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A Study on Healthcare Policy Response to Risks of Future Infectious Diseases: Focused on Infectious Disease Surveillance Systems

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미래감염병 위험성에 대한 보건의료정책에 관한 연구: 감염병 감시체계를 중심으로

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Abstract The purpose of this study is to make suggestions for the infectious disease surveillance systems as part of the government's healthcare policy intended to minimize damage by implementing an appropriate and swift crisis management in the event of future infectious disease outbreaks. To that end, this descriptive study analyzes the infectious disease outbreaks and the management and control thereof in Korea and other countries, so as to suggest some approaches to infectious disease surveillance systems applicable to affected regions. The analysis results shed light on the causes of the spread of future infectious diseases over the past years, and the management systems that could possibly deal with the trial and error in the response policy. It seems crucial to roll out appropriate information, training and promotion programs as part of the national disaster response systems to prevent infectious diseases in relation to the roles of multiple relevant government agencies in the event of disasters especially amid the COVID-19 pandemic.

Key Words : Infectious diseases, future infectious diseases, infectious disease surveillance system, health care, health care policy

요 약 본 연구의 목적은 미래감염병 발생 시 적합하고 신속한 위기관리체계를 수행으로 인한 피해경감을 최소화할 수 있는 정부의 보건의료정책을 마련하기 위한 감염병 감시체계 방안의 모색하는 것이다. 연구의 방법으로는 국내외 감염병 발생과 관리현황을 분석하고, 재난피해 지역에 대한 감염병 감시체계방안을 제시하기 위한 기술적 연구를 하는 것이다. 본 연구를 통해 과거 미래감염병의 사회적 확산에 대해서 원인과 그 대응정책의 시행착오 등에 대해 보다 명확한 관리체계를 확인할 수 있었다. 이에 대유행하고 있는 코로나바이러스감염증-19 확산사태를 지켜보면서 국내 재난대응체계에서는 재난 발생시 참여하게 되는 여러 기관의 역할과 관련된 감염병 예방을 위한 교육 및 훈련과 홍보가 매우 중요할 것으로 본다.

키워드 : 감염병, 미래감영병, 감염병 감시체계, 보건의료, 보건의료정책

1. Introduction

Global pandemics of newly emerging infectious diseases pose persistent risks, underscoring the government-led response to future infectious diseases. The World Health Organization(WHO) has issued the warning of unprecedented outbreaks of

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newly emerging infectious diseases in recent years. Indeed, since the 1970s, over 40 newly emerging infectious diseases have broken out including SARS, MERS, Ebola, Chikungunya, avian influenza and Zika. Since the 2014 Ebola outbreak, the WHO has established 9 criteria to prioritize the newly emerging infectious diseases, i. e. transmission to humans, fatality rates, pandemic potential, evolution potential, medical response measures, challenges in surveillance and control, public healthcare system in affected regions, risk of international spread, and impacts on society[1].

In Korea, the 2009 novel influenza A/H1N1 pandemic claimed 270 lives, imposing approx. KRW 1.9 trillion socioeconomic costs. Notably, cases of newly emerging infectious diseases have been reported in Korea due to climate change and globalization, e.g. the increase in imported cases of tropical fevers such as malaria and dengue as well as West Nile, Lyme and Chikungunya viruses[2]. Unfortunately, however, even after the WHO issued the criteria, public healthcare facilities failed to attract media and public attention as outbreaks subsided, even though media highlighted the roles and significance of public hospitals every time the country was affected by global outbreaks (e.g. 2015 MERS and 2016 Zika). Historically, the spread of newly emerging infectious diseases has drawn attention to the public effects of healthcare and policy issues in Korea. The escalating public attention to a policy issue triggered a socio-political change, where media played a critical role. When the public attention to an issue intensified, media persistently covered the issue, while at the same time the media coverage sustained the public attention to the issue, which resulted in a socio-political change[3-7].

