



Short Communication

Coronavirus Disease-19: Quarantine Framework for Travelers Entering Korea



Quarantine Management Team, COVID-19 National Emergency Response Center*

Korea Centers for Disease Control and Prevention, Cheongju, Korea

ABSTRACT

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South Korea is operating a flexible quarantine management system which is based on the results of epidemiological investigations of patients arriving from overseas with coronavirus disease-19 (COVID-19), and closely monitoring COVID-19 outbreaks. South Korea has designated countries with a localized, high prevalence of infection as “quarantine inspection required areas” and has reinforced quarantine measures by applying special immigration procedures for people entering South Korea. Furthermore, South Korea also provides information on international travel history of entrants (who are South Korean citizens and foreign nationals) to all medical institutions, through the smart quarantine information system. On March 11th 2020, the World Health Organization characterized COVID-19 as a pandemic. Inevitably, the number of patients from overseas with COVID-19 (based on 10,000 people entering South Korea), increased to 10 cases in the second week of March, 37 cases in the third week, and 67.7 cases in the fourth week. However, after enforcing quarantine strengthening measures, and with a decrease in the number of people entering the country, the number of cases decreased to 52.0 in the first week of April.

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Introduction

In accordance with Article 5 of the Quarantine Law, South Korea has been carrying out quarantine management by designating countries with infectious diseases as “quarantine inspection required areas” to prevent the inflow and spread of new infectious diseases from overseas. Anyone who enters South Korea from a country designated as a “quarantine inspection required area” is obligated to complete a mandatory health status questionnaire at the point of entry. This is followed by quarantine officers assessing for symptoms of a fever, in addition to a cough, sore throat, and dyspnoea based on the answers given in the health status questionnaire. Quarantine investigations are subsequently conducted for symptomatic individuals [1]. Further, epidemiological

investigations are conducted on symptomatic individuals, and if diagnostic tests are needed, samples are collected, and diagnostic tests are conducted in the quarantine laboratory [2].

Following the mass outbreak of “pneumonia with unknown cause” in January 2020 in Wuhan, Hubei Province of China, South Korea designated it a new infectious disease on January 8th, in accordance with the Quarantine Law. The quarantine policy was reinforced for people entering South Korea by designating Wuhan City as a “quarantine inspection required area” [3].

COVID-19 was reported as a novel coronavirus; the source of infection and pattern of transmission were unknown. Moreover, the rate of transmission and pathogenicity of the virus had not been identified at the time [4]. Therefore, in accordance with the Quarantine Act, South Korea strengthened

*Corresponding author: Quarantine Management Team, COVID-19 National Emergency Response Center
Korea Centers for Disease Control and Prevention, Cheongju, Korea
E-mail: sontaejong@korea.kr

quarantine measures by designating countries with a high prevalence of localized COVID-19 as “quarantine inspection required areas.” Special immigration procedures were also established and implemented to strengthen quarantine management of individuals from such countries.

This article presents the quarantine system used in South Korea, which seeks to prevent infectious diseases at the point of entry. It links the quarantine system with the infectious disease management system in the community to prevent the influx and spread of COVID-19. Furthermore, this study aimed to elucidate the strengthened and flexible quarantine measures in South Korea for people entering the country, according to the degree of risk, determined by the prevalence of COVID-19 in the country from which the individual departed from.

Materials and Methods

This study utilized the computerized quarantine management system of the integrated health care and disease management system at the Korea Centers for Disease Control and Prevention (KCDC), to investigate the number of people entering the country via aviation. There were 7,631 (between January 3rd and April 9th) cases from overseas presenting with symptoms of a fever and respiratory infection at the point of entry into the country; they underwent diagnostic tests in quarantine where epidemiological investigations began. There were 352 patients who were confirmed COVID-19 positive based on diagnostic tests, and were categorized as “overseas cases” of COVID-19. In addition, 517 patients who were confirmed to be COVID-19 positive based on diagnostic tests after presenting with symptoms in the community, and who had an overseas travel history confirmed using epidemiological investigations, were also categorized as overseas cases of COVID-19.

Based on passenger information from the airlines, the smart quarantine information system links Information and Communication Technologies using the roaming records of mobile carrier companies, the passport information system of the Ministry of Foreign Affairs, the immigration records management system of the Ministry of Justice, and the Health Insurance Review and Assessment Service (which is a health institution for the local community), the information of individuals from “quarantine inspection required areas” could be confirmed and passed onto local medical institutions (medical facilities and hospitals) during COVID-19 monitoring periods (Figure 1).

