DOI Number: 10.37506/v20/i1/2020/mlu/194541

An Analysis of the Risk of the Infection Disasters by Legal Infectious Disease Outbreak in South Korea

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Abstract

Background/Objectives: This study aimed to analyze the risk of the infection disasters by outbreak status of Group 1 to 4 legal infectious diseases in South Korea.

Methods/Statistical analysis: The raw data regarding "legal infectious diseases under complete surveillance" disclosed by the Ministry of Health Welfare (MOHW) and the Korea Centers for Disease Control and Prevention (KCDC) were used. The infectious diseases are divided into Group 1, 2, 3, 4, and 5 infectious diseases, designated infectious diseases, infectious diseases supervised by the World Health Organization (WHO), bioterrorism-related infectious diseases, sex-mediated infectious diseases, zoonosis, and medically-related infectious diseases. Of these, Group 1 to 4 legal infectious diseases found between 2014 and 2018 were included in this study. The analyses were carried out by using an SPSS Version 20.0 program.

Findings: Between 2014 and 2018, the number of Group 2 legal infectious diseases (562,830 cases) was greatest, followed by Group 3 (194,847), Group 1 (25,844), and Group 4 (3,183). Group 3 (625 cases) resulted in the greatest number of deaths, followed by Group 2 (275), Group 4 (214), and Group 1 (18). Of these, Middle East Respiratory Syndrome (MERS), Group 4 infectious disease, resulted in 38 cases of death in 2015. Such a high death toll was due to the poor awareness of the risk of MERS introduced from abroad and the absence of a good control and coping system. Since the MERS outbreak in 2015, the awareness of infection disasters has changed, resulting in the absence of death in 2016.

Improvements/Applications: It is unclear how to determine the intensity of infection for infectious diseases introduced from abroad. It is necessary to make efforts to improve precautions, reinforce coping against the spread, enhance capabilities through mock drill, improve the legal system, and increase infrastructures with the objective of building an efficient crisis control system against infectious diseases.

Keywords: *Infectious disease, Legal infectious disease, Surveillance, Infection disaster, Prevention*

Introduction

The law regarding infectious disease prevention and control has been established to prevent the outbreak and prevalence of infectious diseases harmful to the people's health, define the requisites for their prevention and control, and contribute to the promotion and maintenance of the people's health [1]. In 2014, some countries, including the United States, made an agreement among them to accelerate prevention, surveillance, and coping against the intentional, accidental, and natural threats of infectious diseases [2].

In this context, the law regarding infectious disease prevention and control has been established to classify the legal infectious diseases in pursuit of infectious disease prevention and control [1]. The legal infectious diseases are divided into Group 1, 2, 3, 4, and 5 infectious

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diseases, designated infectious diseases, infectious diseases supervised by WHO, bioterrorism-related infectious diseases, sex-mediated infectious diseases, zoonoses, and medically-related infectious diseases [1].

While the infectious disease mortality is on the increase, there is no treatment for Evola virus whose lethality is 50% to 90% [3]. Since its discovery in 2012, Middle East Respiratory Syndrome(MERS)-CoV has affected approximately 1,100 people, including children, in 12 countries and resulted in higher mortality than Severe Acute Respiratory Syndrome (SARS) (40% vs. 10 %) [4].

In 2015, South Korea was at risk of national disaster due to the outbreak of MERS [5]. Since the introduction of MERS into South Korea in 2015, 38 out of 186 persons definitively diagnosed with the disease have died [6]. It can be said that the disease strongly affected its society, economy, and health [5, 6]. Five super-spreaders were very likely to affect infection: 82.7% of all those definitively diagnosed with the disease were reportedly able to spread it [6]. The prevalence of new infectious diseases, including SARS, Avian influenza, and MERS, which are sources of anxiety, requires efforts to cope with critical situations at the national level [7].

Benca [8] noted that regions having artificial disasters (war, terrorism, industrial accidents, etc.) and natural disasters (earthquake, flood, tsunami, volcano explosion, etc.) are strongly correlated with the factors for infectious disease outbreak. That is, disaster zones are at high risk of infectious disease outbreak. In addition, WHO [9] noted that people could be more susceptible to an infectious disease if it occurred at specific regions and was more likely to occur.