When it comes to rational approaches to risks, technical approaches minimizing material and objective risks are important. At the same time, it is equally important to find out and mitigate any factors that would otherwise amplify the risks posed to individuals or communities. This study approaches the spread of risks throughout society from the perspective of future infectious diseases.

In that the potential risks of future infectious diseases imply temporality characterized by the shifting targets of management over time, future infectious diseases should be put under persistent surveillance, while newly emerging infectious diseases should be watched intently and re-prioritized over time.

Also, to organize new systems for diagnosing, characterizing and monitoring infectious diseases by developing strategies for aggressively utilizing state-of-the-art science technologies for future infectious disease management systems, it is imperative to analyze comparable cases and formulate risk prediction models and proper healthcare policy. Major countries including the US and the UK have been building and reinforcing their advanced public healthcare systems to respond to unknown infectious diseases that might emerge in the future.

Hence, the purpose of this study is to offer suggestions for infectious disease surveillance systems conducive to government-led healthcare policy for minimizing the damage in the event of future infectious disease outbreaks by implementing appropriate and fast crisis management systems. The findings of this study would contribute to increasing the efficiency in responding to not only future infectious diseases but also highly contagious existing infectious diseases, and minimizing damage.

2. Risks of future infectious diseases

Since 2000, the world has gone through 7 epidemics, i. e. the 2003 SARS, 2009 H1N1, 2013 SFTS(severe fever with thrombocytopenia syndrome), 2014 Ebola, 2015 MERS, 2016 Zika and 2017 avian influenza(H5N1 virus)[8]. Those outbreaks have impacted different aspects of

governments' healthcare policy to a greater or lesser extent. The 2015 MERS outbreak revealed the inferiority in healthcare and epidemic prevention systems and caused people to panic, wreaking havoc on national economy. By the same token, public healthcare issues including newly emerging infectious diseases are considered to have influenced the country's public healthcare policy[9].

Infectious disease outbreaks following natural disasters do not necessarily arise from the disasters but vary with the sizes of disaster-related victim groups, their health conditions and vaccination statuses, drinking water supply and hygienic conditions, and proximity to healthcare facilities.

Kouadio et al., defined the influx of victims into regions affected by epidemics, crowded living conditions, post-flood puddles, drinking water contamination, poor sanitation, propagation of vectors, victims' nutrition and vaccination statuses, and physical damage as the risk factors of epidemics following natural disasters, and described such factors might lead to waterborne or airborne infectious diseases, droplet infections, vector-borne infectious diseases and wound infections.

3. Potential infectious disease outbreaks resulting from disasters

3.1 Law on Prevention and Management of Infectious Diseases

Storms and floods often cause such risk factors as crowded living conditions among victims, puddles, contamination of drinking water, and propagation of vectors. Therefore, storm and flood victims are highly susceptible to acute diarrhea, leptospirosis, hepatitis A[9], acute respiratory diseases, measles, meningococcosis, tuberculosis, malaria and tick-borne diseases. Earthquakes often cause such risk factors as crowded living conditions among victims, contamination of drinking water and physical damage.[10] Therefore, earthquake victims are highly prone to acute diarrhea, hepatitis A, acute respiratory diseases, measles, meningococcosis, tuberculosis and tetanus. Heat waves may cause the contamination of drinking water and propagation of vectors. Both heat and cold waves may compromise the nutritional intakes of community residents, who may in turn become vulnerable to acute diarrhea and acute respiratory diseases.

3.2 Method of evaluating the perceived risks of future infectious diseases

Quantitative psychology modeling is based on heuristic modeling which tends to rely on affective intuition rather than scientific figures to evaluate the general public's perception of technically complex and difficult issues such as risks[10].

The essence of quantitative psychology modeling is that the scientifically derived 'extent of risks' and the 'likelihood of risks' turn into 'fear' and 'unknown extents,' respectively, and serve as the reference points for the general public's subjective assessment of risks[11].

That is, the general public has a propensity to assess risks based on not quantitative figures of the extents and likelihood of risks but qualitative attributes(fear and unknown extents) of risks deduced from such quantitative figures.

