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An Analysis of the Risk of Infection Disaster with the Coronavirus Disease 2019 (COVID-19) Pandemic

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Abstract

Background/Objectives: This study aimed to examine the trend of COVID-19 infection due to its spread and determine the risk of infection disaster. It intended to identify efficient response systems and preventive measures against infection disaster.

Methods/Statistical analysis: The COVID-19 status data disclosed by KDCA were coded. The data were coded to determine the trend at a ten-day interval, starting from occurrence. The research covered the period from January 20 to September 30, 2020. 23,812 cases were confirmed and 413 were dead of COVID-19 by September 30 in South Korea. Data were analyzed using an SPSS Version 20.0 (Windows) program.

Findings: The first case of COVID-19 infection in South Korea appeared on January 20, 2020. There were 23,812 confirmed cases of COVID-19 and 413 deaths by September 30. The fatality rate was 1.74%. Infection spread was first caused by Confirmed Case 31 related to a specific religion on February 18. On February 10, before Case 31 was confirmed, there were 27 confirmed cases and 0 death. On February 29, after Case 31 was confirmed, there were 3,150 confirmed cases and 17 deaths (fatality rate: 0.54%). On March 10, the mortality rate was found to be on the increase: 7,513 confirmed cases and 54 deaths (fatality rate: 0.72%). The activity of Confirmed Case 31 in closed spaces, crowded places, and close-contact settings (3Cs) seemingly made infection disaster spread more rapidly.

Improvements/Applications: The results of this study have demonstrated that 3Cs make COVID-19 infection spread more rapidly. It is therefore necessary to refrain from any 3Cs activity without full supply of COVID-19 vaccines and therapies. Efficient methods of preventing any infection disaster may include social distancing, personal hygiene, mask-wearing, rapid supply of vaccines, and establishment of a quarantine system.

Keywords **:** COVID-19, Pandemic, Infection, Disaster, Risk, Confirmed

1. Introduction

COVID-19 was initially identified in Wuhan, China in December 2019[1]. COVID-19 is a respiratory infection of SARS-CoV-2 [2]. At first, Coronavirus Disease 2019(COVID-19) was called 2019 Novel Coronavirus [3]. Then, it was called SARS-CoV-2 [3].

COVID-19 symptoms include cough, fever, fatigue, abdominal pain, dyspnea, headache, and diarrhea [2, 4]. While these symptoms generally appear 2-14 days later, some patients can have no symptom until the condition becomes worse [2]. The best strategy of coping with SARS-CoV-2 infection involves the efforts to control the source of infection, protect the vulnerable bracket, and block the source of infection [4]. It also requires early supply of COVID-19 vaccines [5].

COVID-19 spreads due to the contact with a surface stained with respiratory droplets and viruses from cough and sneezes [2]. Personal methods of infection prevention include physical distancing and mask wearing [6]. As a measure of reducing an inter-contact transmission rate, wearing a mask is effective in preventing viruses from spreading [6]. Other personal methods of infection prevention are washing hands with soap (least 20 seconds), avoiding crowded public places, refraining from any travel, social distancing (2 m), avoiding touching an eye or the nose with a hand, and covering the mouth when coughing or sneezing [2].

The conditions at high risk of worsening COVID-19 infection include cancer, asthma, dementia, obesity, diabetes, heart disease, pregnancy, liver disease, smoking, stroke, and cerebrovascular disease [7]. Villapol [8] noted that COVID-19 could seriously worsen the results of the infection when it is combined with such factors as old age, hypertension, diabetes, and obesity. Wu & Mc Googan [9] noted

that while the total mortality rate of COVID-19 infection was no more than 2.3%, the older, the more mortality rate: 14.8% for those aged ≥80 and 8.0% for those aged 70-79. These patient groups at higher risk need preventive measures because they can be at higher risk of death in case of COVID-19 infection.

KCDA [10] noted that cumulative COVID-19 confirmed cases amounted to 23,812 and the number of cumulative deaths was 413 (1.73%) by September 30, 2020. WHO [11] found that cumulative COVID-19 confirmed cases amounted to approximately 32 million and the number of cumulative deaths was 991,224 by September 28, 2020.