Infection may cause damage to spread rapidly from a certain area to vast regions. While research on some cases of infection has been conducted, few studies using annual data have been conducted and little research using the data disclosed by MOHW and KCDC [10] has been performed. This study aimed to use the annual data regarding "legal infectious diseases under complete surveillance" disclosed by MOHW and KCDC [10] to determine the risk of infection disasters.

It intended to determine the risk of infection disasters related to the annual outbreak of legal infectious diseases—Group 1 to 4—in South Korea on the basis of the data regarding "legal infectious diseases under complete surveillance" disclosed by MOHW and KCDC [10]. The period between 2014 and 2018 was reviewed to determine the annual status of legal infectious diseases.

Method

1. Study design

The raw data regarding "legal infectious diseases under complete surveillance" disclosed by MOHW and KCDC [10] were used. On this basis, secondary data analysis was performed to determine the "risk of infection disasters by legal infectious disease outbreak status."

2. Instruments and subjects

This study used the data regarding each of the "legal infectious diseases" disclosed by MOHW and KCDC [10] to determine the risk of infection disasters between 2014 and 2018. The data from the complete surveillance of legal infectious diseases during the period of five years from 2014 to 2018 were drawn.

The legal infectious diseases are divided into Group 1, 2, 3, 4, and 5 infectious diseases, designated infectious diseases, infectious diseases supervised by WHO, bioterrorism-related infectious diseases, sex-mediated infectious diseases, zoonoses, and medically-related infectious diseases [1, 11].

Among the legal infectious diseases, Group 1 to 4 infectious diseases were included in this study. Since there were raw data regarding Group 1 to 4 infectious diseases among the legal infectious diseases under complete surveillance, as disclosed by MOHW and KCDC [10], these four groups were included in this study. It is mandatory to report any of Group 1 to 4 legal infectious diseases without delay. If a legal infectious disease occurs, it is first reported to the target monitoring agency and then to the department of health at the level of cities, counties, and districts, the department of health at municipal and provincial levels, and KCDC [11].

There were 88,774 cases of Group 1 to 4 legal infectious diseases in 2014, 104,028 cases in 2016, and 170,498 cases in 2018.

3. Ethical consideration and Analysis

This study has obtained the approval of review exemption from the Institutional Review Board (IRB) of C University (Human-008-20190523-1st)(Review Exemption). The data were analysed using an SPSS

WIN 20.0 Version program.

Result and Discussion

1. Changes in trend of legal infectious disease outbreak and mortality

The trend of Group 1 to 4 legal infectious disease outbreak and mortality between 2014 and 2018 was presented in [Table 1], [Figure 1], and [Figure 2]. Between 2014 and 2018, the number of Group 2 legal infectious diseases (492.227) was greatest, followed by Group 3 (159,400), Group 1 (16,907), and Group 4 (2,623). Legal infectious disease mortality was incongruous with outbreak size: Group 3 (456) resulted in the greatest number of deaths, followed by Group 2 (261), Group 4 (196), and Group 1 (12).

With the increase and decrease in outbreak and mortality of infectious diseases, international cooperation is made to control and cope with infectious diseases [2, 12]. WHO adopted the International Sanitary Regulations to prevent the global spread of infectious diseases in 1951 and the International Health Regulations in 2005 [12]. In 2014, the Global Health Security Agenda (GHSA) presented a vision [2].

Table 1. Changes in trend of legal infectious disease outbreak and mortality

Category		2014	2015	2016	2017	2018	Total
Group 1	Outbreak size	1,816	2,128	5,077	4,875	3,011	16,907
	Number of deaths	1	1	2	3	5	12
Group 2	Outbreak size	70,535	70,446	72,127	98,308	117,811	429,227
	Number of deaths	11	36	23	70	121	261
Group 3	Outbreak size	16,178	18,851	26,208	49,100	49,063	159,400
	Number of deaths	64	33	43	105	211	456
Group 4	Outbreak size	245	561	616	588	613	2,623
	Number of deaths	16	60	19	55	46	196
Total (Outbreak size)		88,774	91,986	104,028	152,871	170,498	608,157
Total (Number of deaths)		92	130	87	233	383	925