Results

1. Operation of the smart quarantine information system

To check the overseas travel history of people entering South Korea who presented to medical institutions with symptoms of COVID-19, it was necessary to determine whether they had visited countries with a prevalence of COVID-19. There were 3 stages where this occurred; reception, treatment, and prescription. The Centers for Disease Control and Prevention used the qualification inquiry systems of the National Health Insurance Corporation, the Drug Safety Utilization Review of Health Insurance Review and Assessment Service, and International Traveler Information System, and shared immigration information of all individuals entering South Korea, including Korean citizens and foreign nationals, with medical institutions during COVID-19 monitoring periods (Figure 1).

Immigration information for individuals from Wuhan City was collected in early January. In the wake of the worldwide outbreak of COVID-19, by the end of January, this was subsequently extended to all people entering South Korea from mainland China. As COVID-19 appeared to spread throughout China and neighboring countries, additional immigration information on people entering South Korea from Hong Kong, Macau, Singapore, Thailand, Vietnam, Japan, Taiwan, and Malaysia were provided to medical facilities. In early March, the number of COVID-19 patients in Europe increased and immigration information on those individuals who entered South Korea from Italy, Iran, France, Germany, Spain, the UK, and the Netherlands was also provided to the medical facilities. Since March 18th, as the outbreak of COVID-19 spread across the world, immigration information on all people entering South Korea from overseas was provided to community medical facilities (Table 1). The monitoring period for COVID-19 was 14 days, during which information on overseas travel history was provided to local medical facilities. However, since there were newly confirmed positive cases after the 14-day period, immigration records were provided to local medical facilities for 21 days post-entry to South Korea, to allow for facilities to refer to this information during treatment of patients with COVID-19.

2. Changes to the quarantine policy in Korea based on COVID-19 outbreaks overseas

The KCDC designated mainland China, the first country that reported an outbreak of COVID-19, as a “quarantine inspection required area” on January 28th, and reinforced quarantine measures for people entering South Korea who had departed from China. Considering the increased risks, such as the number of confirmed COVID-19 cases exceeding 10,000