According to WHO [11], cumulative confirmed cases and deaths amounted to 16,233,110 and 546,864, respectively, in the Americas and 6,720,771 and 110,711, respectively, in South-East Asia. Cumulative confirmed cases and deaths amounted to 5,662,875 and 234,681, respectively, in Europe and 2,340,215 and 60,345, respectively, in the Eastern Mediterranean region. Cumulative confirmed cases and deaths amounted to 1,172,342 and 25,481, respectively, in Africa and 600,891 and 13,129, respectively, in the Western Pacific region[11]

Alabdulmonem et al. [12] contended that SARS-CoV-2 brought about the disaster of stopping the whole globe. Vries and Rambabu [13] noted that as for the effects of the natural disaster caused by the COVID-19 spread, the rate of infection (153.0%) and mortality (602.0%) was highest at the peak of outbreak. WHO [14] categorized the cases into China “Very High”, Regional “High”, and Global “High” in the risk assessment at the initial stage of COVID-19 and, then, into China “Very High”, Regional “Very High”, and Global “Very High” as of February 28, 2020; thus, the whole globe has entered the pandemic situation in terms of risk.

Choi et al. [15] suggested that the measures against the increase in the rate of confirmed cases and deaths in case of sudden infection disaster should include personal hygiene, social distancing, avoiding any crowded area, and infection disaster program activation. Zhu et al. [1] contended that the efforts to prevent COVID-19 infection from spreading should require the government to take a series of measures, including restraint on inter-city travels, quarantine reinforcement, patient tracking, information provision, and diagnosis kit development. However, mask-wearing, personal hygiene, and social distancing are used to prevent COVID-19 infection [2, 6]. While such problems as the lack of medicines, incomplete healthcare service, and insufficient healthcare items appeared at the early stage of COVID-19 outbreak, the problems with healthcare service and items have been relieved [1].

COVID-19 is not limited to some countries but rapidly spreads around the globe and becomes pandemic. Attention should be taken until the end of COVID-19 infection because vaccines are not in sufficient supply around the globe.

This study aimed to examine the COVID-19 infection status disclosed by KDCA [10] and determine the spread and risk of infection disaster. The research covered the period from January 20 to September 30, 2020. This study aimed to help develop efficient methods of preventing and coping with infection against the risk of infection disaster. It also intended to provide basic data that could help develop an infection disaster program in case of sudden infection.

2. Methods

2.1. *Study design*

This study has cross-sectional design of coding the data from KCDA [10] in terms of "infection status" from COVID-19 outbreak to September 30, 2020.

2.2. *Research Period and Subjects*

The first COVID-19 case appeared in China in December 2019. It appeared in South Korea on January 20, 2020. This study covered the period between January 20 and September 30, 2020.

Between January 20, 2020, when COVID-19 broke out, and September 30, 2020, COVID-19 confirmed cases amounted to 23,812 and there were 413 deaths. This study analyzed 23,889 confirmed cases to determine its trend.

2.3. *Instruments*

This study used the "COVID-19 infection status" data disclosed by the Korea Disease Control and Prevention Agency (KDCA) [10]. The data concerning "infection status" were used to determine the trend and sudden increase of COVID-19.

KDCA [10] gave a briefing on the COVID-19 status for the previous day on a daily basis. The briefing contained the number of confirmed cases and deaths for the previous cases, preventive measures, infection prevention policies, and vaccine supply. The daily number of confirmed cases and deaths was based on the data for 24 hours between 00:00 the previous day and 00:00 that day. The number of confirmed COVID-19 cases and deaths was given at a 10-day interval and was coded for its trend. The number of confirmed COVID-19 cases and deaths disclosed by WHO [14] was also coded for its trend at a 10-day interval.

With the sudden increase in the number of confirmed cases and deaths, the form of the status data provided by KDCA [10] and WHO [14] was changed. KDCA [10] changed it from 00:00 the previous day to 00:00 that day. WHO[14] began to collect data by weekly adding-up on August 10 and there were three-week data for August. For September, there were four-week data.

The fluctuation trend was determined on the basis of the data concerning daily COVID-19 status to help return to normal daily life and cope with the situation. At its initial stage, WHO [14] categorized China into "Very high" in the risk assessment, and the remaining countries were at lower risk than China. Then, the whole globe was categorized into "Very high" in the risk assessment and entered a pandemic situation as of February 28, 2020. The COVID-19 infection status, which was used as a research instrument in this study, can be a method of understanding the trend in the number of confirmed cases and deaths and developing how to cope with the situation.

