

# Prevention of Transmission of SARS-CoV-2 Infection: A Review

<sup>1</sup>Selasih Putri Isnawati Hadi, <sup>2</sup>Cipta Pramana, <sup>3</sup>Agus Supinganto, <sup>4</sup>Kholis Ernawati, <sup>5</sup>Lenny Irmawaty Sirait, <sup>6</sup>Nur Aini Staryo, <sup>7</sup>Nurhidayah

<sup>1,2</sup> Institut of Health Science Guna Bangsa, Yogyakarta, Indonesia

<sup>2</sup> Obstetrics and Gynecology Department, Faculty of Medicine Tarumanagara University, Jakarta Indonesia

<sup>3</sup> YARSI Institute of Health Science, Mataram Nusa Tenggara Barat, Indonesia

<sup>4</sup> Faculty of Medicine Universitas YARSI, Jakarta, Indonesia

<sup>5</sup> Medistra Institute of Health Science Indonesia, Jakarta, Indonesia

<sup>6</sup> Public Health Department, Universitas Respati, Yogyakarta, Indonesia

<sup>7</sup> Mitra Institute of Health Science RIA Husada, Jakarta, Indonesia

## Correspondence:

Selasih Putri Isnawati Hadi

Institut of Health Science Guna Bangsa Yogyakarta, Indonesia

Email: selasih.pih@gunabangsa.ac.id

## ABSTRACT

Coronavirus 2019 (2019-nCoV) or often known as COVID 19 is a new virus that has spread to all parts of the world, including Indonesia. These days the case is increasing. Efforts to break the COVID-19 are continuing to break the chain of distribution. Many non-pharmacological efforts that can be done as prevention efforts in breaking the Covid-19 distribution chain include maintaining social distance, physical distance, quarantine, increasing the role of mass media, trying to improve public health by familiarizing themselves with a culture of health protection, and use of personal protective equipment (PPE) according to standards for health workers. The case of COVID-19 continues to grow, the number of events is increasing every time, there needs to be cooperation between the community, health workers and the government.

**Keywords:** Social distance, Physical distance, Personal protection equipment

## INTRODUCTION

Coronavirus 2019 disease or often known as COVID 19 is a new mysterious disease from Wuhan, Cina.[1] This disease was first considered as pneumonia with unidentified etiology. However, due to the advance in technology, the cause of this disease was announced by the Chinese Center for Disease Control and Prevention (CDC) on January 8, 2020, as a new coronavirus and not existed before.[2] The more days pass, the wider the virus has spread, eventually, on January 31, 2020, World Health Organization (WHO) declared that COVID-19 is a state of public health emergency and becomes a high-risk international concern. In global, the COVID-19 spread is rapidly increasing, even on March 11, 2020, WHO established COVID-19 as a pandemic after the virus spread up to 114 countries. [3,4]

Most COVID-19 cases only indicated mild symptoms that can be detected only after hundreds of accumulative and fatal cases. These cases usually can be recognized after 5 to 8

weeks later, which might occur recently during the COVID-19 outbreak in Iran, South Korea, Italy, and the USA, even in Indonesia. [5] The COVID-19 virus spreads globally and very rapidly. The transmission of this disease is estimated through droplets or contact with positively infected people of COVID-19.[6] While most people positive for COVID-19 suffer from mild diseases or without any symptoms, in 14% of people, this disease becomes severe requiring them to be inpatient with oxygen support and 5% needs ICU (Intensive Care Unit).[7]

The first case of Covid-19 in Indonesia was reported on March 2, 2020. [8] Meanwhile, the first adult Covid-19 case in Semarang was reported on March 17, 2020. [9], and the neonatal Covid-19 case was reported on April 3, 2020. [10] As of February 3, 2021, there were 104,480,575 confirmed cases of Covid-19 worldwide (covering 221 countries), 2,264,877 deaths. For Indonesia, it was confirmed that Covid-19 had 1,111,671 and 30,770 people died.[10]

There are six species of coronavirus that have been identified to cause infection to humans. Four of them cause flu in immunocompetent individuals, and two of them cause SARS infection (Severe Acute Respiratory Syndrome) and MERS-CoV (Middle East Respiratory Syndrome Coronavirus). The two types of virus attacked in 2002-2003 in Guangdong China and 2012 in the Middle East. The management of coronavirus has not been exactly found. The medication of coronavirus is symptomatic, supportive, and placed in the isolation room. There has been no specific antiviral for this coronavirus. There has been no vaccine to prevent infection. Therefore, initial identification and prevention are very important.

Considering that the virus spread is very rapid, while there has been no vaccine, the only attempt to prevent the widespread of this virus and to minimize the number of patients is through prevention. The spread of coronavirus can be avoided and controlled through some efforts, for example, wash hands with soap and water for at least 20 seconds, avoid touching face, nose, eyes, and mouth too often, avoid the direct contact with sick people, cover with a tissue when coughing or sneezing, keep the environment clean, and call the health workers if having direct contact or showing symptoms.[12] Other actions and efforts as the prevention to cease the chain of COVID-19 spread are social distancing, physical distancing, doing quarantine, enhancing the roles of mass media to raise public awareness by getting used to a healthy lifestyle, and using PPE based on the standard for health workers.