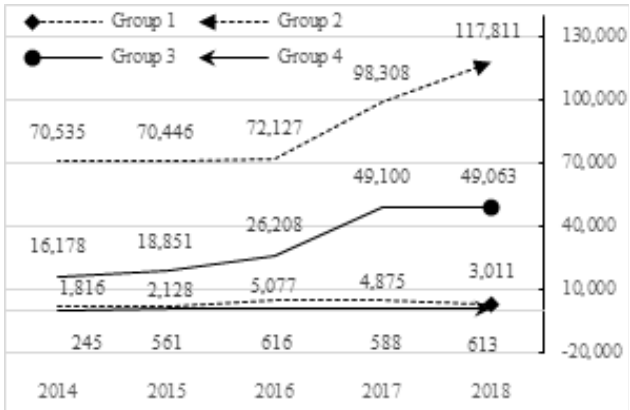

Figure 1. Changes in trend of legal infectious disease outbreak

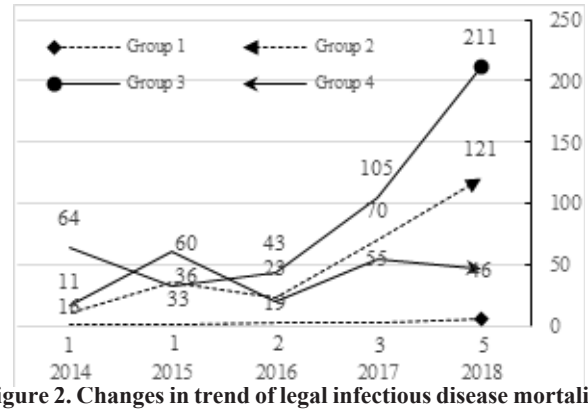

Figure 2. Changes in trend of legal infectious disease mortality

2. Trend of mortality by criteria for Groups 1 and 2 legal infectious disease classification

The changes in the trend of mortality by the criteria for Group 1 and 2 legal infectious disease classification between 2014 and 2018 are presented in [Table 2]. Among Group 1 infectious diseases, hepatitis A (8 cases) had high mortality, but cholera, paratyphoid fever, and bacillary dysentery resulted in no case of death.

Among Group 2 infectious diseases, Pheumococcus (240 cases) and Japanese encephalitis (12) had high mortality, but diphtheria, pertussis, measles, mumps, poliovirus resulted in no case of death.

Group 1 infectious diseases, which are mediated by water or food and are very likely to have mass outbreak, require making anti-epidemic measures immediately after the outbreak or prevalence; Group 2 infectious diseases require national vaccination [1,11]. Group 1 and 2 infectious diseases have low mortality probably because of the prevention of food mediation and national vaccination. Lee [13] found that the awareness of legal infectious diseases was poor: an average of 6.56 out of 14.

Table 2. Trend of mortality by criteria for Groups 1 and 2 legal infectious disease classification

Category		**2014**	**2015**	**2016**	**2017**	**2018**	**Total**
Group 1	Cholera	0	0	0	0	0	0
	Typhoid fever	1	0	0	0	0	1
	Paratyphoid fever	0	0	0	0	0	0
	Bacillary dysentery	0	0	0	0	0	0
	Enterohemorrhagic Escherichiacoli	0	0	0	0	3	4
	Hapatitis A	0	1	2	3	2	8
	Total	1	1	2	3	5	12
Group 2	Diphtheria	0	0	0	0	0	0
	Pertussis	0	0	0	0	0	0
	Tetanus	0	0	2	0	2	4
	Measles	0	0	0	0	0	0
	Mumps	0	0	0	0	0	0
	Rubella	0	0	0	0	0	0
	Poliovirus	0	0	0	0	0	0
	Japanese encephalitis	4	2	3	2	1	12
	Varicella	0	0	0	0	1	1
	Acute hepatitis B	1	0	0	1	2	4
	Haemophilus influenzae type B	0	0	0	0	0	0
	Pheumococcus	6	34	18	67	115	240
	Total	11	36	23	70	121	261

3. Trend of mortality by criteria for Groups 3 and 4 legal infectious disease classification

The changes in the trend of mortality by the criteria for Group 3 and 4 legal infectious disease classification between 2014 and 2018 are presented in [Table 3]. Among Group 3 infectious diseases, Vibrio vulnificus septicemia (109 cases), Carbapenem-Resistant Enterobacteriaceae (CRE) (180), and Tsutsugamushi disease (60) had high mortality, but scarlatina, Hansen's disease, leptospirosis, and anthrax resulted in no case of death.

