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2013 Modularization of Korea's Development Experience:

Establishment of Korea's Infectious Disease Surveillance System

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MINISTRY OF HEALTH & WELFARE

KOFIH
Korea Foundation for International Healthcare

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Establishment of Korea's Infectious Disease Surveillance System

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Preface

The study of Korea's economic and social transformation offers a unique window of opportunity to better understand the factors that drive development. Within one generation, Korea had transformed itself from a poor agrarian society to a modern industrial nation, a feat never seen before. What makes Korea's experience unique is that its rapid economic development was relatively broad-based, meaning that the fruits of Korea's rapid growth were shared by many. The challenge of course is unlocking the secrets behind Korea's rapid and broad-based development, which can offer invaluable insights, lessons and knowledge that can be shared with the rest of the international community.

Recognizing this, the Korean Ministry of Strategy and Finance (MOSF) and the Korea Development Institute (KDI) launched the Knowledge Sharing Program (KSP) in 2004 to share Korea's development experience and to assist its developing country partners. The body of work presented in this volume is part of a greater initiative launched in 2007 to systematically research and document Korea's development experience and to deliver standardized content as case studies. The goal of this undertaking is to offer a deeper and wider understanding of Korea's development experience in hopes that Korea's past can offer lessons for developing countries in search of sustainable and broad-based development. In furtherance of the plan to modularize 100 cases by 2012, this year's effort builds on the 20 case studies completed in 2010, 40 cases in 2011, and 41 cases in 2012. Building on the past three year's endeavor that saw publication of 101 reports, here we present 18 new studies that explore various development-oriented themes such as industrialization, energy, human capital development, government administration, Information and Communication Technology (ICT), agricultural development, and land development and environment.

In presenting these new studies, I would like to express my gratitude to all those involved in this great undertaking. It was their hard work and commitment that made this possible. Foremost, I would like to thank the Ministry of Strategy and Finance for their encouragement and full support of this project. I especially would like to thank KSP Executive Committee, composed of related ministries/departments, and the various Korean research institutes, for their involvement and the invaluable role they played in bringing this project together. I would also like to thank all the former public officials and senior practitioners for lending their time and keen insights and expertise in preparation of the case studies.

Indeed, the successful completion of the case studies was made possible by the dedicated efforts of the researchers from the public sector and academia involved in conducting the studies, which I believe will go a long way in advancing knowledge on not only Korea's own development but also development in general. Lastly, I would like to express my gratitude to Professors Kye Woo Lee, Jinsoo Lee, Taejong Kim and Changyong Choi for their stewardship of this enterprise, and to the Development Research Team for their hard work and dedication in successfully managing and completing this project.

As always, the views and opinions expressed by the authors in the body of work presented here do not necessary represent those of the KDI School of Public Policy and Management.

April 2014

Joon-Kyung Kim

President

KDI School of Public Policy and Management

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Summary

Infectious disease surveillance is part of public health surveillance applied to the prevention and control of infectious diseases. The results of infectious disease surveillance provide the basis of planning and evaluation of infectious disease prevention and control programs. Therefore, a surveillance system for infectious disease functions as the first step in the prevention and control of infectious diseases.

The most important basis for controlling infectious diseases is an intensive surveillance system for continuous monitoring of infection occurrences. Korea has overcome various infectious diseases that still cause social problems in developing countries, and continues to maintain adequate control of traditional infectious diseases. In this sense, this paper shares an effective surveillance system template that was developed over several decades. Such an effective surveillance system is expected to have positive effects on identifying the prevalence of a disease, discovering new health problems in a variety of fields, discovering the factors involved in the spreading of the disease, understanding the disease processing aspect, clarifying the scale of the disease, and studying the natural history of the disease.

Korea has operated an infectious disease surveillance system since the Prevention of Contagious Disease Act in 1954. This effort to manage infectious diseases was one of the most important health policies in treating acute infectious diseases in the 1950s. In 1946, Korea was under the U.S. military administration, and Cholera became a nation-wide epidemic. Other acute infectious diseases, hemorrhagic fever, and re-emerging malaria also became big problems due to the outbreak of the Korean War in 1950. Following these outbreaks, related prevention acts with regard to specific infectious diseases were promulgated, and the government continuously took over investigations by the Korea National Institutes of Health. In particular, research on Japanese encephalitis had been begun in 1949, and the number of related deaths decreased to less than 10 people by 1980. Likewise, food

poisoning, shigellosis, and HIV/AIDS have been under the efficient management system, resulting in related Acts being passed and investigations taking place as occurrences of the illnesses became more frequent.