Vaccination is an effective means of preventing viral infection, stopping transmission of it, and developing herd immunity. Currently, more than 115 vaccine candidates have been developed from various technology platforms with some of them in clinical trials. Most of these vaccine candidates were developed based on experience with other coronaviruses with the aim of inducing neutralizing antibodies against the virus' spike protein or its different receptor binding domains.<sup>13</sup>

## EPIDEMIOLOGY

Since the first case in Wuhan, there has been an increase in COVID-19 cases in China every day and reached its peak in the end of January to the beginning of February 2020. At first, most of the reports were from Hubei and the surrounding provinces, spreading to other

provinces and throughout China.[14] On January 3, 2020, there were 7,736 confirmed cases of COVID-19 in China, and 86 other cases were reported from various countries such as Taiwan, Thailand, Vietnam, Malaysia, Nepal, Sri Lanka, Cambodia, Japan, Singapore, Saudi Arabia, South Korea, the Philippines, India, Australia, Canada, Finland, France, and Germany.[15] Currently, per April 8, 2020, coronavirus disease has spread to 209 countries including Indonesia. It has infected 1.434.861 (one million four hundred thirty-four thousand eight hundred sixty-one) people and 82.159 (eighty-two thousand one hundred and fifty-nine) deaths.[16]

In Indonesia, the first infected case of COVID-19 was on March 2, 2020, there had been no case identified before. However, over time, the number of cases rapidly increases. Currently, the number of cases is up to 2,378, and the deaths are 221 of people (8%).[16] A COVID-19 virus is a unique virus currently emerging in the world. This virus becomes a pandemic and triggers global health problems. Numerous prevention efforts of COVID-19 are carried out thoroughly by ceasing the spread chain. The aims of these preventive interventions are reducing/ suppressing the spread of COVID-19, limiting the impact on health services, especially hospitals and intensive care units, to ensure access to high-level care when needed.

## TRANSMISSION

Novel coronavirus 2019 (SARS - CoV-2), which originated in Wuhan, China, has gained worldwide attention. The Chinese government has taken emergency steps to control the outbreaks and the initial procedures in the diagnosis and treatment of the novel coronavirus 2019 (COVID-19) infection. However, SARS-CoV-2 has a very strong infectious pathogenicity and infectiousness than SARS-CoV and MERS-CoV and still has many unsolved questions, for example, whether the virus can be transmitted by asymptomatic patients or by mothers to their babies.[17]

Some case reports indicate suspected transmission of an asymptomatic carrier, but the exact mechanism is unidentified. Cases related to transmission from asymptomatic carriers generally have a history of close contact with COVID-19 patients. A previous study reported a 10-year-old boy with COVID-19 infection, despite no symptoms but abnormality on chest CT examination. If the findings of this report are true that transmission can occur from asymptomatic people, prevention of COVID infection will be very difficult. However, the results of this study require further research.[18]

Moreover, a study reported that COVID-19 infection can be transmitted through eyes. On January 22, 2020, Guangfa Wang, a member of the national committee on pneumonia, reported that he was infected by Covid-19 after investigating outbreaks in Wuhan. He put an N95 mask but didn't wear eye protection. A few days before suffering from pneumonia, Wang complained of red eyes. Infected droplets and body fluids can easily contaminate the human conjunctival epithelium. Therefore, it is suspected that the respiratory tract may not be the only route of COVID-19 transmission.[19] The transmission of COVID-19 infection through

The transmission of Covid-19 infection through intrauterine in pregnant women remains unclear. The research by Chen H. et al reported that 9 pregnant women who

underwent labor, then examined newborn neonates by taking a sample of amniotic fluid, umbilical cord blood, and throat swab samples to ascertain the possibility of fetal infection during cesarean section, to guarantee that the sample is not contaminated and highly represents the condition of the intrauterine fetus. The results showed that no SARS-CoV-2 infection was found in all samples above, indicating that no intrauterine fetal infection occurred due to the mother's infection of COVID-19 during the later stages of pregnancy. This finding is in line with the studies on pregnant women infected with SARS, claiming there is no evidence of transmission of intra-uterine infection.[20]

SARS-CoV-2 is proven to infect the gastrointestinal tract based on the biopsy results in gastric, duodenal, and rectal epithelial cells. The virus can be detected in feces, even in 23% of patients, it was reported that the virus remained detected in the feces although it was not detected in the respiratory tract. These two facts corroborate the possibility of fecal-oral transmission.[21]

A study conducted in Singapore revealed that extensive environmental pollution is in the rooms and toilets of patients with COVID-19 with mild symptoms. The virus can be detected in door handles, toilet seats, light switches, windows, cabinets, to ventilation fans, but not in air samples.[22] Other studies reported that aerosol and fomite transmission of SARS-CoV-2 is possible and reasonable because the virus can survive and transmit in aerosols for hours and on the surface for several days.[23]

## **CEASING THE CHAIN OF SPREAD**

### **1. Social distancing**

One of the easiest ways for people to reduce the risk of infection during this pandemic is to lower contact with an infected person.[24] This is a non-pharmacological intervention called social distancing. Social distancing is one of the attempts to limit oneself from making contact with everyone. Social distance has been effective in past disease epidemics, limiting human-to-human transmission and reducing morbidity and mortality, including breaking the chain of COVID-19 spread, which can be done by the community.[25] Community movements during social distancing need support from the community itself.