The specific components of the status include the number of newly confirmed cases, that of cumulative confirmed cases, that of new deaths, that of cumulative deaths, preventive action rules, how to relieve stress, wearing a mask, social distancing, vaccine supply policies, side effects of vaccination and social distancing policies.

2.4. *Analysis*

The data concerning the status between the first outbreak of COVID-19 (January 20, 2020) and September 30, 2020 were collected. The COVID-19 data were coded for analysis at a ten-day interval, starting from its outbreak. SPSS 20.0 Version (Windows) was used to code the data.

2.5. *Ethical consideration*

This study was reviewed by the institutional review board (IRB) in C University (E-2nd-2020-003). This study was conducted with review exemption.

3. Results and Discussion

3.1. *Causes of COVID-19 spread in South Korea*

The causes of the COVID-19 spread in South Korea are as shown in Figure 1. Between January 20 and September 30, 2020, there were 23,812 confirmed cases and 413 deaths. The first COVID-19 case was confirmed on January 20 in South Korea.

The drastic increase in infection spread was first caused by Confirmed Case 31 related to a specific religion on February 18. On February 10, before Case 31 was confirmed, there were 27 confirmed cases and 0 death. On February 29, after Case 31 was confirmed, there were 3,150 confirmed cases and 17 deaths (fatality rate: 0.54%). On March 10, there were 7,513 confirmed cases and 54 deaths (fatality rate: 0.72%). That is, the number of confirmed cases and deaths has been on the increase since Case 31. This is consistent with the contention of Desai and P Patel [2] that COVID-19 spreads via respiratory droplets from cough and sneezes.

The second cause of the increased number of confirmed cases is probably the assembly on August 15, 2020. Crowdedness and close contact, though not closed spaces, might have accelerated the spread. On August 10, before the assembly, there were 14,626 confirmed cases. On August 20 and 30, after the assembly, its rapid spread was found: 16,346 and 19,699, respectively. Alabdulmonem et al. [12] contended that SARS-CoV-2 was the disaster of stopping the whole globe. Choi et al. [15] suggested that the measures against the increase in the infection rate should include personal hygiene, social distancing, and avoiding any crowded area. 3Cs in specific religion facilities as well as crowdedness and close contact for the assembly might have accelerated the spread. In other words, the suddenly increased spread rate in South Korea is probably due to the specific religion facilities and the assembly.

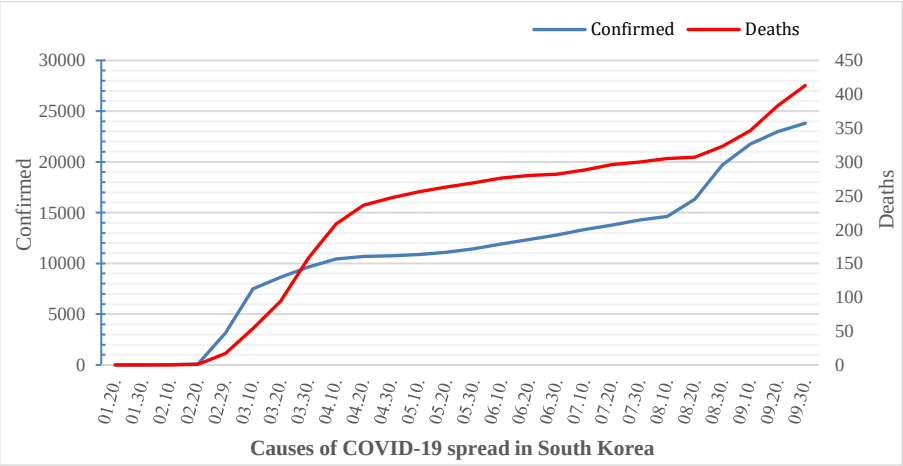

Figure 1. Number of COVID-19 confirmed cases and deaths in South Korea

3.2. *Global trend of increase in COVID-19*

The global trend status of the increase in COVID-19 is as shown in Figure 2. The research on the speed of the global COVID-19 spread covers the period between January 20 and September 30, 2020. WHO began to collect data by weekly adding-up on August 10 and there were three-week data for August. For September, there were four-week data. There were 32,730,945 confirmed cases and 991,224 deaths. The fatality rate was 3.03%.