To be specific, Korea has achieved a reduction in mortality and incidence rates as a result of its infectious disease surveillance system. Regarding acute infectious diseases, water and food borne diseases, and vaccine preventable diseases, such incidences have been declining for about five decades. Tuberculosis, among the chronic infectious diseases, has decreased dramatically compared to 50 years ago, but continues to appear in society. The total mortality rate by infectious disease in Korea fell continuously in the last 60~70 years, and the rate of reduction has been stable for the last 30 years. Four specific diseases in particular – cholera, typhoid fever, paratyphoid fever and shigellosis – enjoyed significant reductions compared to 50 years ago. At the same time, the reporting rate, one of the major elements of the disease surveillance system, was limited to only five percent 50 years ago, but has recently been increasing continuously.

However, the transference and development of the new effective infectious diseases surveillance system did witness some problems. The function of hygiene management was transferred to the Ministry of Health and Social Affairs from the "sanitary police" in the early 1960s. During the "sanitary police" administration, the infectious disease surveillance system placed medical personnel into a passive position, and the public suffered from coercive monitoring. The revision of the official names of infectious diseases was delayed until 1976, more than 30 years after Korea's liberation from Japanese colonial rule. This framework was an obstacle even after the Republic of Korea government had been established in 1948, for almost half a century.

The Prevention of Contagious Disease Act was completely revised and promulgated by 2000. This was a milestone in that Korea made its own framework beyond what had been followed for more than half a century under the coercive Japanese sanitary police system. The norms regarding controlling infectious diseases such as the role of governments and protecting the rights of a patient were considered for the first time. Also, promoting public awareness of and educating the public on the surveillance system continued. As a result of such efforts, various surveillance systems have been constructed, and the reporting rate has improved continuously. However, as medical personnel still lack understanding of the diagnostic criteria of infectious diseases and the amended Act, further efforts and studies are required to perform periodic assessments of the surveillance system, to understand the problems of the existing surveillance system, to provide reform measures, and to improve utilization of surveillance data.

There are nine key projects regarding infectious disease surveillance in the process of development. The Prevention of Contagious Disease Act was promulgated in 1954. The government divided infectious diseases into 3 Groups of notifiable infectious diseases. In addition, the "Department of Infectious Diseases" was established in 1999 by the Korea National Institutes of Health in order to manage quickly and effectively various infectious diseases. This department was expected to make several response systems unified.

The Prevention of Contagious Disease Act was then amended in 1999. According to the amended Act, the classification of notifiable infectious diseases was re-organized, and a nationwide infectious diseases surveillance system with sentinel doctors was launched.

The Korea National Institutes of Health launched the sentinel surveillance system of major infectious diseases in 1999. And the Korea National Institutes of Health was expanded and reorganized into the Korea Centers for Disease Control and Prevention in 2004. This has led to a centralized response in disease management as the Korea National Institutes of Health and Quarantine Stations were reorganized.

The Korea Tuberculosis Association conducted the first national survey of tuberculosis in 1965 with the administrative support of the Korean government, WHO's technical support, and equipment from UNICEF. The survey had been performed every 5 years since to identify trends and occurrences in tuberculosis. As the prevalence of tuberculosis decreased, the survey was discontinued in 2000, and the notification and reporting systems were improved.

An epidemiological investigation has been performed to prevent infectious diseases from spreading and promote early detection of the infection pathway. A web-based infectious disease surveillance system was also launched in 2007. Finally, the Infectious Disease Control and Prevention Act was newly enacted from existing laws in December 2010. The term "contagious disease" was also modified to the term "infectious disease" so that the term would include comprehensive diseases such as non-human-to-human transmitted infections. Additionally, the range of notifiable infectious diseases was enlarged.

There were various other institutional and organizational transitions, including the Early National Institute for Communicable Disease Prevention and Control, Korean Institute for Communicable Disease Prevention and Control, National Institute for Communicable Disease Prevention and Control, and Korea Centers for Disease Control and Prevention. In addition, a surveillance system of infectious diseases was adapted to these transitions. Moreover, the "Communicable Diseases Prevention Act" had been revised eight times until the "Infectious Disease Control and Prevention Act" was completed in 2000.