CDC continues to study the spread and effects of new coronaviruses throughout the United States. We know from the recent research that most individuals with coronavirus have no symptoms ("asymptomatic"), even those who eventually develop symptoms ("pre-symptoms") can transmit the virus to others before showing symptoms. It means that the virus can spread among people who are interacting in a close range - for example, talking, coughing, or sneezing - even if the people have no symptoms. [26, 27]

#### **Definition of social distancing**

Social distancing sometimes called "physical distancing," means keeping the distance between a person with another outside the house. To practice social or physical distancing, do as follows:[27]

- Live at least 2 meters away from others
- Don't gather in groups
- Avoid crowded places and mass gatherings

When COVID-19 spreads in our area of residence, everyone must limit close contact with individuals outside the house, both indoor and outdoor. Because people can spread the virus before they reveal they are sick, it is important to stay away from others if possible, even if the people have no symptoms. Social distancing is very important for people who are at high risk of becoming more severely ill.

Actions to achieve public health goals may include quarantine, which involves movement limitations, or separation from the population, healthy people who may be exposed to the virus, aiming to monitor their symptoms and ensure early detection of cases. Many countries have the legal authority to enforce the quarantine. Quarantine must be implemented only as a part of comprehensive public health responses and preventive measures, following Article 3 of the International Health Regulations 2005, it must fully respect the dignity, human rights, and basic individual freedoms.

COVID-19 spreads mainly among people who have been in close contact (within 2 meters) for a long time. The spread occurs when an infected person coughs, sneezes, or talks so that the drops from their mouth or nose come out into the air and land on the mouths or noses of people nearby. Also, droplets can be inhaled into the lungs. Recent studies show that infected but have no symptoms may also have a role in the spread of COVID-19.

An individual can have COVID-19 by touching a surface or an object that has a virus on it, then touching her/his mouth, nose, or eyes. However, it is not considered the main way of spreading the virus. COVID-19 can live for hours or days on the surface, depending on factors such as sunlight and humidity. Social distancing helps limit contact with infected people and contaminated surfaces.[27]

Although the risk of severe disease may be different for different people, anyone can spread COVID-19. Everyone has a role to slow down the spread and protect themselves, their families, and their communities. However, several effects need further investigation because of social distancing, including its effect on the national economy. The results of research in China indicated that early intervention of social distance can significantly reduce the spread rate, and there is a need for early steps decided by a country in implementing social distancing.[24] Efforts in conducting social distancing include canceling face-to-face meetings, reducing the use of public transportation, providing opportunities to work at home and having online teaching-learning.

Policies at the workplace can be realized through no handshaking policy, postponing meetings and replacing them with online meetings, providing hand sanitizer in strategic places, limiting the use of eating and drinking equipment alternately at the office, applying the concept of healthy living behavior, applying the coughing and sneezing ethics, cleaning office environment, disinfecting the surface of things often touched by people, giving permission to unhealthy staff, making policies that allow staff to work at home, assessing the risk of staff travel.[7]

Policies at school can be realized by providing hand sanitizers in strategic places, applying coughing and sneezing ethics, postponing direct in-group activities, doing the learning process at home for example by using an online system, applying the concept of healthy living behavior, giving permission to unhealthy students who are not healthy.[7]

Social distancing which was conducted at the national level in China led the State Council to extend the Spring Festival holiday in 2020, all parts of the country actively cancel or delay activities such as sporting events, theaters, and schools as well as universities. Companies and institutions are closed. The Department of Transportation prepares thousands of health and quarantine service areas nationally at the passenger entrance and exit in the station. Hubei Province adopts the most strict traffic control actions, such as urban public transport suspensions, including subways, ferries, and long-distance passenger transportation. Every citizen must wear a mask in public. As a consequence of all these actions, public life is greatly reduced.[28]

## **2. Physical distancing**

The next effort to prevent the COVID-19 transmission is to do physical distancing which means minimizing physical to reduce contact from person to person that can spread the disease. This action is expected to help protect others, especially to vulnerable groups, reduce the number of infections and reduce the intensity of the pandemic.[29] WHO has recommended physical distancing by limiting social activities in public spaces, closing public institutions, and private companies with a strict curfew in several countries.