As for the speed of infection spread, the number of confirmed cases almost trebled from March 20 to 30, 2020: 234,073 and 693,282, respectively. The number of deaths also almost trebled from 33,106 to 92,798 during the same period. The number of confirmed cases (1,521,252) more than doubled and that of deaths (92,798) almost trebled from March 30 to April 10. Since then, it has never more than doubled; still, the number of cumulative confirmed cases and deaths has been on the steady increase. Alabdulmonem et al. [12] contended that COVID-19 was the disaster of stopping the whole globe. He et al. [4] suggested that the best strategy of coping with SARS-CoV-2 should involve the efforts to control the source of infection and block the source of infection.

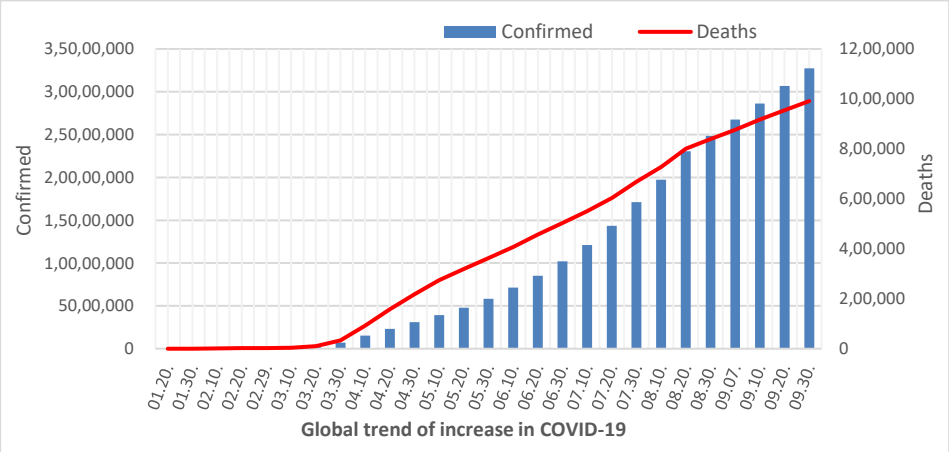

Figure 2. Number of global COVID-19 confirmed cases and deaths

3.3. *Regional trend of increase in COVID-19*

The regional trend status of the increase in COVID-19 is as shown in Figures 3-1 and 3-2. As for the increase in COVID-19 at the global level, WHO gave a division into China and the other countries until March 10, 2020 and, then, began to have a division into six regions as it became pandemic. WHO began to collect data by weekly adding-up on August 10 and there were three-week data for August. For September, there were four-week data.

The number of COVID-19 confirmed cases and deaths tended to soar in the Wester Pacific region on August 10 in the European region, on April 30, and in the South-East Asia region on April 10. In the South-East Asia region, it more than trebled between March 30 and April 10.

The number of COVID-19 confirmed cases and deaths tended to soar in the Eastern Mediterranean region, the Americas, and the South-East Asia region on March 30. In the Eastern Mediterranean region, it more than doubled between March 20 and 30. In the American region, it increased by approximately 10 times or more between March 20 and 30. In the African region, it increased by approximately 7 times or more between March 20 and 30. Vries and Rambabu [13] noted that as for the effects of the natural disaster caused by the COVID-19 spread, the rate of infection and mortality was highest at the peak of the outbreak. This is consistent with the high risk at the early stage of infection disaster. COVID-19 infection was found to be related to the vulnerable bracket [4]. This is probably associated with the countries whose healthcare system is poor.

