

Protection and disinfection policies against SARS-CoV-2 (COVID-19)

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SUMMARY

In late December 2019, reports from China of the incidence of pneumonia with unknown etiology were sent to the World Health Organization (WHO). Shortly afterwards, the cause of this disease was identified as the novel beta-coronavirus, SARS-CoV-2, and its genetic sequence was published on January 12, 2020. Human-to-human transmission via respiratory droplets and contact with

aerosol infected surfaces are the major ways of transmitting this virus. Here we attempted to collect information on virus stability in the air and on surfaces and ways of preventing of SARS-CoV-2 spreading.

Keywords: SARS-CoV-2, COVID-19, prevention, disinfection, transmission, droplet.

INTRODUCTION

Coronavirus includes of a large family of viruses that are common to both humans and animals (cattle, camels, cats and bats). Sometimes animal coronaviruses can infect humans, such as SARS-CoV, MERS-CoV, and now SARS-CoV-2. Acute respiratory tract infection due to SARS-CoV-2 is currently spreading rapidly worldwide and has become a public health concern. This infection is now officially called the novel coronavirus disease (COVID-19) [1, 2]. COVID-19 is characterized by high fever, difficult breathing, dry cough and atypical pneumonia and is usually

confirmed by positive RNA test or computed tomography (CT) of lung [3]. COVID-19 is spreading rapidly in the world and on 11 March 2020, WHO announced the outbreak a global pandemic [4, 5]. There are currently few studies on the pathogenic properties of SARS-CoV-2 and its spreading mechanism, and the present knowledge is largely based on the characteristics of similar coronaviruses. The genomic similarities of SARS-CoV-2 to SARS-CoV, which is known to cause a major outbreak of Severe Acute Respiratory Syndrome (SARS) with 8098 cases, 774 deaths and a final mortality rate of 9% in 2002-2003, can explain the structural and pathogenic features of the SARS-CoV-2 [6, 7]. The strategy of isolating cases and contacts in the fight against SARS-COV-2 has been implemented from the beginning, but it has had a different effect on different countries. After the first major outbreak in Wuhan, China in Jan-

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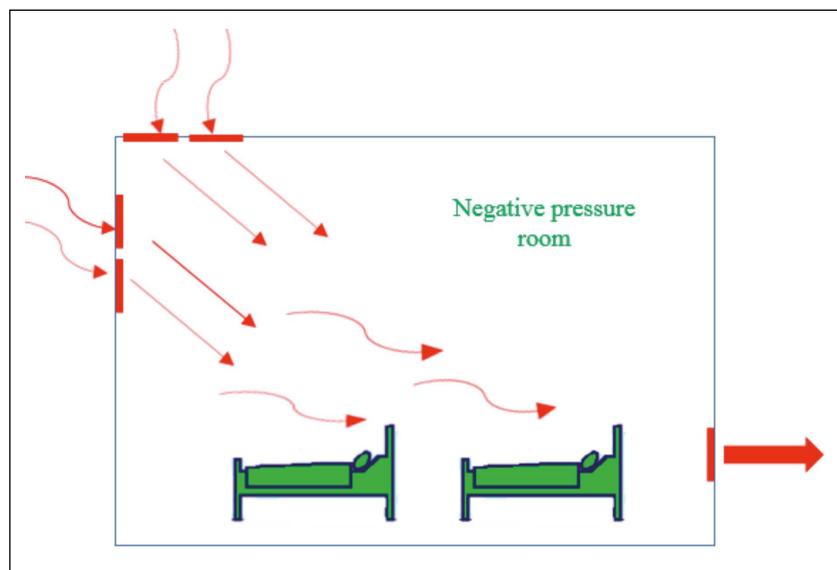
uary, South Korea, Iran and Italy in late February and early March 2020 became involved in this epidemic [8]. Many countries are currently combating COVID-19 and trying to prevent its further spread and to reduce morbidity and mortality rates, and thereby to diminish the overall stress and tension in their health-care system [9]. Since there is no definitive cure and specific vaccine for SARS-CoV-2, all measures to supplying public health rely on preventing the spread of the virus by droplets and close contact and contaminated surfaces [1]. The person-to-person transmission and spreading from dry surfaces contaminated with nose, mouth and eyes secretions of infected person has been proven about SARS-CoV-2 [10, 11]. Given the severity of this major outbreak and the importance of prevention and protection against the spread of SARS-CoV-2, we summarize and review the latest findings by scientists about the SARS-CoV-2 persistence outside the body and strategies to prevent further its spread.