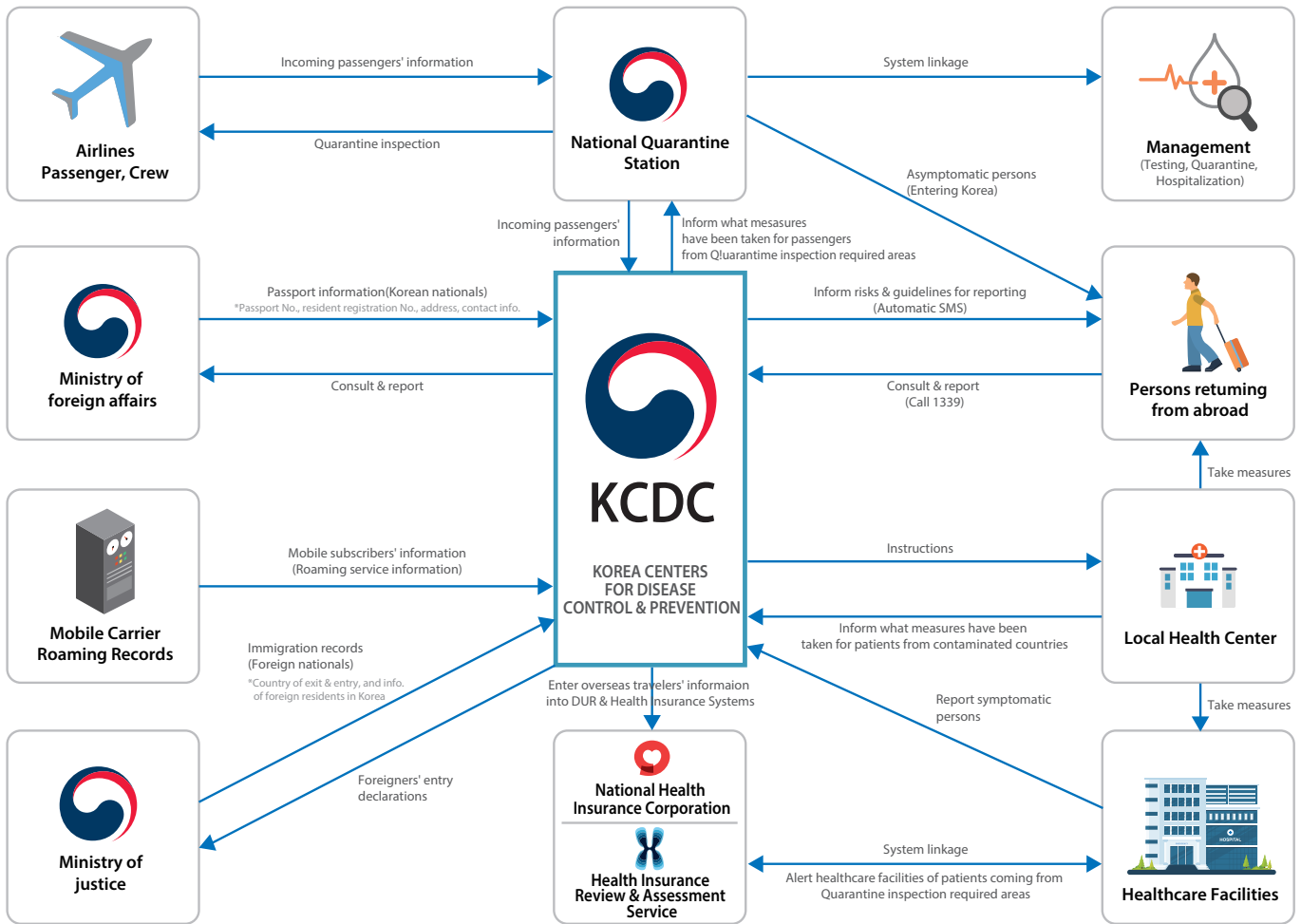


Figure 1. Establishing and operating the smart quarantine information system.

Table 1. Information provided (people entering South Korea, confirmed cases, and released cases from isolation) to medical institutions using ITS/DUR.

Classification	Country	Time period for supply of information (d)	Start date
People entering South Korea	China	21	28 th Jan
	Hong Kong, Macau, Singapore, Thailand, Vietnam		11 th Feb
	Japan		13 th Feb
	Taiwan, Malaysia		17 th Feb
	Italy, Iran		5 th Mar
	France, Germany, Spain, U.K., Netherlands		15 th Mar
	Worldwide		18 th Mar
Confirmed COVID-19 cases	-		
Released cases from isolation	-	14	

ITS/DUR = international traveler information system/drug utilization review.

in China (February 1st) [5], special immigration procedures were implemented for individuals traveling from China after February 4th.

Moreover, following the spread of COVID-19 to Europe, and with more than 10,000 confirmed cases worldwide, the KCDC implemented special immigration procedures from March 15th for 5 European countries (UK, Germany, France, Switzerland, and the Netherlands), which had direct flights to South Korea. As the risk of spread of infection from Europe increased, the prevalence of confirmed cases in Europe exceeded China on March 19th, and with more than 100 European patients with confirmed COVID-19, targeting of all travelers from Europe began on March 22nd. After 10 days of conducting diagnostic tests for COVID-19 on all people entering South Korea from

Europe, the total number of confirmed cases reached 202. From April 1st to 9th, the number of confirmed cases from overseas decreased to 89 confirmed cases.

Considering the rapidly increasing number of confirmed cases of COVID-19 in the United States, the KCDC conducted a 14-day self-quarantine measure for all people entering South Korea from the United States from March 27th. Of the 869 people classified as COVID-19 overseas cases, 313 (36.0%) traveled from the United States, and the number of confirmed overseas cases per 10,000 people entering South Korea was 4.5 in the second week of March, and 41.2 in the third week, with an increase (109 patients) in the last week of March, followed by a decrease (95.1 patients) in the first week of April (Figure 2).