A study stated that physical distancing is highly influenced by empathy and motivation. Empathy is very important especially for groups vulnerable to viruses. Each individual should have the empathy to bring up motivation in doing physical distancing. Therefore, everyone can use this empathy to encourage motivation to obey physical distance.[30]

COVID-19 pandemic evokes unique challenges for worldwide people. In history, most of the global social crises (e.g., financial crisis in 2008) can be successfully handled through political intervention, and citizens remain calm and do their activities as usual. However, the current epidemic crisis is very different. To prevent the transmission of infection, there must be rapid changes in people's behavior and habits. In particular, citizens need to get involved quickly in physical distancing" which is reducing and minimizing close contact with others. Physical distance can reduce the chance of an infected person spreading the SARS-CoV-2 virus to an uninfected person. Keeping your distance does not only protect yourself but also has a prosocial aspect that helps protect others especially the most vulnerable group from the virus infections.[31]

## **3. Quarantine and Isolation**

To improve the prevention and control of the COVID-19 epidemic, there are several questions concerning the effect of non-pharmaceutical interventions of social distancing and epicenter lockdown need to be addressed. With use the developed a data-driven susceptible-exposed-infectious-quarantine-recovered (SEIQR) model of the COVID-19 epidemic in Wuhan, Hubei Province, and other provinces in China to investigate these questions.[32]

The next effort to prevent COVID-19 is quarantine. Observing the number of COVID 19 patients that are continually increasing, this will certainly add the pressure on health workers, even there will be lack of health workers. This phenomenon, if we examine, will be a vicious circle. The more patients treated in health services the more health workers are exposed. Not to mention, people out there who have just contacted the patients must be quarantined for medical observations.

Quarantine is used to protect someone who may be exposed to COVID-19 from another person. People in quarantine remain separate from others, and they limit their movements outside their home or current place. Someone may have been exposed to a virus without realizing it (for example, while traveling or going out in the community), or they can have a virus without feeling symptoms. Quarantine helps to limit the further spread of COVID-19.[33]

Measures to achieve health goals in the community may include quarantine, which involves movement limitation, or separation from a population, healthy people who may be exposed to the virus, aiming to monitor their symptoms and ensure early detection of cases. Many countries have the legal authority to enforce the quarantine. Quarantine must be implemented as a part of comprehensive public health responses and preventive measures, by Article 3 of the International Health Regulations 2005, must entirely respect the dignity, human rights and basic individual freedom.[28]

Quarantine is different from isolation. Quarantine is instructed to people who have been acknowledged by medical personnel as exposed to asymptomatic.[24] The purpose of quarantine is to monitor symptoms and early detection of COVID-19. Quarantine management is a fundamental measure that must be performed once the human-to-human transmission is ensured. Theoretically, if social distance and / or central outbreak lockdown is carried out substantially since the very beginning, it is expected that there will be no prevalence or no transmission. However, it takes time to conduct preliminary research to measure its impact. It is due to a consideration that strict measures will create profound social effects and wide economic consequences. Therefore, to determine the right social distancing choice, one must be able to understand at the right area scale and time. [31,32]

Meanwhile, isolation is the separation of sick people from others to prevent the wider spread.[29] Isolation is used to separate sick people from healthy ones. People in isolation must stay at home. At home, anyone who is ill must separate from others by staying in a room or a “sick” room and using a different bathroom (if possible).[27,31,32]

Quarantine is an important method for controlling coronavirus. Isolation measures for patients who were tested positive for this virus were been taken during the MERS CoV case. Research conducted on Bangladeshi travelers returning from the Middle East and experiencing fever and respiratory symptoms was studied from October 2013 to June 2016. Patients with respiratory symptoms that meet the WHO MERS-CoV case algorithm were tested for MERS-CoV. After tested positive, they had to do isolation. [33,34]

The previous research stated that the analysis of self-protection abilities from vulnerability and isolation as well as monitoring close contact with patients are effective measures to control disease when the MERS outbreak occurred in 2015 the Republic of Korea.[30] The COVID-19 modeling study states that early and strict prevention and control measures that reduce the rate of contact and infection efficiency are keys to overcome the outbreak.[36]

WHO recommends that a person to be quarantined has done a laboratory test and quarantine for 14 days since the last time they were exposed to a patient. If the authorities decide to quarantine someone, it is necessary to concern with the availability of adequate food, water, and hygiene during the quarantine time as well as fulfilling the minimum

requirements to monitor the health of the quarantined person during the quarantine.

#### **4. Enhancing the roles of mass media**

Another effort is increasing the roles of mass media in the prevention of COVID-19 cases. The role of mass media is very significant as it can influence people's attitudes towards COVID-19 and increase awareness of their self-protection. Mass media will change one's behavior in taking proper precautions such as getting used to washing hands, doing social distancing, and even isolation at home to avoid contact with others. In the initial stages of the outbreak, with insufficient resources and data, a media report is considered effective to minimize the spread of COVID-19.[37]

#### **5. Efforts to improve community health**

It is important to improve public health by getting used to a healthy lifestyle behavior. To prevent this pandemic, there are several things to do by everyone through activities such as frequently washing hands, not touching face with unwashed hands, not touching surfaces and objects that are not regularly disinfected, avoiding people who are coughing or sneezing, covering the cough or sneeze with the elbow, and throw the tissue after use. [28,38]