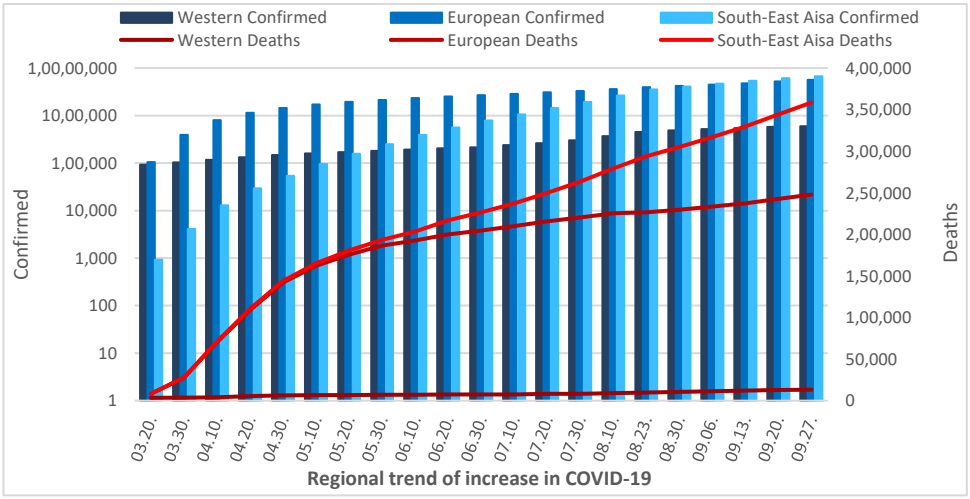

Figure 3.1. Number of regional COVID-19 confirmed cases and deaths (Western Pacific, European. South-East Asia)

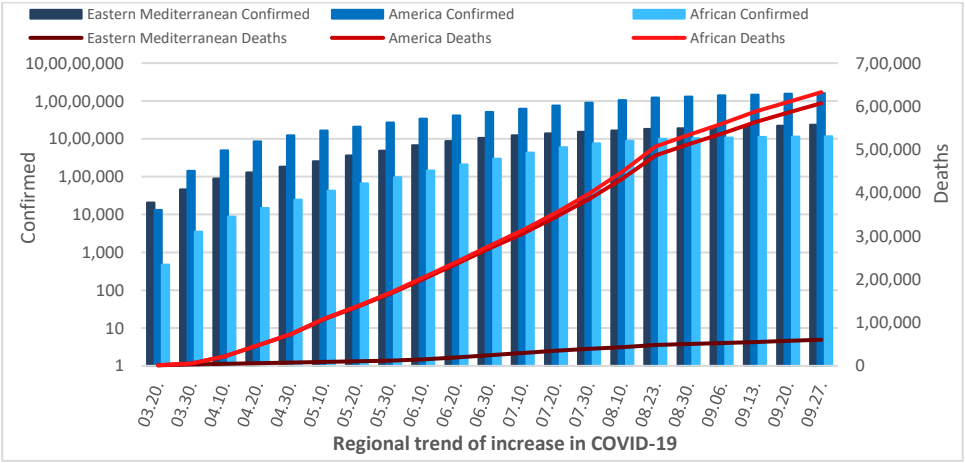

Figure 3.2. Number of regional COVID-19 confirmed cases and deaths (Eastern Mediterranean. Region of the Americas. African)

3.4. *Measures to reduce risk*

The methods of reducing the risk of COVID-19 infection spread are as shown in Table 1. They include personal hygiene, mask-wearing, drive-thru, walking-thru, sending a relevant message, social distancing, and rapid supply of vaccines and therapies. Specifically, they are blocking any source of infection, washing hands for at least 20 seconds, avoiding any crowded public place, social distancing (2m), drive and walking through, contact tracing, covering the mouth when coughing, and supply of COVID-19 vaccines [2,4,5,6,16,17,18]. They can probably give the best safety from the risk of infection.

Table 1: Measures to reduce risk

Measures		Description*	Subject
Personal hygiene		-Washing contacted items and hands thoroughly (for ≥20 sec)	personal
Wearing a mask		-Wearing a clean (disposable) mask	personal
Distance		-Social distancing : 2m	personal
Through method	drive	-Getting diagnosed and sampling safely from inside car	public
	walking	-Outside of booth: healthcare provider. -Inside of booth: an examinee	public
Sending a message		-Patient journey information disclosure	public

4. Conclusion

This study aimed to investigate the infection disaster risk in the pandemic situation with COVID-19. This can investigate the trend of infection, the risk of infection disaster, and the response systems as COVID-19 spreads. The results of this study have demonstrated that 3Cs make COVID-19 infection spread more rapidly. It is therefore necessary to refrain from any 3Cs activity without full supply of COVID-19 vaccines and therapies. Efficient methods of preventing infection disaster occurrence may include social distancing, personal hygiene, mask-wearing, and establishment of a quarantine system. These methods can protect life from the risk of infection. Subsequent research needs to make a specific experiment with the objective of reducing the risk.

5. Acknowledgment

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