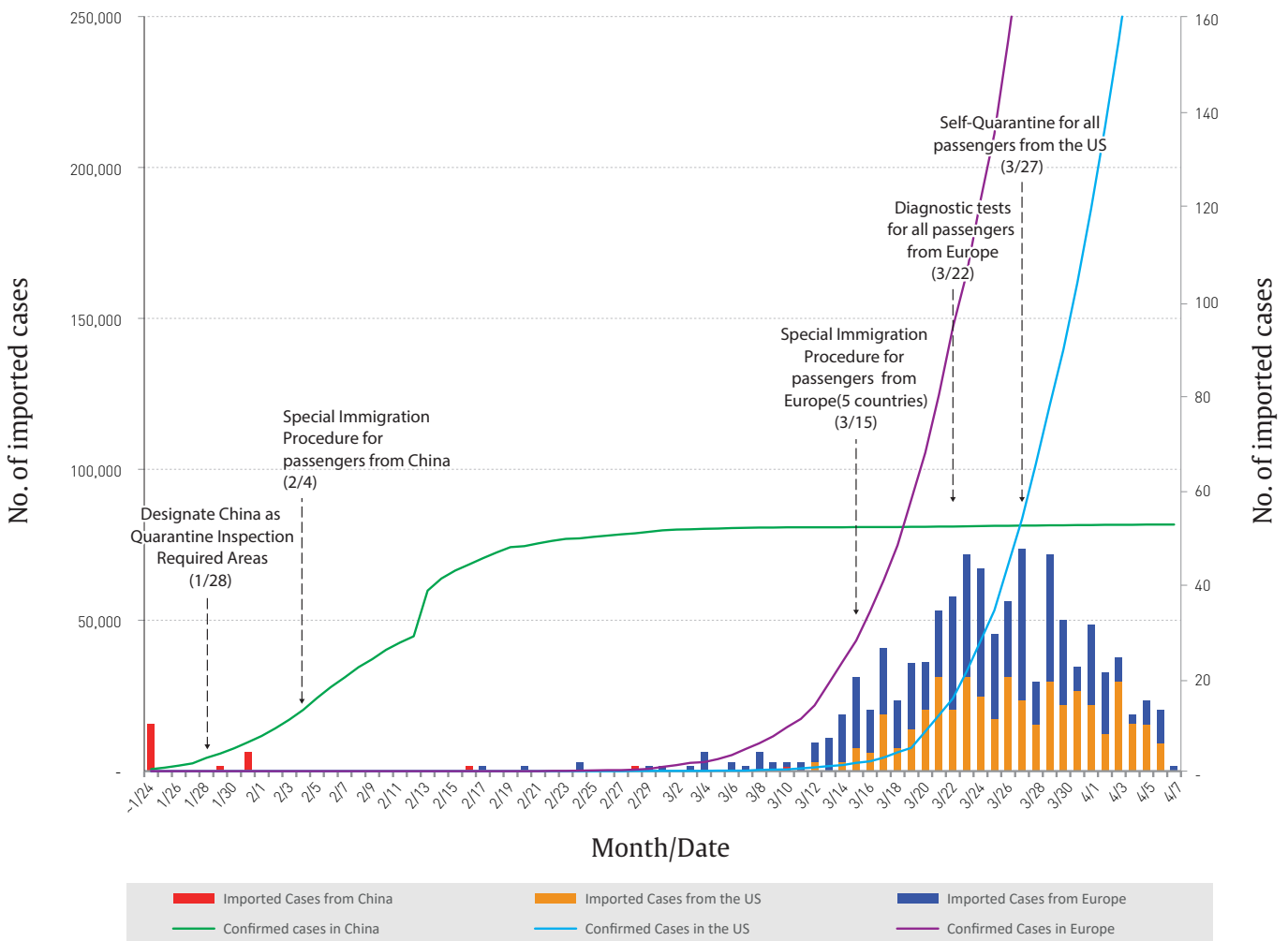


Figure 2. Occurrence of COVID-19 and quarantine measure change, according to overseas entry of COVID-19 patients, 2020.

Table 2. Risk assessment based on confirmed COVID-19 cases per 10,000 people entering South Korea, 2020.

Classification	2 nd wk of Mar (13 th –19 th)			3 rd wk Mar (20 th –26 th)			4 th wk Mar (27 th Mar–2 nd Apr)			1 st wk Apr (3 rd –9 th)		
	Immigrants	Confirmed cases	Confirmed cases per 10,000 people	Immigrants	Confirmed cases	Confirmed cases per 10,000 people	Immigrants	Confirmed case	Confirmed cases per 10,000 people	Immigrants	Confirmed cases	Confirmed cases per 10,000 people
Total	68,251	68	10.0	61,578	228	37.0	50,650	343	67.7	36,703	191	52.0
Europe	9,830	49	49.8	8,843	125	141.3	8,559	159	185.8	4,563	58	127.1
USA	15,428	7	4.5	17,720	73	41.2	12,475	136	109.0	10,939	104	95.1
Thailand	5,367	2	3.7	4,270	5	11.7	2,488	12	48.2	1,179	-	-
Philippines	12,005	8	6.7	5,862	13	22.2	2,384	10	41.9	1,600	4	25.0
Indonesia	2,549	-	-	2,987	3	10.0	2,284	3	13.1	1,773	9	50.8
Japan	1,731	-	-	2,276	-	-	4,203	1	2.4	2,046	3	14.7
Others	21,341	2	0.9	19,620	9	4.6	18,257	22	12.0	14,603	13	8.9

3. Risk assessment of COVID-19 by countries according to the status of confirmed cases from overseas

There was a total of 869 confirmed COVID-19 cases from overseas between the 20th January and the 9th April in South Korea. The patients with confirmed COVID-19 arrived from Europe (410 cases), the United States (313 cases), the Philippines (38 cases), Thailand (22 cases), China (16 cases), Indonesia (15 cases), and Canada (11 cases).

