protective equipment (Desai
Wearing face masks helps in the prevention of transmission of viral infection for both wearer, and another person in the society in case wearer is affected by a viral infection (Seale et al., 2009). Can these preventive measures effectively protect us against the spread of COVID-19? This article is based on the probability of effectiveness of some measures against COVID-19 and the mechanisms by which the preventive measures especially wearing face masks, sanitisers and maintaining social distancing, pharmaceutical interventions act against COVID19 and the identification of paramount precautionary measure among the above-described measures.

MATERIALS AND METHODS

The material used was online tools to review publications, journals and articles related to recent world pandemic COVID-19 referred from Google scholar, PubMed, nature research, International journal of research in pharmaceutical sciences and other available sites. The method is about comparing those articles and getting concluded with the best way of prevention against COVID-19.

DISCUSSION

Social Distancing

The term social distancing includes efforts taken to minimise physical contact between people in society to interrupt the transmission of COVID-19 infection (Niud and Xu, 2020; Adolph et al., 2020). Initially, this effort has no surety of controlling disease; however, excellent results of these methods in early pandemics like influenza made them be implemented (Institute of Medicine, 2006). Later, social distancing considered being the key measure as it aims at decreasing the chance of contact between an infected and a healthy person in society (Fisher and Wilder-Smith, 2020). A mass gathering of people, social events like marriage, family function, educational institutions, workplaces and entertainment venues which includes heavy crowd gathered in a close confined space, where the respiratory infections are most likely to be transmitted (Rothe et al., 2020). Social distancing plays a vital role here by withholding a simple mechanism, of restricting the frequency and contact between person-person in a community by which it prevents a person from the exposure of virus from another individual (Kelso et al., 2009). The community may include healthy individuals, symptomatic individuals and an asymptomatic individual who were not aware of virus carried by them (Rothe et al., 2020) Hence this measure is required for the mitigation of spread of COVID-19. The implementation of social distancing should be even among society, for example, closure of schools, public playgrounds first because children are more vulnerable to the COVID-19 and not the closing of working venues for economical purpose is not beneficiary (Ebrahim et al., 2020). Social distancing is a major nightmare for the people below the poverty line as it affects them economically due to the closure of workplaces. But to overcome the transmission of a deadly virus, everyone must maintain social distancing in the community. As it was described earlier, social distancing includes two types, results of many kinds of research on social distancing reveals that implementation of combined social distancing without delay and following it effectively for a long time plays a significant role against the further spread of this respiratory ill-
ness (Kelso et al., 2009). Many pieces of evidence imply that growth rate of the virus in China declined after the implementation of social distancing whose results implemented social distancing for the mitigation of virus spread in other countries like Singapore, Bahrain, Iran, Kuwait (Hatchett et al., 2007). Although this measure as some snag on the psychiatric and economic wellbeing of an individual, it is a valuable measure for prevention of dreadful virus SARS-CoV-2 (Yezli and Khan, 2020).

Sanitiser

The transmission of COVID-19 occurs from infected droplets from an affected person. In a community, where asymptomatic person survives, it is better and safe for us to maintain perfect hand hygiene by washing our hands frequently. It is also advisable to maintain hand hygiene before, and after personal protective equipment, therefore transmission of COVID-19 can also be effectively interrupted with a perfect method of hand hygiene. Hand hygiene can be acquired by washing hands with soap and water for about 40-60 seconds, and there exists another way by using alcohol-containing hand rub called sanitisers. According to WHO “It is a preparation containing alcohol used for hand hygiene to inactivate or depress micro-organism or to prevent their growth temporarily”. Initially, hand sanitisers became preferable than soap water washing in a health care setting (Hall, 2012). Recently, due to massive violation of COVID-19 hand sanitisers have become well-liked in the community setting too. However, these hand sanitisers are not effective against all micro-organisms WHO insisted that use of sanitisers are beneficially against COVID-19. The WHO suggests two formulations of alcohol-based sanitisers against COVID-19, First formulation contains ethanol-80% vol/vol (by volume), glycerine-1.45% vol/vol and hydrogen peroxide-0.125% vol/vol. Second formulation contains isopropanol-75% vol/vol, glycerine-1.45%vol/vol, hydrogen peroxide-0.125% vol/vol (Kingsland, 2020). Centre for disease control and prevention suggests that a hand sanitiser is effective against COVID-19 virus only if contains about 60% to 95% of alcohol content. Alcohol-based hand sanitisers withhold a simple mechanism of killing microbial cells. The alcohol content such as ethanol, isopropanol kills or inactivate the virus by degrading or denaturing the outer protein coat of the virus and by dissolving their membranes. CDC and WHO suggests the use of hand sanitiser only as an alternative to soap water hand washing. Sanitisers are still stumbling block because of several reasons. If we use hand sanitiser every day, it may affect our body microbiomes, impairs our immune system, leads to antibiotic resistance. (WHO, 2014). Alcohol-based sanitisers should be used wisely; the method of washing hands with sanitiser include certain steps which is also depicted in pictorial representation in Figure 1.