Among Group 4 infectious diseases, Severe Fever with Thrombocytopenia Syndrome(SFTS)(156 cases) and MERS (38) had high mortality, but pest, Yellow fever, dengue fever, and rabbit fever resulted in no case of death.

Group 3 infectious disease requires continuous monitoring of outbreak and establishment of anti-epidemic measures due to the likelihood of intermittent prevalence; Group 4 infectious disease is a new type of infectious disease that occurs or is likely to occur domestically or infectious disease prevalent overseas that can possibly be introduced into South Korea [1, 11]. Jang [7] indicated that simply controlling the existing infectious diseases could lead to easy collapse of the national network of anti-epidemic measures due to new types of infectious diseases, which can occur anytime, anywhere. Jeong et al. [14] suggested the need to give systematic education and management concerning vaccination and travel-related precautions prior to business trip and provide continuous control service following business trip according to destination in travel.

The mortality of Group 4 infectious disease was on a sudden increase in 2015. The absence of good control or coping with the introduction of MERS from abroad resulted in 38 cases of death. The outbreak of the infectious disease in 2015 led to the spread of infection disasters. Lee [13] reported that 74.9% of the respondents suggested the need to make anti-epidemic measures against introduction of SARS, SFTS, and MERS into South Korea [13],

Table 3. Trend of mortality by criteria for Groups 3 and 4 legal infectious disease classification

Category		2014	2015	2016	2017	2018	Total
Group 3	Malaria	5	0	1	3	4	13
	Scarlatina	0	0	0	0	0	0
	Hansen's disease	0	0	0	0	0	0
	Meningococcal meningitis	0	1	0	1	1	5
	Legionella species	0	1	8	17	22	48
	Vibrio vulnificus Septicemia	40	13	12	24	20	109
	Typhus fever	0	0	0	0	0	0
	Murine typhus	0	0	0	0	0	0
	Tsutsugamushi disease	13	11	13	18	5	60
	Leptospirosis	0	0	0	0	0	0
	Brucellosis	0	0	0	0	0	0
	Anthrax	0	0	0	0	0	0
	Hydrophobia	0	0	0	0	0	0
	Hemorrhagic fever with renal syndrome	3	7	3	0	0	13
	Lues	0	0	0	0	0	0
	Creutzfeldt-jakob disease(CJD)	3	0	6	5	11	25
	Hapatitis C	-	-	-	0	5	5
	Vancomycin resistant staphylococcus aureus	-	-	-	0	0	0
	CRE	-	-	-	37	143	180
	Total	64	33	43	105	211	456

Cont... **Table 3. Trend of mortality by criteria for Groups 3 and 4 legal infectious disease classification**

Group 4	Pest	0	0	0	0	0	0
	Yellow fever	0	0	0	0	0	0
	Dengue fever	0	0	0	0	0	0
	Viral hemorrhagic fever	0	0	0	0	0	0
	Variola	0	0	0	0	0	0
	Botulism	0	0	0	0	0	0
	SARS	0	0	0	0	0	0
	Avian lnfluenza virus	0	0	0	0	0	0
	Novel swine-origin influenza A(H1N1)	0	0	0	0	0	0
	Rabbit fever	0	0	0	0	0	0
	Q fever	0	0	0	1	0	1
	West Nile fever	0	0	0	0	0	0
	Lyme disease	0	1	0	0	0	1
	Tick borne encephalitis	0	0	0	0	0	0
	Melioidosis	0	0	0	0	0	0
	Chikungunya Virus	0	0	0	0	0	0
	Emerging infectious disease	0	0	0	0	0	0
	SFTS	16	21	19	54	46	156
	MERS	-	38	0	0	0	38
	Zika virus	-	-	0	0	0	0
	Total	16	60	19	55	46	196

Conclusion

This study aimed to analyze the risk of the infection disasters by legal infectious disease outbreak. Of the legal infectious diseases, Group 1 to 4 infectious diseases were included in this study. Of these, MERS, Group 4 infectious disease introduced from abroad, resulted in 38 cases of death in 2015. It is unclear how to determine the intensity of infection for infectious diseases introduced from abroad. The efforts to supplement infection control facilities in healthcare institutions, supplement professional manpower, improve the manual, and give education and training are expected to help develop a program against infection disasters.

Ethical Clearance: Not required

Source of Funding: Self

Conflict of Interest: Nil

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