Of the 639 confirmed cases of COVID-19 cases that occurred between the second and fourth week of March, 333 patients (52.1%) were people entering South Korea from Europe, followed by 216 confirmed cases from the United States.

The number of overseas cases decreased in the first week of April (191 cases) compared to the fourth week of March (343 cases). However, the risk associated with travelers from the United States was considered to be high, as the majority of overseas cases arrived from the United States (104 cases) compared to Europe [58 cases (Table 2)].

In particular, the number of confirmed COVID-19 patients from overseas per 10,000 immigrants from Europe exponentially increased with 49.8 patients in the second week of March (13th–19th), 141.3 in the third week of March (20th–26th), and 185.8 in the fourth week of March (27th–2nd April). From the last week of March, during which diagnostic examinations and quarantine measures for all immigrants from Europe began, until the first week of April (3rd–9th), the number of confirmed cases decreased to 127.1. Moreover, the number of confirmed COVID-19 patients per 10,000 people entering South Korea from the United States increased from the second week of March (4.5 cases), through the third (41.2

cases) and fourth weeks of March (109.0 cases). This continued until March 27th. Following the quarantine measures targeting all people entering South Korea from the United States were implemented, the number of cases decreased to 95.1 confirmed cases in the first week of April. From the fourth week of March, the number of confirmed cases from Asian regions, such as the Philippines, Indonesia, and Japan, showed an increasing trend per 10,000 people entering South Korea (Table 2).

Discussion

Following the report of a mass outbreak of pneumonia with unknown cause in Wuhan City in January 2020 [6], the KCDC designated Wuhan City as a “quarantine inspection required area” (January 8th, 2020) to prevent the spread of infection into the country. The quarantine measures for symptomatic patients were strengthened by checking the body temperature of all people entering South Korea, and requiring individuals from Wuhan City to complete a health status questionnaire.

On March 11th 2020, the World Health Organization characterized COVID-19 as a pandemic. Special entry procedures for immigrants from China was enforced between February 4th and March 19th to prevent the spread of the infection into the country. The special immigration procedures included a process whereby an individual was only allowed to enter the country after installing a self-health check app on their mobile phone which required them to report their symptoms (such as a fever or cough) every day, for 14 days. When symptoms were registered using the app, a dedicated

team was notified to guide the user to medical facilities for examination and/or treatment. This helped improve the management of the infectious disease within the community by enabling a rapid diagnosis, and quarantine treatment of the suspected COVID-19 patient who exhibited symptoms, (such as fever and cough), who previously had been asymptomatic (due to the incubation period of COVID-19) upon entry into the country.

Since the outbreak of MERS in Korea, in 2015, the KCDC established, and implemented the smart quarantine information system, to promptly manage the spread of infectious diseases that may be brought into the country from overseas. This was facilitated by linking the quarantine process at the border entry point with the management of infectious diseases within the community. The KCDC used the smart quarantine information system to provide information to all medical institutions regarding individuals from overseas who have come into contact with a patient confirmed to have COVID-19, and individuals who had COVID-19, but no longer required isolation. Such information was provided to medical facilities in the local community using the Drug Safety Utilization Review of Health Insurance Review and Assessment Service, and the International Traveler Information System, so that facilities could confirm overseas travel history upon patient presentation (Figure 1). By confirming whether the patient had been exposed to COVID-19 infection during reception, treatment, and prescription, medical facilities were able to refer to this information during treatment and promptly classify suspected patients to minimize contact with other individuals, thereby effectively managing COVID-19 in the local community.