4. Analysis of infectious disease outbreaks and control in Korea and abroad

4.1 Future infectious disease control

In Korea, the Center for Disease Control (KCDC) is responsible for controling infectious diseases and operating surveillance systems[9]. The country's organized infectious disease control and surveillance systems cover officially designated infectious diseases, waterborne and food-borne infectious diseases and respiratory infectious diseases as well

as mosquito-, tick- and rodent-borne infectious diseases.

In 2017, the government published an infectious disease control manual in response to typhoons and floods to present the strategies for stepwise response and control measures applicable to infectious diseases in the event of disasters. Yet, the infectious disease control and response systems applicable to other types of disasters except floods and storms leave much to be desired. The National Emergency Management Agency has been responding to the COVID-19 pandemic as follows.

In relation to the COVID-19 outbreak, the National Emergency Management Agency has developed the plans for managing COVID-19 patients who tested positive twice, supporting the transport information concerning international travelers using KTX upon entering Korea, distancing in everyday life led by municipal governments, and managing the self-isolation sites.

4.2 Future infectious disease control in overseas countries

4.2.1 The U.S.

The U.S. Center for Disease Control and Prevention (CDC) proposes infectious diseases following natural disasters such as typhoons, earthquakes, floods and heavy snowfalls should be managed by the Office of Public Health Preparedness and Response, and implements comprehensive response measures including preparedness for disasters, surveillance systems, information and training programs, social media, public health monitoring and warnings, and management of senior citizens and young children[12].

4.2.2 Japan

The National Institute of Infectious Disease (NIID) in Japan operates the standing Infectious Disease Surveillance Center (IDSC) focused primarily on preventing and monitoring 1~5 categories of officially designated infectious diseases[9].

5. Suggestions for infectious disease surveillance system policy for affected regions

It is necessary to develop more proactive national infectious diseases surveillance systems. Since it is difficult to early detect the risks of infectious disease outbreaks based on a few suspected or diagnosed cases reported by healthcare providers, a syndrome surveillance system needs to be utilized to examine the symptoms associated with infectious diseases. In addition, surveillance systems for individual community residents and groups affected by disasters need to be considered.

5.1 Health center-based surveillance systems for affected regions

Infectious disease surveillance refers to a process of systematically and consistently collecting, analyzing and interpreting the data on the vectors of infectious disease outbreaks, as well as sharing the results with those in need of such information for the benefit of preventing and controling infectious diseases. Currently, the Korean government operates a mandatory surveillance system requiring healthcare providers to report any suspected cases of infectious diseases immediately to competent health centers, and a sentinel surveillance system where participant healthcare providers who meet certain criteria are designated as sentinel surveillance entities and required to report any suspected cases of infectious diseases to competent health centers within 7 days[9].

The current Infectious Disease Control and Prevention Act stipulates 6 categories of 80 infectious diseases, 59 and 21 of which are subject to the mandatory and sentinel surveillance systems, respectively. The infectious diseases subject to the mandatory surveillance system include water- and food-borne infectious diseases, which are sub-classified into the Class 1 infectious diseases including cholera and typhoid that require immediate preventive measures against epidemics, the Class 2 infectious diseases subject to the national vaccination project including measles and pertussis, the Class 3 infectious diseases that potentially and intermittently develop into epidemics and require preventive measures such as malaria and tuberculosis, and the Class 4 infectious diseases including MERS (Middle East Respiratory Syndrome) that newly emerge in Korea or are feared to be imported to the country.

Influenza among the Class 3 infectious diseases, the Class 5 and other designated infectious diseases are subject to the sentinel surveillance system. The sentinel surveillance system applies to those cases characterized by relatively low severity and high incidence rates, which make the mandatory surveillance system hardly applicable. The sentinel surveillance system analyzes and distributes the data about given infectious diseases regularly collected from designated sentinel surveillance healthcare providers for the control and prevention of infectious diseases[13]. The sentinel surveillance system is intended to keep up to date with the incidence rates and trends of infectious diseases (early detection of pandemic signs), identify high-risk groups, and prepare for and respond to a pandemic by facilitating the information flow.