■ PERSISTENCE SARS-COV-2 IN AIR

The transmission of pathogens through aerosols have been proven in closed spaces. There are several respiratory diseases that spread through airborne route, such as tuberculosis [12]. Based on the results of a retrospective cohort study after the 2003 SARS epidemic, airborne transmission could

play a significant role in the spread of disease [13]. SARS-CoV-2 can be released when coughing, talking and sneezing of infected person. Droplets containing the virus can infect others if they do not follow the safe distance [14]. Moriyama et al. have stated that low humidity and temperatures increase the viability of SARS-CoV-2 in the droplets, and since the receptor of this virus, angiotensin converting enzyme II (ACE2), appears in a small number of type II alveolar cells, SARS-CoV-2 defects ciliary clearance and defense innate immunity for greater access to deep lung tissue [15, 16]. According to a recent study published in the The New England Journal of Medicine, SARS-CoV-2 can persist for 3 hours in aerosols [17]. Given this finding, safety considerations in the infected sectors and ICU where infected patients are under surveillance are important to prevent the spread of contamination by aerosols. One of these is to prevent high traffic in the infected sections and to inhibition the virus spreading through the airflow. Careful regulation and inspection of air conditioning systems is very important, as air conditioning in polluted areas must be done under negative pressure (Figure 1). A negative pressure room uses lower air pressure to allow outside air into the segregated environment. This traps and keeps potentially harmful particles within the negative pressure room by inhibition of internal air from leaving the space [18]. A study in Chi-

Figure 1 - Airflow movement in infected Room.



na showed that negative pressure ventilation and high air exchange levels within CCU, ICU and ward room of Renmin Hospital were effective in reducing SARS-CoV-2 airborne [14]. To reduce the risk of airborne contamination, early detection of asymptomatic carriers for treatment or quarantine, avoiding crowded communities, use of face masks in places where pollution is high, such as in hospitals and also when using public transportation equipment is recommended [14].

■ SARS-COV-2 ON THE SURFACES

SARS-CoV-2 spreads mostly through respiratory droplets and then through contaminated surfaces. Recent studies have shown that SARS-CoV-2 can persist on a variety of surfaces from hours to days (Figure 2) [17, 19]. Kampf and his colleagues stated that human coronaviruses can persist for up to 9 days at room temperature. This time can be up to 28 days for veterinary coronaviruses, and the interesting thing is that with increasing the temperature to 30 degrees or more, coronavirus persistence was shorter [19]. This indicates that the person may get the virus and become infect-

ed after touching the infected objects. Although the load of SARS-CoV-2 on inanimate surfaces at the time of its outbreak is unclear, it does appear that can reduce the load of viruses on the surfaces by disinfectants, especially the surfaces touched by the patient and the space around the patient where have the highest viral load. WHO recommends to ensure that disinfection and environmental cleaning procedures are performed correctly and consistently. Environmental surfaces must be thoroughly cleaned with water and disinfectant. Using hospital disinfectants such as sodium hypochlorite can be an effective method [20]. Disinfection and cleaning of frequently touched surfaces such as doors, toilets, desks, switches and sinks should be carried out with household disinfectants. Different types of biocidal agents such as alcohols, hydrogen peroxide, benzalkonium or sodium hypochlorite chloride are applied worldwide for disinfection [19]. It has been proven that disinfectants with 62-71% ethanol or 0.1% sodium hypochlorite can reduce coronavirus contamination on surfaces within one minute of exposure [19]. Cleaning should be done after disinfection for contaminated surfaces. Examples