Maintaining one's health and protecting others can be done as follows:[28]

a. Wash your hands as often as possible

Regularly wash your hands by rubbing them with alcohol or soap and running water, because this can kill viruses that might be on your hands.

b. Maintain social distance

Maintain an distance of at least 2 meters away from anyone who coughs or sneezes. Because when someone is coughing, or sneezing, she/he is spreading droplets from their nose or mouth that may contain viruses

c. Avoid touching the eyes, nose, and mouth

Hands usually touch many surfaces and possibly get viruses. After contaminated, the hands can transmit the virus to the eyes, nose or mouth. This can make the virus enter the body and can cause someone sick.

d. Keep breathing clean

Keep the breathing clean means covering the mouth, and nose with elbows or bent hands when coughing or sneezing. Then immediately remove the used tissue because droplets can cause viruses. By keep the breathing clean, this can protect people around us from viruses such as flu and Covid-19.

e. Stay at home if you feel unwell

When experiencing a fever, cough and difficulty in breathing, a person is recommended to seek medical help by contacting the health service first.

f. Following the advice given by health workers

#### **6. Wearing a face mask/cover [39]**

Center for Disease Control and Prevention (CDC) recommends wearing a cloth face mask to enforce the community to reduce the virus transmission because social distancing and other precautions are still difficult to do (for example, grocery stores, markets, etc. are still crowded by the community), especially in significant community-based transmission areas.

CDC also recommends using a simple cloth face mask to slow down the virus spread and help people who might have the virus from spreading it to others. Cloth face



masks, which are made of household things or made at home from common materials at low cost, can be used as an additional measure, voluntary public health measure.

Cloth face masks should not be given to children under 2 years of age, people who suffer from breathing difficulty, or are unconscious, unable to remove cloth face masks without assistance. The recommended cloth face mask is not a surgical mask or an N-95 respirator, because those masks are used and reserved for medical personnel, paramedics and other officers who are related to the care of Covid-19 patients.

#### **Wearing a face mask [39]**

- a. The cloth face mask must fit comfortably on all sides of the face
- b. There is a strap attached to the ears
- c. It can be modified into several layers of fabric, as long as it is possible to breathe
- d. It can be washed and dried without damaging or changing the shape, washed regularly depending on the frequency of use.
- e. Care must be taken not to touch the eyes, nose, and mouth when removing the mask and washing hands immediately after removing.

Besides, there are some protective measures for people who have recently visited COVID-19 areas (the past 14 days). A person can follow the above steps and remain at home if he starts feeling unwell and reduces contact with others and if possible can visit health care facilities.[40]

The use of masks is recommended by WHO, United States Centers for Disease Control and Prevention (CDC) and the European Center for Disease Prevention and Control (ECDC), is especially for the prevention of transmission of Covid-19. The mask at first designed to be used to prevent spread virus between the wearer and the people around. Apart from that, it also served to protect a drip, blood splash-borne infection and body fluids, which enter the body system through the susceptible mucosal surface, deep a certain distance (usually less than 1 meter), and this is transmitted through breathing, face-to-face conversation, coughing and sneezing. The droplets also form capable aerosols spread over a wider distance (more than 1 meter) with the airflow and last longer around it living environment. [41]

Research conducted by Cipta Pramana et al., on Knowledge, Attitudes, and Practices of Using Masks towards 501 respondents. Those who used 329 (65.7%) participants who used cloth masks 329 (65.7%), surgical masks 112 (22.4%) and used both types of masks (cloth and surgical) 60 (12%). Most of the public's level of knowledge about masks and their use during the COVID-19 pandemic is very good. Knowledge, attitudes, and practices of using masks by general public, are very effective in preventing the spread of COVID-19 infection. A positive attitude and community discipline in using cloth masks and surgical masks helps to deal with disease transmission. Therefore, an awareness campaign for the use of appropriate face masks is needed to prevent infection transmission and overcome the COVID-19 pandemic. [42]

#### **7. The use of personal protective equipment (PPE) for health personnel**

Health workers are professionals who are at the front line in handling COVID-19. They will be exposed more often to this disease. Health workers are more susceptible to Covid-19 infections because they are exposed for a long time to the increasing number of patients. It

increases the risk of worker's infection, moreover, the level of pressure, work intensity and lack of rest cause health workers very vulnerable to this infection. [43] Another factor is the lack of personal protection for health workers at the beginning of the epidemic. WHO recommends personal protective equipment (PPE) in health services including gloves, medical masks, goggles or face shields, and dresses/gowns, as well as special N95 masks and aprons.[43,44]

Appropriate use of PPE includes the selection of appropriate PPE based on the needs and the training of how to properly wear, remove, and dispose of it. PPE aims to reduce the spread of pathogenic viruses from health workers to patients and vice versa as well as reducing contamination on the surface of inanimate objects. Besides the availability of PPE, it is required to provide adequate space to allow a minimum distance of 1 meter between officers and patients and ensure availability of a well-ventilated isolation room for patients with suspected or confirmed COVID-19.[44]