5.2 Surveillance systems based on conditions in affected regions

As a rule, infectious disease surveillance is subdivided into passive and active surveillance based on active/passive data collection, into population- and case-based surveillance based on reporting units, and into mandatory and sentinel surveillance based on the scope of reporting entities.

Korea also operates a lab-based surveillance system focused on pathogens of infectious diseases, not the surveillance of individual patients, pseudo-patients and carriers of infectious diseases. The KCDC performs the laboratory surveillance of major acute infectious diseases, collects the information about the time an outbreak began, patients' age and pathogens causing the outbreak per region, and early detects the outbreaks caused by certain pathogens. Also, the KCDC operates the 'acute diarrheal disease laboratory surveillance system (Enter Net)' using the specimens from the suspected patients of water- and food-borne infectious diseases, the 'Korea Influenza and Respiratory Surveillance (KINRESS)' project using the specimens from the suspected patients of respiratory infectious diseases, and a range of other surveillance projects relevant to specific pathogens and purposes including the infectious disease vector surveillance system (Vector Net) and the Antimicrobial Resistance Monitoring System(KARMS)' to identify and predict outbreaks caused by pathogens.

5.3 Infectious disease report system in affected regions

For the effective infectious disease surveillance in regions affected by natural disasters, local health centers should be designated as one of the

aforementioned infectious diseases surveillance systems so that they will be responsible for the surveillance of all healthcare facilities in their regions. Given most disaster-related infectious diseases are included in the officially designated infectious diseases in Korea, all healthcare providers should immediately report to their local health centers as required by the existing surveillance systems.

The existing report system for officially designated infectious diseases, if properly operated, facilitates the identification of epidemiology as well as the early detection of and response to diseases. That said, the existing system leaves something to be desired in view of the complexity of infectious diseases to be reported, the lack of immediacy, and the low report rates. It is essential to implement information and promotion programs designed to encourage healthcare providers to actively report the cases found in affected regions. For the surveillance of risks before any patients or pseudo-patients with infectious diseases are found or formally reported, the syndromic surveillance may be a more proactive and complementary approach.

6. Conclusion

The findings of this study suggest the control and surveillance systems should be reinforced so that the causality of future infectious disease outbreaks in the past and the trial and error in the response policy can be managed more explicitly. Moreover, proper response policy measures for future infectious disease pandemics need to be developed. In particular, the global COVID-19 pandemic underlines the need for specific policy measures, which should be sought as follows.

First, the preparedness for potential infectious disease outbreaks in the event of natural disasters is essential. On the grounds that the country has been impacted by A/H1N1, MERS and COVID-19 outbreaks, that the frequency and intensity of natural disasters including typhoons, floods and earthquakes have been increasing, and that the public attention and tension have risen surrounding infectious diseases associated with the climate change including heat/cold waves around the world, Korea needs to formulate a wide range of disaster response measures.

Second, it is necessary to support the shelters for disaster victims. Particularly, given concerns are raised over the substantial increase in risks of infectious diseases due to the crowded living conditions and the insufficient drinking water and sanitary facilities around the shelters accommodating the victims whose residences or utilities are devastated by disasters, a thorough preparedness is imperative.

Third, effective disaster-related infectious disease surveillance systems need to be developed. As evidenced by the COVID-19 pandemic, the retention of social infra and healthcare resources, and the fast and accurate surveillance systems via the NEDIS (National Emergency Department Information System) in addition to the established health center-based surveillance system have been proved essential. Furthermore, in addition to the existing officially designated infectious diseases and those covered by the sentinel surveillance system, the early syndromic surveillance of diarrhea and respiratory symptoms should be employed.

Taken together, it is crucial to provide information, training and promotion programs as part of the national disaster response systems for the prevention of infectious diseases in light of the roles of multiple agencies participating in disaster response measures.

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