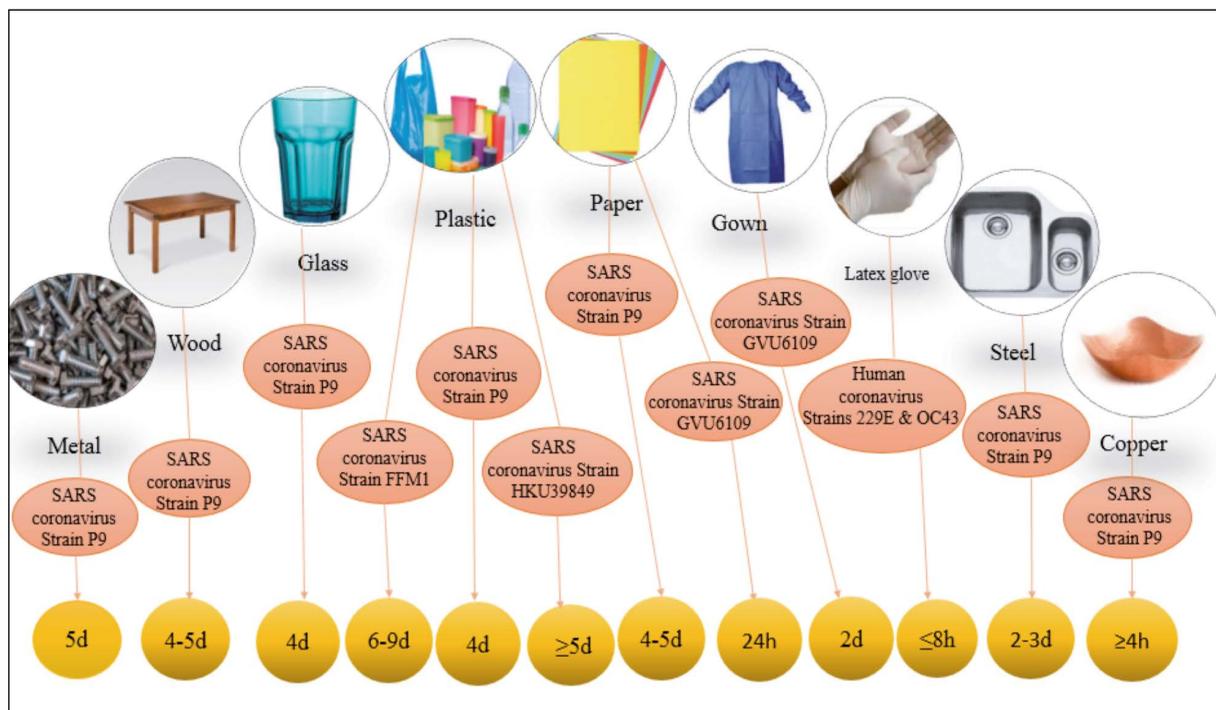


Figure 2 - Persistence of SARS-COV-2 on surfaces [19].

Table 1 - Inactivation of SARS coronavirus Strain FFM1 by different types of biocidal agents.

Virus	Biocidal agent	Reduction of viral infectivity (\log_{10})	Exposure time	Ref
SARS coronavirus Strain FFM1	Ethanol 95%	≥ 5.5	30s	[21]
	Ethanol 78%	≥ 5.0	30s	[21]
	2-Propanol 75%	≥ 4.0	30s	[22]
	2-Propanol 70%	≥ 3.3	30s	[23]
	Formaldehyde 1%	>3.0	2min	[23]
	Glutardialdehyde 0.5%	>3.0	2min	[23]
	Povidone iodine 0.23%	≥ 4.4	15s	[24]

of disinfectants and necessary duration for their effect on SARS coronavirus are shown in Table 1.

PREVENTION OF SPREADING SARS-CoV-2

Lifestyle (quality sleep, eating healthy and exercise) and health observance play a major role in controlling and preventing the virus spreading (Figure3) [25, 26]. According to CDC recommendations, the main strategies for preventing the spread of the virus include:

- Avoiding contact with symptomatic persons.
- Covering sneeze or cough with a tissue and discarding the contaminated tissue in a contained trash.
- Avoiding travel to high risk areas.
- Wash hands with soap and water for at least 20 seconds.
- If soap was unavailable, use a disinfectant that contains at least 60% alcohol.
- Avoiding hand contact with facial components
- Cleaning and disinfecting repeatedly touched surfaces [27].