The KCDC applied various levels of quarantine measures, including the designation of “quarantine inspection required areas” and the implementation of special immigration procedures, considering the COVID-19 pandemic, and the status of people traveling from overseas to South Korea. In January 2020, the degree of risk of spread of infection from China, which accounted for more than 90% of COVID-19 patients worldwide, was assessed as high [7]. Accordingly, the “quarantine inspection required area” was expanded from Wuhan City to the entirety of mainland China on January 28th, and the quarantine was strengthened for these people entering South Korea, who departed from China. Furthermore, considering that the number of COVID-19 patients exceeded 10,000 in China, and that numerous exchanges occur between Korea and China, a special entry procedure was implemented from February 4th. In addition, the risk of COVID-19 was assessed as considerably high in areas where more than 10,000 cases of COVID-19 were reported; therefore, the special immigration procedure was also applied for people entering South Korea who departed from Italy. Moreover, it was

essential to consider both direct and multi-stop flights entering Korea, where multiple destinations in Europe may have been visited. Accordingly, the special immigration procedure was expanded from 5 European countries to all European countries in mid-March. The enforcement of the quarantine management policy to people from overseas entering South Korea, was a systematic and flexible quarantine management reinforcement measure, taking into consideration the COVID-19 infection rate overseas, and the level of risk of spread of infection into Korea (Figure 2). During this process, there were 7,631 diagnostic tests for COVID-19 performed between the 3rd January and the 9th April conducted at immigration, on symptomatic individuals (with confirmed fever and respiratory symptoms) during the quarantine procedure into the country. As a result, by April 9th, 352 individuals were diagnosed as COVID-19 positive, and were transferred to isolation treatment beds. This accounted for 4.6% of symptomatic patients who were diagnosed with COVID-19 at point of entry into the country.

The KCDC established the quarantine policy by determining the target and timing of quarantine measures, as well as the degree of the quarantine measures. This was performed by referring to risk assessments that reflected the number of confirmed cases of COVID-19 in people entering the country from overseas (per 10,000 entering the country), and the quarantine management performed on individuals entering South Korea from countries with a high prevalence of COVID-19. For Europe, there were 49.8 confirmed cases per 10,000 people entering South Korea from overseas in the second week of March, showing an increasing trend. Therefore, diagnostic tests and imposed self-quarantine were conducted after March 22nd for all people entering South Korea who had departed from Europe. Moreover, the number of confirmed cases from the United States showed an increase from the third week of March (41.2 cases). Therefore, all people entering South Korea from March 27th, from the United States were required to self-quarantine. As the total number of confirmed cases from overseas had increased over the third (37.0 cases) and fourth weeks of March (67.7 cases), self-quarantine measures were implemented from April 1st, for all people entering South Korea worldwide. As a result, the number of confirmed cases from overseas per 10,000 people entering South Korea, decreased for Europe (from 185.8 to 127.1 cases) and the United States (from 109.0 to 95.1 cases) in the first week of April, compared with the fourth week of March (Table 2). Consequently, the total number of confirmed cases from overseas per 10,000 people entering South Korea also appeared to decrease. Therefore, the degree of risk from the COVID-19 pandemic appeared to show a downward trend.

However, of the total number of confirmed cases from overseas, the proportion of cases from Europe decreased steadily over the second (72.1%), third (54.8%), and fourth

weeks of March (46.3%). During this period, of the total number of confirmed cases from overseas, the proportion of the cases from the United States continued to increase over the second (10.3%), third (32.0%), and fourth week of March (39.6%). In particular, the proportion of cases from the United States accounted for 55.0% of the total number of confirmed cases from overseas in the first week of April, which was higher than that of Europe (30.7%). Although the number of confirmed cases from overseas was decreasing, the risk of cases from the United States appeared to be increasing considering the proportion of confirmed cases from the United States of the total number of overseas confirmed cases (Table 2).

There are currently 869 cases of COVID-19 from overseas as of the 9th April in South Korea, of which 352 cases (40.5%) were identified at the point of entry into the country, and 517 cases (59.5%) were confirmed during imposed self-quarantine within the community. The results of this study are an outcome of improving the quarantine information systems, and the quarantine and epidemiological investigation methods at the point of entry at the country's border and quarantine sites, following the 2015 MERS outbreak in Korea. It is also considered to be the outcome of expanding the quarantine infrastructure, such as conducting diagnostic tests at the point of entry, and establishing isolation monitoring facilities, in addition to establishing and operating a multi-layered quarantine system to link the prevention of infectious diseases at the quarantine stage upon entry into South Korea, with the infectious disease management system in the community. Since the COVID-19 pandemic, the KCDC has been closely monitoring the overseas trends of COVID-19 to prevent spread of the disease into South Korea, and into the local communities. Furthermore, the KCDC plans to continue to operate a flexible quarantine system based on the degree of risk in other countries.

Conflicts of Interest

The authors have no conflicts of interest to declare.

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