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Review Article

Rapid Transmission of Coronavirus in Iran

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Abstract

Sever acute respiratory syndrome coronavirus-2 (SARS-CoV-2) was first identified in people who visited the Huanan seafood market in Wuhan, China. Subsequently, the infection was transmitted by travelers to all countries of the world, including Iran. In the country, the primary foci of the infection were observed in Qom and Gilan provinces. The infection was then transmitted to all provinces of Iran by inter-provincial trips. By 6 August 2021, 4,092,671 individuals had been infected and 93,086 had died in the country. Some people became infected during January and February 2020 by close contact with the patients in crowded medical centers in Qom and Gilan. However, most people became infected through asymptomatic persons (healthy carriers) in overcrowded places. In this case, the transportation system, especially buses and subways, played a major role in spreading of the infection. Furthermore, the tight crowded markets, the coffee shops and funerals led to further spread of the infection. To control COVID-19 and disrupt the transmission cycle, the following suggestions are recommended until the end of September 2021: stopping the activity of public transportation system, preventing from gatherings, maintaining social distance, face mask wearing as well as accurate quarantine of infected people and avoidance of family cycles.

Keywords: *SARS-Cov-2; Transmission; Asymptomatic; Social Gatherings; Social Distance*

Introduction

coronavirus disease 2019 (COVID-19) is a zoonotic pneumonia that was first identified in late 2019 in people who visited the Huanan seafood market in Wuhan, China, where fish and live animals were sold [1]. The causative agent of the disease is a virus that spread rapidly from China to other countries [2]. Currently, the disease has spread to 222 countries and has become pandemic, with more than 202 million infected people (6 August 2021) [3]. The emergence of COVID-19 has been officially announced since 19 February 2020 in Iran. Transmission of the virus occurs from animal to human [4], human to human [5] and human to animal [6]. The most common clinical symptoms are fever, dry cough, fatigue, and dyspnea. Typical laboratory findings in critically ill patients are leukopenia, leukocytosis, lymphopenia, and increased serum CRP and LDH level [7]. In some cases, loss of the sense of smell and taste are observed [8]. However, the complication of upper respiratory tract and gastrointestinal involvement are rare. Therefore, it seems that the virus has tropism for the

cells of the lower respiratory tract [9]. In most people, the disease is asymptomatic, but the healthy carriers can transmit the infection to others [10,11]. About 20% of infected persons develop pneumonia, which leads to acute respiratory failure in 5% of cases with the need for special care. The disease eventually leads to death in some elderly people or those with underlying disease [12].

In this review, the factors facilitating the rapid spread of the infection and the high mortality rate of the disease in Iran were discussed. Identification of the factors will help the better understanding of the shortcomings of the public health care system. Then, it leads to make preventive decisions to reduce the burden of COVID-19 in Iran and other parts of the world.

Virology

The causative agent of COVID-19 was initially called the novel coronavirus 2019 (2019-nCoV). However, the International Committee on Taxonomy of Viruses renamed it as sever acute respiratory syndrome coronavirus-2 (SARS-CoV-2) due to 79.5% identity of genome sequence [13] with severe acute respiratory syndrome coronavirus (SARS-CoV), the causative agent of the 2002-2003 epidemic. SARS-CoV-2 has been classified in the family Coronaviridae, genus Betacoronavirus, and subgenus Sarbecovirus [14]. The large virus has a lipid envelope and contains a genome of single-stranded RNA of 29891 nucleotides that encodes 9860 amino acids [15]. The genome of the virus has an open reading frame 1a (ORF1a), ORF1b encodes non-structural proteins, and genes encoding structural proteins including spike (S), envelope (E), membrane (M), and nucleocapsid (N) proteins [4]. Interestingly, the genome of SARS-CoV-2 has 96% sequence similarity with the bat coronavirus RaTG13 strain [13] and 98.7% similarity with the partial RNA-dependent RNA polymerase (RdRp) of BtCoV/4991 strain [16]. The virus binds to its receptor on a host cell by S1 and S2 subunits of spike glycoprotein. Considerable number of the virus receptor, angiotensin-converting enzyme 2 (ACE2), expresses on the surface of alveolar epithelial cells [17].

Subsequently, the virus performs virion assembly by using N protein and other structural proteins [18]. Phylogenetic analysis based on whole genome sequencing of SARS-CoV-2 [14], SARS-CoV [19], severe acute respiratory syndrome coronavirus (MERS-CoV) [20], and bat SARS-like coronavirus showed that SARS-CoV-2 is a separated species from SARS-CoV and MERS-CoV. The primary virus probably evolved after mutations in the S and N genes of bat SARS-like coronavirus horseshoe-bats [18].