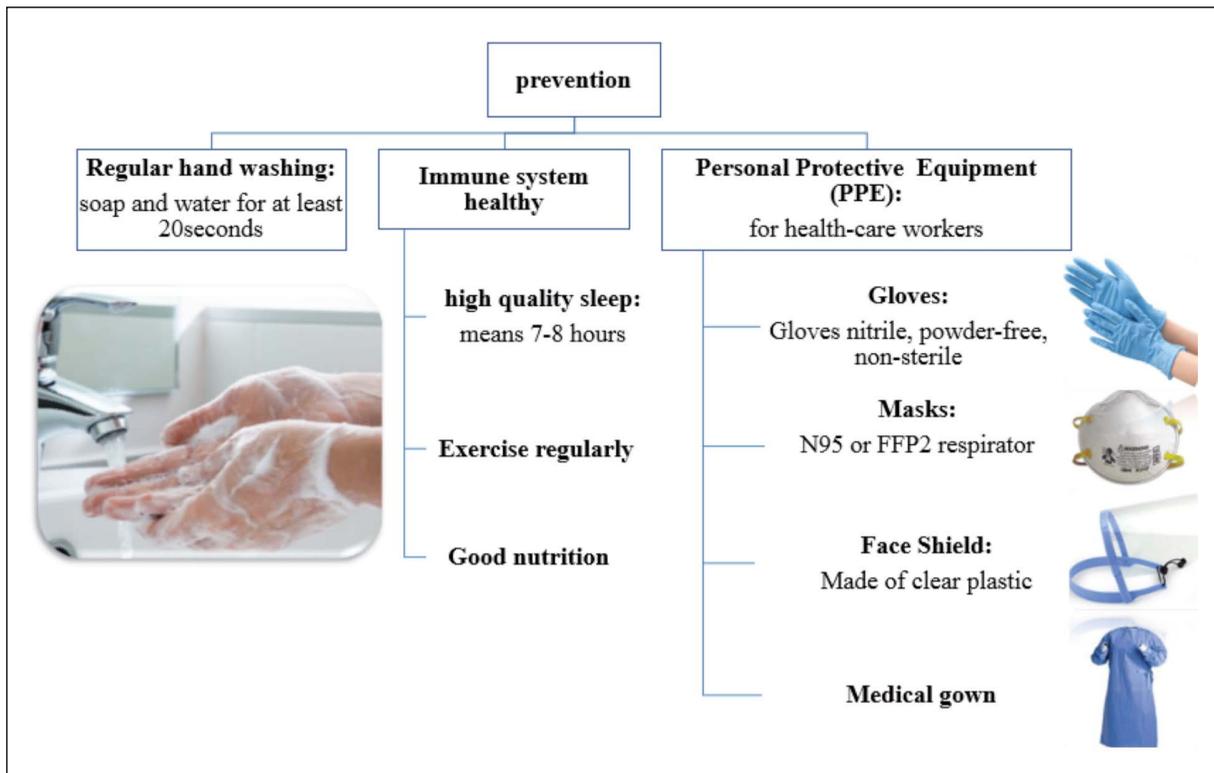


Figure 3 - Preventive and protective measures against COVID-19.

■ PERFORMANCE OF FACE MASKS AGAINST SARS-COV-2

The size of the coronavirus-shaped spherical particles is estimated to be about 0.125 microns (125 nm) using an electron microscope. The smallest of them are 0.06 microns and the largest are 0.14 microns [3]. The most common masks used by health care workers and the general public include:

Surgical mask:

Surgical masks are generally created to protect vulnerable patients from doctors and health care professionals can protect the wearer against large droplets and sprays [28]. Although these masks have been widely used by the public, there is no evidence that these masks are protective against SARS-CoV-2, but may slightly reduce the spread of the virus from the infected patient [29].

N95 respirator

An N95 mask is a type of respirator which filter out at least 95% of very small particles (0.3 mi-

cron). N95 masks should be used in health care center where health-care workers are in straight contact with patient [30]. Although experience has shown that these masks are used continuously or intermittently for 8 hours, they are usually used at health centers by health concerns (such as loss of performance due to contamination) or practical considerations (e.g., the need to Resting or using the toilet) is indicated [31].

FFP2 respirator

A filtering face piece 2 (FFP2) respirator out at least 94% of very small particles (0.3 micron). FFP2 or N95 are the gold standard to protection against very small particles [32, 33]. Figure 4 shows the types of masks based on the filter capacity, the ability to capture particles with a diameter of 0.3 microns or larger.

■ IS THE MASK NECESSARY FOR EVERYONE OR NOT?

Despite the consensus that there is a need to use masks in symptomatic patients and staff in med-



Figure 4 - Types of face masks (removing power of 0.3 micron particle).

ical centers, disagreements have been observed for the general population [34]. According to health recommendations in Germany and the UK, evidence supporting the effective protective effect of face masks for members in the community is extremely rare. However, the use of the mask as a precautionary measure when caring for patients with respiratory infections is on the agenda of health-care workers [35]. It is wise for vulnerable people to avoid crowded areas and use surgical masks when exposing in high risk regions [36]. Currently, WHO recommend using the mask only to people with respiratory symptoms and to healthy people who are caring for someone with respiratory symptoms [37]. However, given the recent findings by scientists that the virus survives in the air for 3 hours [17], it is necessary to discuss the need to use the face masks for people in the community in addition to the medical staff.

■ CONCLUSION

COVID-19 is now a global health threat and the number of confirmed reports of new cases and deaths is increasing every day. Since the SARS-CoV-2 can remain in the air and on surfaces for several hours to several days, in addition to observing individual hygiene tips such as regular hand washing and avoiding contact, use of negative pressure ventilation in hospital sectors, open space, the face mask wearing in the crowded areas, disinfection of frequently touched surfaces is required to reduce SARS-CoV-2 spreading through of aerosol. however, it is clear that hand hygiene compliance and isolation or quarantine alone cannot prevent the spread of SARS-CoV-2. Therefore, further research needs to be done to increase knowledge about the structural and pathogenic features of SARS-CoV-2 and to find effective therapies and vaccines to control this disease.

Conflict of Interest

None to declare.

Funding

None.

Acknowledgment

This study was supported by Tabriz University of Medical Sciences with grant number 65174. We

thank all staff of hospitals for all they did during Covid-19 pandemic and in memorial of all our colleagues lost their life during this pandemic.

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