Administrative and management control, particularly in hospitals, must have available resources for prevention and infection control measures, such as appropriate infrastructure, fixed procedures, prevention policies, clear infection control, access to laboratory facilities, triage, and appropriate patient placement based on the diagnosis and adequate staff and patient ratio and, if necessary, special training for health workers.[44]

Epidemiological studies on the transmission of a severe acute respiratory syndrome (SARS) asserted that personal protective equipment (PPE) is very important in preventing the spread of SARS to health workers. However, the virus can persist on PPE; hence, it can trigger a risk of disease transmission if there is no appropriate handling of contaminated PPE. Therefore, reusing PPE needs to be controlled and considered properly.[45]

Medical personnel needs to wear special PPE when treating patients who potentially release aerosols, for example, dental care by a dentist or when performing intubation-extubation for patients treated in the ICU. The special mask used an N95 respirator mask with the effectiveness of up to 90% in avoiding the virus transmission through aerosols. Meanwhile, the use of surgical masks and masks from other materials is only able to protect from the spread of less than 34%. Protection from dust, allergens, and infectious aerosols by using face masks and N95 respirators depends on the concentration of aerosol compounds and the dose of infectious or inhalation. The results show that the use of face masks for surgical masks may not provide enough protection from inhaled aerosols.[46]

## **8. Vaccinations**

SARS-CoV-2 still shows a potential for an increasing epidemic [47]. Vaccine development to prevent the spread of Covid-19 is deemed very important [48]. Many countries are trying to develop vaccines for the prevention of Covid-19. Around the world are looking for several strategies in developing this Covid-19 vaccination, such as attenuated types of viruses, nanoparticles containing virus vectors or virus-like particles, subunit components, proteins/peptides, RNA, DNA, or even living cells. [49].

Data from WHO states, there are 28 vaccine candidates are in the process of clinical evaluation and 8 of them are awaiting the testing process [50]. To date, there are no vaccines licensed to prevent the spread of the covid-19 virus in humans, including vaccines for MERS-CoV, and SARS-CoV-1. The success factors in vaccine development are the selection of

antigens, the method of administration, the type of immune response generated, and the efforts to develop the vaccine itself [51].

## CONCLUSION

The conclusion of this research related to efforts in preventing the spread chain of Covid-19 are:

1. Doing social distancing, which is reducing contact with an infected person.
2. Doing physical distancing, which is reducing the physical distance to minimize person-to-person contact that possibly spreads this disease.
3. Doing quarantine for people who have been confirmed by medical personnel as exposed to asymptomatic.
4. Increasing the role of mass media as the medium to change one's behavior in taking appropriate precautions.
5. Effort to improve community health
6. The use of standard PPE for health workers who are more prone to Covid-19 infection.
7. Efforts to improve public health can be carried out through developing healthy behavior
8. Vaccination

## COMPETING INTEREST

The authors declare no competing interest.

## SOURCE OF FUNDING

There is no source of funding

## REFERENCES

1. Zhang, Y., Jiang, B., Yuan, J. and Tao, Y., 2020. The impact of social distancing and epicenter lockdown on the COVID-19 epidemic in mainland China: A data-driven SEIQR model study. *medRxiv*.
2. Li, Q., Guan, X., Wu, P., Wang, X., Zhou, L., Tong, Y., Ren, R., Leung, K.S., Lau, E.H., Wong, J.Y. and Xing, X., 2020. Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. *New England Journal of Medicine*.
3. World Health Organization, 2005. Statement on the second meeting of the International Health Regulations (2005) Emergency Committee regarding the outbreak of novel coronavirus (2019-nCoV).
4. Aguado-Cortés, C. and Castaño, V.M., 2020. Translational Knowledge Map of COVID-19. *arXiv preprint arXiv:2003.10434*.
5. MacIntyre, C.R., 2020. Global spread of COVID-19 and pandemic potential. *Global Biosecurity*, 1(3).
6. Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19). <https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-final-report.pdf>. Upgrade 16-24 February, 2020
7. World Health Organization, 2020. *Clinical management of severe acute respiratory infection (SARI) when COVID-19 disease is suspected: interim guidance, 13 March 2020* (No. WHO/2019-nCoV/clinical/2020.4). World Health Organization.
8. Presiden Jokowi Umumkan Kasus Infeksi Corona Pertama di Indonesia, Tertular dari Warga Jepang yang Tengah Berkunjung. <https://www.pikiran-rakyat.com/nasional/pr-01346105/presiden-jokowi-umumkan-kasus-infeksi-corona-pertama-di-indonesia-tertular-dari-warga-jepang-yang-tengah-berkunjung>. Tim Pikiran Rakyat. 2 Maret 2020