A well-proven and effective surveillance system leads to a variety of surveillance systems to be developed. A surveillance system can be classified by reporting/notification

criteria, for example, individual infected cases. If the system is classified by data collecting methods, it is either passive or active. If it is classified by range of monitoring, it is classified as a general surveillance system or a sentinel surveillance system.

A survey system is classified into (Field) Surveys and Epidemiological investigations. Korea has two representative field surveys, the Nationwide Survey of Intestinal Parasites and National Survey of Tuberculosis. The Nationwide Survey of intestinal parasites is a government project based on the Parasitic Diseases Prevention Act, which started in 1971. Since then, the survey has been performed every 5~8 years. The purpose of the survey is to identify the status of intestinal parasites in Korea. Through eight rounds of surveys, the status concerning the prevalence of intestinal parasites among the Korean population was determined. Enormous amounts of statistical data showed fluctuations and trends in the national health control system. In addition, this research project is successfully decreasing the number of population who are infected with intestinal parasites up to almost the eradication level.

The National Tuberculosis Survey has conducted seven times at five-year intervals in order to understand and changes in and size of the tuberculosis issue from 1965 to 1995. The WHO and UNICEF supported this project. Free treatment was provided for patients and their families. Various tests and vaccinations were also carried out. In addition, to manage this illness at the national level, the government provided a department at the center currently under the Ministry of Health and Welfare.

An epidemiological investigation should be performed to track the source of infection when the notifiable infectious diseases have been reported. The design of the study depends on the standard form of the KCDC with interviews of patients, parents, contacts, and attending physicians, collecting specimens and definitive diagnoses from diagnostic tests. To conduct these epidemiological studies, the KCDC organizes a central unit for epidemiological investigations. The metropolitan cities and provinces also have units with supporting city, country or district epidemiological investigation units. Each unit has its own role, and the timing of investigations differs.

A success factor of an infectious disease surveillance system in Korea is a balance among various elements: the monitoring system, related regulations and Acts, ICT, human capacity building and other elements. Infectious diseases are managed well by related regulations and legislations. Technology has also aided in this effort to distribute information in real-time to public health officers or the general public based on infectious disease web statistics. The government is able to take appropriate measures against epidemics of infectious disease through the medium of training and education for practitioners, EIS officers and laboratory workers. Furthermore, the system's reporting rate, timeliness, holistic approach and adaptability ensure a quality operation.

There are a few limitations. For example, information regarding infectious disease surveillance is not always used productively with less-than-optimal dissemination of the information despite the frequency of these weekly, monthly and annual reports. While the utilization of surveillance data has also been increasing recently, the system needs to develop more content for utilization. There are also general problems including past slow reporting rates. However, education and public relations activities have increased.

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Chapter 1

Goal and Aim of Korea's Infectious Disease Surveillance System

1. Definition and Purpose of an Infectious Disease Surveillance System
2. Goals and Aims of Infectious Disease Surveillance in Korea

Goal and Aim of Korea's Infectious Disease Surveillance System

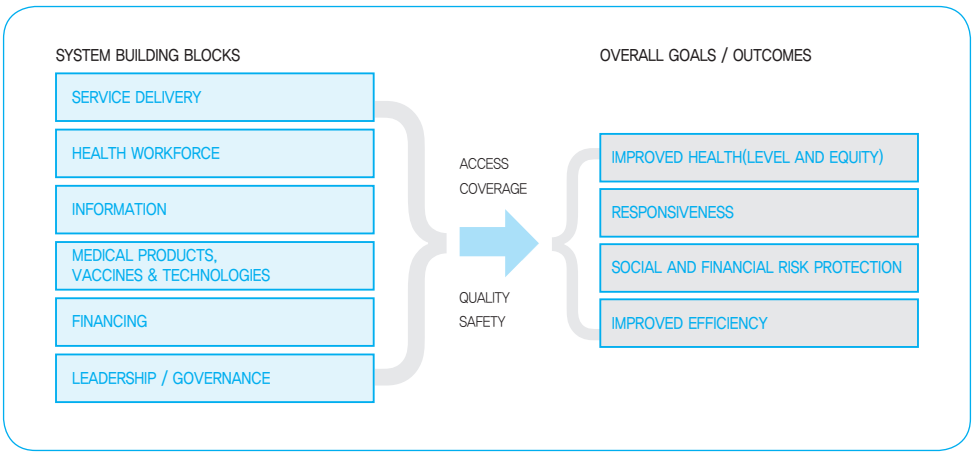
1. Definition and Purpose of an Infectious Disease Surveillance System