Mutations in spike glycoprotein and nucleacapside proteins (N) may able the virus to infect humans, but reduced its pathogenicity, then the modified virus was transmitted to humans through an intermediate host [21].

SARS-CoV-2 transmission

The persistence of viral infection in society depends on the transmission of the virus to the new host. The virus is usually spread in the same way that it enters the host body, therefore, the coronavirus is transmitted in the community mostly through coughing, sneezing, and aerosols created while talking [22]. The virus can be disseminated in the environment by feces and urine [23]. Transmission of the virus may also possible from mother to fetus [24]. Human-to-human transmission of SARS-CoV and MERS-CoV was reported among family members or through nosocomial transmission [25]. However, the transmissibility of SARS-CoV-2 is much higher than SARS-CoV and MERS-CoV and its reproduction number (Ro) is about 3.28 [26]. Transmission of the infection between family members, friends, and those have close contact with the patients mostly occurs in cluster form [27] not only during the symptomatic course of the disease but also during the recovery and incubation period. In addition, SARS-CoV-2 is transmitted through hand contact of healthy people with contaminated surfaces with COVID-19 nasal and oral secretions. The virus remains infective for a long period on aluminum, Teflon, ceramic, plastic, glass, wood, surgical gloves, gowns, mask, and steel [28,29]. The virus transmission also occurs by asymptomatic persons which making it more difficult to control [10] because the virus load in the individuals is similar to that in symptomatic patients [30]. Given that the number of asymptomatic people is more than the patients, they can infect a large number of people in the gatherings.

The role of gatherings and travel in SARS-CoV-2 transmission

The modern transportation system has shortened the distance between people and made them more comfortable, but it also facilitates the transmission of infectious diseases. On the other hand, gatherings [31] and non-adherence to public health measures [32] are the most important ways of the virus transmission. Overcrowding and short distances between passengers on public transportation systems such as subways, buses, trains and airplanes can lead to the transmission of the virus [33]. There is also the possibility of virus transmission in crowded places including stores, schools, factories, shrines, mosques, universities, clinics, offices, banks, churches, sports competitions, gyms and swimming pools, Friday and congregational prayers, tourist attractions, cinema halls, theaters, funerals, weddings, cafes, and meetings. Accumulation of people in confined spaces increases the likelihood of SARS-CoV-2 transmission, for instance, in Diamond Princess cruise on the coast of Japan, 712 people were infected [34].

Travel plays a key role in the spread of the SARS-CoV-2. In China, during the Lunar New Year holiday, the massive travel of people in Wuhan, Hubei Province, Crowds of trains and buses during the long trips, and close contact between healthy and infected people enhance the transmission of the infection to other Chinese provinces [22,33]. The infection has also spread to other parts of the world through international travelers. Quarantine and travel bans on 23 January 2020 for 75 days controlled COVID-19 in China and reduced the number of new cases to less than 5 per day in the province. Therefore, travel bans along with adherence to public health measures can prevent or delay the spread of the infection to other areas [35]. In regions that appear to be free of infection, people should also adhere to public health measures; otherwise we will face an increasing burden of the disease in recently infected countries and cities.

SARS-CoV-2 outbreak in Iran

Due to the extensive economic and student relations between Iran and China or a possible political blow to this good relationship, SARS-CoV-2 probably came to Iran before the quarantine which was announced and travel was banned in Hubei Province, China. Infected traders and students may have entered Iran (Qom and Gilan provinces, two small provinces with a high population due to the pilgrimage and being a tourist, respectively) and have transmitted the infection to new people and the primary centers in Iran have been formed in these two provinces. Infected people with clinical symptoms such as fever, cough and shortness of breath went to medical centers, clinics and doctors' offices. Because the disease is unknown to doctors therefore, it was mistaken for seasonal influenza and colds and due to the lack of successful treatment, patients were referred to different centers. Disorders governing clinic appointments on the one hand and several hours of waiting in the private offices of doctors, which is due to the wrong plan of "per case" in the medical system in the country on the other hand they caused the presence of infected people in the population and thus spread the disease [30]. Qom has a lot of traffic because it is a pilgrimage city and a significant number of workers from other cities work in this city. During the public announcement about the outbreak of the disease in the city people to be safe from the disease on the one hand and the stagnation of economic and cultural activities on the other they went to their cities, especially to nearby cities such as Kashan and Arak and turned other cities into COVID-19 centers and Gilan, due to its greenery and being next to Mazandaran Lake, is a place for weekend trips for the people of Tehran, Qazvin, Zanjan, Ardabil and East Azarbaijan provinces. Excessive travel to the province has spread the virus and infected large populations there, and the passengers have transmitted the infection to their provinces as of 6 March 2020, there was no clean province in Iran and the infectious was observed in all provinces. In Iran, with a population of about 84 million, unfortunately, as of August 6, 2021, 4092671 people were infected and 93086 people were killed. In Iran, unfortunately, in the Ministry of Health, Treatment and Medical Education, due to the priority of treatment on health and the existence of a self-management plan (per-case plan), the medical centers may have been the cause of the rapid spread of the SARS-CoV-2 virus.