9. Pramana C, Herawati S, Santi N, Maryani LP, Dachliana OR. The First Case of COVID-19 in Semarang, Indonesia: A Case Report. Luh Putu Endyah Santi and Dachliana, Oktina Rachmi, The First Case of COVID-19 in Semarang, Indonesia: A Case Report (January 4, 2021). 2021 Jan 4.
10. Sumarni N, Dewiyanti L, Kusmanto MH, Pramana C. A case of 2019 novel coronavirus infection in a preterm infant with severe respiratory failure. *International Journal of Pharmaceutical Research*. 2020 Oct;12(4).
11. COVID-19 Coronavirus Pandemic. <https://www.worldometers.info/coronavirus/#countries>. February 03, 2021
12. Carlos, W.G., Dela Cruz, C.S., Cao, B., Pasnick, S. and Jamil, S., 2020. Novel Wuhan (2019-nCoV) coronavirus. *American journal of respiratory and critical care medicine*, 201(4), pp.P7-P8.
13. Chen W. Promise and challenges in the development of COVID-19 vaccines. *Human Vaccines & Immunotherapeutics*. 2020 Jul 14:1-5.
14. Coronavirus disease 2019 (COVID-19) situation reports. Available from <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports>. Online: accessed Februari 8, 2020.
15. Wu, Z. and McGoogan, J.M., 2020. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72 314 cases from the Chinese Center for Disease Control and Prevention
16. Reported cases and Death by Country, Territory, or Conveyance. Available from. <https://www.worldometers.info/coronavirus/#countries>. Online: accessed April 8, 2020.
17. (Han, Y. and Yang, H., 2020. The transmission and diagnosis of 2019 novel coronavirus infection disease (COVID-19): A Chinese perspective. *Journal of Medical Virology*.)
18. Bai, Y., Yao, L., Wei, T., Tian, F., Jin, D.Y., Chen, L. and Wang, M., 2020. Presumed asymptomatic carrier transmission of COVID-19. *Jama*.
19. Lu, C.W., Liu, X.F. and Jia, Z.F., 2020. 2019-nCoV transmission through the ocular surface must not be ignored. *The Lancet*, 395(10224), p.e39.)
20. Chen, H., Guo, J., Wang, C., Luo, F., Yu, X., Zhang, W., Li, J., Zhao, D., Xu, D., Gong, Q. and Liao, J., 2020. Clinical characteristics and intrauterine vertical transmission potential of COVID-19 infection in nine pregnant women: a retrospective review of medical records. *The Lancet*, 395(10226), pp.809-815).
21. Xiao, F., Tang, M., Zheng, X., Li, C., He, J., Hong, Z., Huang, S., Zhang, Z., Lin, X., Fang, Z. and Lai, R., 2020. Evidence for gastrointestinal infection of SARS-CoV-2. *medRxiv*.)
22. Ong, S.W.X., Tan, Y.K., Chia, P.Y., Lee, T.H., Ng, O.T., Wong, M.S.Y. and Marimuthu, K., 2020. Air, surface environmental, and personal protective equipment contamination by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) from a symptomatic patient. *Jama*.
23. Van Doremalen, N., Bushmaker, T., Morris, D. H., Holbrook, M. G., Gamble, A., Williamson, B. N., ... & Munster, V. J. (2020). Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. *New England journal of medicine*, 382(16), 1564-1567.
24. Dalton, C.B., Corbett, S.J. and Katelaris, A.L., 2020. Pre-emptive low-cost social distancing and enhanced hygiene implemented before local COVID-19 transmission could decrease the number and severity of cases. *The Medical Journal of Australia*, 212(10), p.1.
25. Reluga, T.C., 2010. Game theory of social distancing in response to an epidemic. *PLoS computational biology*, 6(5).
26. Rothe, C., Schunk, M., Sothmann, P., Bretzel, G., Froeschl, G., Wallrauch, C., Zimmer, T., Thiel, V., Janke, C., Guggemos, W. and Seilmaier, M., 2020. Transmission of 2019-nCoV infection from an asymptomatic contact in Germany. *New England Journal of Medicine*, 382(10), pp.970-971.
27. Recommendation Regarding the Use of Cloth Face Coverings, Especially in areas of Significant