Infectious disease surveillance is part of public health surveillance applied to the prevention and control of communicable diseases. Generally, public health surveillance is defined as "the ongoing systematic collection, analysis, and interpretation of health-related data essential to the planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those who need to know".[1]

Infectious disease surveillance is required for each member country of the World Health Organization (WHO) by the International Health Regulations (IHR 2005, 2nd ed., World Health Organization, 2008). The surveillance is a sub-phase of "Information" among the six building blocks suggested by the WHO Health System Framework [Figure 1-1].

1. Remington PL & Nelson DE. Communicating public health surveillance information for action. In: Lee LM, Teutsch SM, Thacker SB, St. Louis ME, Principles and practice of public health surveillance, 2nd ed., 2010, Oxford University Press.

Figure 1-1 | WHO Health System Framework



Like general public health surveillance, the results of infectious disease surveillance provide the basis of planning and evaluation of infectious disease prevention and control programs [Figure 1-2]. Therefore, a surveillance system of infectious disease functions as the first step in the prevention and control of communicable diseases.

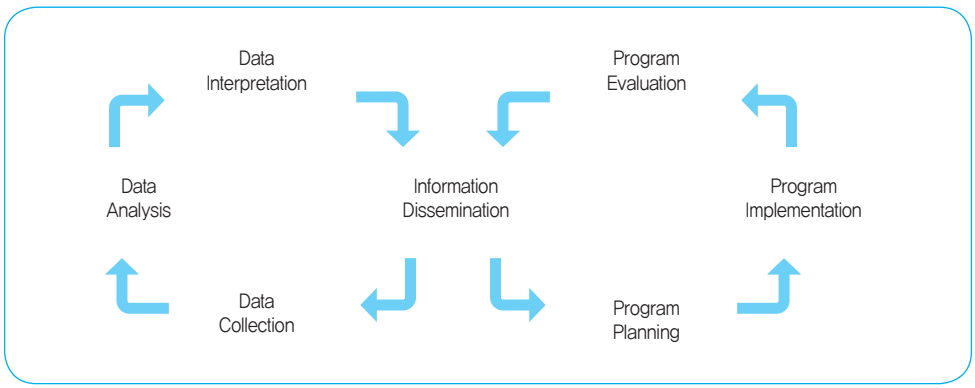
Infectious disease is caused by the infection, presence and growth of pathogenic biological agents in a susceptible (human) body. The transmission of infectious diseases can affect not only individuals but also population and society. Because of wide external effects, the significant epidemics of emerging and reemerging infectious diseases have a threatening impact to a society and its country. For the sake of effective prevention and control of such diseases, it requires a rapid assessment of the magnitude and trend of the disease of interest, and thus every nation establishes legal mandates for the investigation and surveillance system to control and prevent infectious diseases.[2] Therefore, the purpose of infectious disease surveillance is mainly to identify newly diagnosed cases, investigate transmission pathways, and then to control or terminate the transmission.[3] The basic directions of strengthening surveillance are first to improve prompt and accurate reports; second, to promote analysis and application of surveillance information; third, to strengthen the management of data and finally, to enhance professional capacity. The objectives of surveillance are: 1) to predict the magnitude of problems caused by the disease of interest,

2. Prevention, Korea Centers of Disease Control and. "The Results of the National Infectious Diseases Surveillance, 2012." Ed. Prevention, Korea Centers of Disease Control and. Republic of Korea: Public Health Weekly Report, 2012. Vol. 6. Print.