Face Masks

Face masks are generally worn by individuals working in a health care setting to avoid the exposure of airborne infectious micro-organisms from the patients and to avoid infections to the patients. At present usage of surgical masks (face mask) and N95 purifiers are increased due to COVID-19. Usage of masks against the huge pandemic COVID-19 became popular due to the evidence of usage of those masks in earlier respiratory Pandemics like Influenza. The people in different society use diverse types of masks against the spread of the virus. Types of masks used in the battle of COVID-19 includes Surgical masks, N95 respirators and cloth masks (home-made masks). The mechanism by which distinct kinds of masks acts against the virus are illustrated below: A surgical mask is a loose-fitting mask that protects the wearer from micro-organisms acting as a barrier for large infected droplets and filters larger particles present in the air (COVID-19, 2020). This surgical mask should be discarded once it gets moistened and should use only once. (World Health Organisation, 2020) The N95 mask is a tight-fitting mask mostly used in a medical setting which acts by filtering out small as well as large particles including aerosols. It is made of several layers which are efficient in filtering out the tiny particles. The above-described masks contain fibrous nature which involves three mechanisms for the capture of the large and small particles. Two mechanisms inertial impacting, interception is responsible for the capturing of large particles, and a third mechanism called diffusion is responsible for the collection of small particles (CDC, 2020). As the N95 respirators are also made up of electrostatically charged particles (Henneberg, 2020), it also includes an additional mechanism of electrostatic attraction. Cloth masks are least protective, which prevents the droplets from the infected patient to others in the community. It is also readily available. These are designed mainly to cop up with the running out of stock of surgical masks that are allotted for health care workers.CDC recommends only the use of surgical mask among the society and does not support the use of N95 purifiers which can be preferable and mandatory in a health care setting. Due to economic and commercial purpose, cloth or homemade face masks have become well known in society. Both surgical and cloth mask protect against transmission of the virus by reducing the expelling of micro-organism from infected individuals. Still, a
surgical mask was three times more efficacious in defending the transfer of COVID-19 than the cloth mask (Howard et al., 2020). "Wearing a face mask is effective against COVID-19?" This is an ongoing controversy where there is no lot of evidence to support the effectiveness of masks against COVID-19. Masks are useful in this respiratory illness as it prevents the exposure of droplets or micro-organism from infected or suspected individuals to society. Since COVID-19 is also known to be transmitted from asymptomatic individuals, all people should wear a face mask as a preventive measure (Feng et al., 2020). Mask wearing is not preferable due to the improper handling of them among people which could lead to the acquisition of infection. Because of most of the people are unaware about the proper usage of masks they may often remove them while eating, touching the outer part of used mask which may cause the exposure of the virus, reusing the used masks without proper hygiene and improper disposal of the used masks (World Health Organisation, 2020). Wearing a face mask against COVID-19 is considered as a practical measure when it is accompanied by proper hand hygiene and social distancing. Wearing and disposable mask require more caution. The appropriate method of wearing a mask is illustrated in Figure 2 (World Health Organisation, 2020).

Banning Transportation

On implementation of social distancing, it is advisable to ban different modes of transportation which are also a non-pharmaceutical measure in the prevention of virus spread. Transportation leads to the migration of infected persons from an infected region to a non-infected area that causes widespread of the disease across a region. China implemented travel restrictions quite late, where most of the infected patients have already travelled to almost significant parts of the country and across the world (Chinazzi et al., 2020). Epidemiological models suggest that a travel ban in Wuhan helps in the interruption of international spread by 77% in early February (Nowrasteh, 2020). The significant drawbacks of implemented travel restrictions were, The accomplishment of travel restrictions was delayed, Allowance of people from China into their countries, delay of effective measures like social distancing NO (Nowrasteh, 2020). Travel restrictions slowed down the spread of the virus. If travelling is unavoidable, then it should be done with certain precautions. The traveller should maintain about 6 feet distance.