- Community-Based Transmission. [https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/diy-cloth-face-coverings.html?deliveryName=USCDC\\_2067-DM25135](https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/diy-cloth-face-coverings.html?deliveryName=USCDC_2067-DM25135). Online: accessed April 3, 2020.
28. Wilder-Smith, A. and Freedman, D.O., 2020. Isolation, quarantine, social distancing and community containment: pivotal role for old-style public health measures in the novel coronavirus (2019-nCoV) outbreak. *Journal of travel medicine*, 27(2), p.taaa020.
  29. Ahmed, F., Zviedrite, N. and Uzicanin, A., 2018. Effectiveness of workplace social distancing measures in reducing influenza transmission: a systematic review. *BMC public health*, 18(1), p.518.
  30. Kissler, S.M., Tedijanto, C., Lipsitch, M. and Grad, Y., 2020. Social distancing strategies for curbing the COVID-19 epidemic. *medRxiv*.
  31. Pfattheicher, S., Nockur, L., Böhm, R., Sassenrath, C. and Petersen, M.B., 2020. The emotional path to action: Empathy promotes physical distancing during the COVID-19 pandemic.
  32. Zhang, Y., Jiang, B., Yuan, J. and Tao, Y., 2020. The impact of social distancing and epicenter lockdown on the COVID-19 epidemic in mainland China: A data-driven SEIQR model study. *medRxiv*.
  33. World Health Organization, 2020. Considerations for quarantine of individuals in the context of containment for coronavirus disease (COVID-19): interim guidance, 19 March 2020 (No. WHO/2019-nCoV/IHR\_Quarantine/2020.2). World Health Organization.
  34. Muraduzzaman, A.K.M., Khan, M.H., Parveen, R., Sultana, S., Alam, A.N., Akram, A., Rahman, M. and Shirin, T., 2018. Event-based surveillance of Middle East Respiratory Syndrome Coronavirus (MERS-CoV) in Bangladesh among pilgrims and travelers from the Middle East: An update for the period 2013–2016. *PloS one*, 13(1).
  35. Xia, Z.Q., Zhang, J., Xue, Y.K., Sun, G.Q. and Jin, Z., 2015. Modeling the transmission of Middle East respiratory syndrome coronavirus in the Republic of Korea. *PloS one*, 10(12).
  36. Nussbaumer-Streit, B., Chapman, A., Dobrescu, A.I., Mayr, V., Persad, E., Klerings, I. and Gartlehner, G., 2020. The Effectiveness of Quarantine to Control the Coronavirus Disease 2019: A Rapid Review. *Available at SSRN 3550010*.
  37. Zhou, W., Wang, A., Xia, F., Xiao, Y. and Tang, S., 2020. Effects of media reporting on mitigating spread of COVID-19 in the early phase of the outbreak.
  38. Desai, A.N. and Patel, P., 2020. Stopping the Spread of COVID-19. *JAMA*.
  39. Use Cloth Coverings Help Slow Spread/CDC. [https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/diy-cloth-face-coverings.html?deliveryName=USCDC\\_2067-DM25135](https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/diy-cloth-face-coverings.html?deliveryName=USCDC_2067-DM25135). Online: accessed April 13, 2020
  40. Coronavirus disease (COVID-19) advice for the public: When and how to use masks <https://www.google.com/search?client=firefox-d&q=https%3A%2F%2Fwww.who.int%2Femergencies%2Fdiseases%2Fnovel-coronavirus-2019%2Fadvice-for-public>. Online: April 6, 2020.
  41. Supinganto A., Pramana C., Sirait LI., Kumalasari MLF., Hadi MI, Ernawati K., et al. The Use of Masks, as an Effective Method in Preventing the Transmission of the COVID-19, During Pandemic and the New Normal Era: A Review. *International journal of Pharmaceutical Research*. 2021; 13(2) 558-64.
  42. Pramana C, Kurniasari L, Santoso B, Afrianty I, Syahputra A, Noviyanto F, Handoko L, Wulandari R, Susilawaty A. Knowledge, Attitudes, and Practices of Using Masks by The Community During The COVID-19 Pandemic in Indonesia. *PalArch's Journal of Archaeology of Egypt/Egyptology*. 2020 Nov 2;17(9):4800-8.
  43. Wang, J., Zhou, M. and Liu, F., 2020. Exploring the reasons for healthcare workers infected with novel coronavirus disease 2019 (COVID-19) in China. *Journal of Hospital Infection*.
  44. Rational use of personal protective equipment for coronavirus disease 2019 (COVID-19).

[https://apps.who.int/iris/bitstream/handle/10665/331215/WHO-2019-nCov-IPCPPE\\_use-2020.1-eng.pdf](https://apps.who.int/iris/bitstream/handle/10665/331215/WHO-2019-nCov-IPCPPE_use-2020.1-eng.pdf). Online: accessed February 27, 2020.

45. Casanova, L., Rutala, W.A., Weber, D.J. and Sobsey, M.D., 2010. Coronavirus survival on healthcare personal protective equipment. *Infection Control & Hospital Epidemiology*, 31(5), pp.560-561.
46. Bowen, L.E., 2010. Does that face mask really protect you?. *Applied biosafety*, 15(2), pp.67-71.
47. Szkaradkiewicz- Karpińska A, Szkaradkiewicz A. Towards a more effective strategy for COVID- 19 prevention (Review). *Exp Ther Med*. 2020;21(1):1–1.
48. Koven S. Engla, Journal - 2010 - New England Journal. *N Engl J Med* [Internet]. 2020;28(1):1–2. Available from: [nejm.org](http://nejm.org)
49. Engla NEW, Journal ND. 1. Perspective New England Journal. 2010;1489–91.
50. WHO Covid-19. Draft landscape of COVID-19 candidate vaccines. WHO [Internet]. 2020;(June):3. Available from: <https://www.who.int/publications/m/item/draft-landscape-of-covid-19-candidate-vaccines%0Ahttps://www.who.int/publications/m/item/draft-landscape-of-covid-19-candidate-vaccines%0D>
51. Bennet BM, Wolf J, Laureano R, Sellers RS. Review of Current Vaccine Development Strategies to Prevent Coronavirus Disease 2019 ( COVID-19 ). 2020;