In Iran, the factors that caused the rapid outbreak of COVID-1, including : Nowruz shopping, Chaharshanbe Suri ceremony at the end of the year, Crowds and heavy traffic due to the sale of sweets on 19 March 2020, Nowruz fruits are sold by municipal agents, Mourning ceremonies in mosques and wedding celebrations, The free distribution of disinfectants and the unfavorable conditions of Tabriz Fruit

and Vegetable Market had caused a gathering in Tabriz, which was accompanied by a lack of personal hygiene. On the other hand, some people, especially in the poor and densely populated areas of Tabriz, did not pay attention to the announced warnings to refrain from holding rallies and closing unnecessary businesses and social distancing and using disposable masks and gloves in shopping centers. Therefore, they increased the outbreak of the disease in the following days.

Ways to prevent transmission

Due to the rapid transmission from human to human [22,27], SARS-CoV-2 was able to become a major global public health problem in a short period of time [36]. The effective vaccine for COVID-19 disease is not currently available to the public and there is no standard treatment, so the best way in the current situation is to cut the transmission chain to reduce contact with infected people which the most important thing is social distancing, isolating patients, face mask wearing and quarantining people who have been in contact with patients. But, it does not increase the spread of the virus it would be better for the Ministry of Health to hold virtual classes for people. The next step is to change some of the functions of the Ministry of Health, which has been effective in disseminating the number of patients quickly which the most significant of which is the real health priority over treatment and the removal of "pre-case plan" on the one hand, it has caused dissatisfaction of the majority of employees due to discrimination, and it has imposed a very high cost on the government and the deprived people, and on the other hand, it has caused gathering in clinics and medical centers. In the next step, diagnostic tests should be performed on asymptomatic individuals because 80% of infected individuals have no clinical symptoms but can transmit the infection [7]. Careful monitoring should be carried out in offices, banks and municipalities, etc. and social distancing should be carried out properly also, disinfection should be done on busy streets and centers where there are more visitors on a daily basis. Use methods such as intubation less because in patients, positive results have not been significant (unpublished data) but have played a major role in the transmission of infection to the health-care worker. Due to the doctors, nurses and other staff at medical centers are tired and depressed due to their extensive work, officials who are not themselves at the forefront of the fight against Corona should not create strenuous austerity for them, because it causes fatigue and low morale of employees and will increase the possibility of their contamination and will generally delay the control of the disease.

Due to the closure of the business, a significant number of people have been left without funding and are therefore unable to provide personal protective equipment (PPE) such as masks, gloves, and disinfectants, and therefore appear in communities without them. On the other hand, they are delaying the disconnection of the transmission chain, so the PPE must be delivered to the people through the door of the house. Without public cooperation, it would not be possible to cut the transmission chain; therefore, the following should be observed by the people: a) Observe personal hygiene and environmental health, b) take care of themselves and do not touch their mucous membranes with infected hands, c)maintain social distance from others, d) avoid crowded public places, e) avoid touching objects and surfaces outside the home, f) do not encourage the psychological aspects of fear and horror of Corona and do not spread rumors.

Conclusion

In conclusion, imported SARS-CoV-2 to Iran was disseminated in Qom and Gilan provinces due to the lack of priority of health care system in the country and the crowded medical centers. Then, the virus spread through travelers to other provinces of the country. Overcrowding in the public transportation system, not applying mask and extensive travel during the August holidays led to rapid spread of the infection and death of a significant number of the elderly with underlying disease. However, COVID-19 can be controlled in the future days by isolation of infected individuals, treatment of patients, maintenance of social distancing, face mask wearing, and extensive disinfection of crowded areas by military and voluntary groups (Basij organization).

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Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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