In contrast, travelling and should maintain their hand hygiene with an awareness of not spreading the disease to someone or get affected by the disease during travelling (CDC, 2020). The government should also take necessary measures with the person who immigrates into the country or a region. This includes Screening at the entry points which screens the person whether symptoms of COVID-19 exists, they also should be isolated for about 14 days because the person may be an asymptomatic carrier of the virus.

Pharmacological interventions

Current pandemic COVID-19 has no effective vaccine against their action; therefore, the pharmacological interventions are just supportive measure in the management of a viral disease. No specific antiviral drug exists against COVID-19, which leads to use of other antimicrobial medicines and drugs for symptomatic relief. The regimen often includes antiviral drugs, corticosteroids and other anti-inflammatory drugs for the management of the disease (Wu et al., 2020). Clinical trials suggest the usage of various antiviral drugs in the management of the viral infection like hydroxychloroquine, Lopinavir-Ritonavir, Umifenovir, Favipiravir (Wu et al., 2020). Initially, hydroxychloroquine and its Prodrug chloroquine are majorly used against COVID-19 where lately remdesivir are also included in the list of antiviral drugs acting against COVID-19. Chloroquine and hydroxychloroquine are the antimalarial drugs used against COVID19 from the evidence of usage of chloroquine in new SARS pandemic (Katelyn et al., 2020). SARS-CoV-2 acts binding to Angiotensin-converting enzyme-2 receptor, which was described in several studies. There are several mechanisms of action of chloroquine and hydroxychloroquine against COVID-19, one of such mechanism include, prevention of binding of the virus to the ACE receptor by inhibiting terminal glycosylation (Vincent et al., 2005). Hydroxychloroquine contributes to the antiviral effect by preventing the binding of the virus to ganglioside receptors which also further prevents the Angiotensin-converting enzyme receptor being bounded to the virus (Fantini et al., 2020). As all drugs lead to some adverse effects, these drugs also cause cardiac risks like arrhythmias, QT prolongation (Borba et al., 2020). Therefore, the use of this antiviral drug requires caution.

Remdesivir, an antiviral drug developed against Ebola virus, is also now employed against COVID-19 after some clinical trials which show 30% faster recovery than other medications.

SARS-CoV-2, which is an RNA virus replicates its genome by the enzyme called RNA-dependent RNA polymerase (RdRp). Remdesivir is a prodrug which gets converted to its active metabolite called
remdesivir triphosphate that is similar to adenosine triphosphate. This adenosine triphosphate helps the virus in the replication of its genome. Due to the similarity of ATP with remdesivir triphosphate, virus uptakes the active metabolite of remdesivir, which causes the inactivation of the enzyme RdRP (Schmidt, 2020). This remdesivir has data that shows their effectiveness in suppressing the time of recovery in patients (Gallagher, 2020).

These are the most popular used pharmacological interventions against the prevention and management of COVID-19.

**CONCLUSIONS**

The current epidemiological data from all over the world reveals that COVID-19 holds high to moderate mortality rate than other respiratory illness like influenza. Due to a lack of an active vaccine for the inactivation of the virus, preventive measures should be followed stringently. Between non-pharmaceutical measures and pharmaceutical measures, non-pharmaceutical measures play a vital role in the prevention of exposure to the virus. In contrast, pharmaceutical measures involve minor participation in avoiding the exposure of virus as they contribute their significant part in the management of COVID-19 affected individuals or suspected individuals. And, there exists a high probability of development of resistance to an antiviral drug; therefore, it is advisable to prefer over non-pharmaceutical measures for the mitigation of virus spread. The importance of social distancing is more because of their effective role in the prevention of transmission of the virus from asymptomatic individuals. Other measures like banning transportation also become effective in case of their association with social distancing. Face masks are not isolated measure in mitigation of viral spread. It should always be associated with maintenance of hand hygiene and social distancing. Therefore “SOCIAL DISTANCING” is considered as the gold standard measure among all the preventive measures against the spread of COVID-19. Although all precautionary measures withhold disadvantages in their implementation, everyone needs to follow preventive measures rigorously to set free the world from the hands of COVID-19.

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