3. Choi, Bo Yul. "Surveillance System for Infectious Diseases in Korea." Print.

2) to monitor the trends of incidence and prevalence and 3) to discover new problems and to apply control and prevention activities.[4]

Figure 1-2 | Integrating the "Surveillance" and "Program" Loops



Infectious disease control project is one of the fundamental keys for national health policies. Effective national policies for infectious diseases include appropriate measures to prevent new epidemics and to stop them, and timely development of the methods to reduce endemic diseases. A comprehensive and ongoing surveillance system is an essential function for the country to stop the threat of infectious diseases.[5]

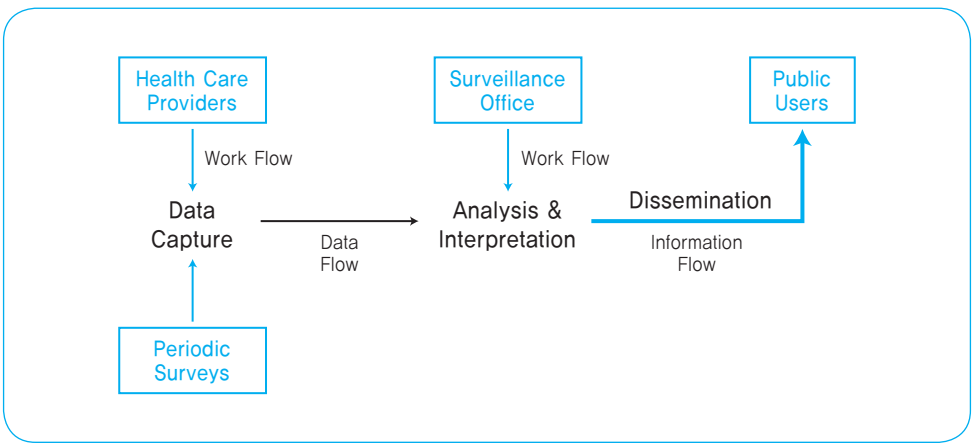
Targets of the surveillance and investigation are to assess the situation and scope of problems from the infectious disease, to observe patterns and progression, and to uncover new assignments. Especially, it requires a unified understanding of investigation and surveillance with an exact diagnosis and survey. The range of infectious disease targeted to investigate should consider the practical circumstances of a country. Factors to prioritize when targeting diseases include: 1) frequency (incidence, mortality), 2) severity (case fatality, admission and disability rates), 3) direct and indirect expenses by the disease, 4) preventability, 5) possibility of transmission and 6) public interest.[6]

Functions of the surveillance depend on the systematic flow of information. The surveillance based on health care facilities involves data collection from the facilities,

4. "2013 Indication of Infectious Disease Control Program." Ed. Prevention, Korea Centers for Disease Control and. Republic of Korea: Korea Centers for Disease Control and Prevention, 2013. Print.
5. Ok Park, Bo Youl Choi. "Introduction and Evaluation of Communicable Disease Surveillance in the Republic of Korea." J Prev Med Public Health 40.4 (2007). Print.
6. Teutsch SM: Considerations in planning a surveillance system. In: Lee LM, Teutsch SM, Thacker SB, St. Louis ME, Principles and practice of public health surveillance, 2nd ed., 2010, Oxford University Press.

data transmission to surveillance offices, data analysis and interpretation by the office, and information dissemination to the public [Figure1-3].[7] If it is difficult to establish a proper data collection system with health care facilities for some kinds of diseases, periodic surveys may be a good solution.

Figure 1-3 | Pathway of Infectious Disease Surveillance Data



2. Goals and Aims of Infectious Disease Surveillance in Korea

Policies for managing infectious diseases are one of the most important public health problems for countries. Korea has not been the exception throughout history, having suffered from various infectious diseases that to this day cause social problems in developing countries.[8] These infectious diseases include acute infections like cholera and malaria, chronic infections like tuberculosis and Hansen's disease, and parasitic infestations like flukes. As of 2013, Korea has overcome most problems with no reports of diphtheria, polio, and typhus (eruptive fever) in a decade. For the past 10 years, there have been limited outbreaks at the eradication level (< 1 case per million people) of cholera and measles, while traditional infectious diseases such as water and food-borne diseases (shigellosis, typhoid

7. Krishnamurthy RS, St. Louis ME: Informatics and the management of surveillance data. In: Lee LM, Teutsch SM, Thacker SB, St. Louis ME, Principles and practice of public health surveillance, 2nd ed., 2010, Oxford University Press.

8. Chun, Byung Chul. "Public Policy and Laws on Infectious Disease Control in Korea: Past, Present and Prospective." Infection and Chemotherapy 43.6 (2011): 474. Print.

fever), zoonoses (brucellosis, anthrax) and vector-borne diseases (typhus, hemorrhagic fever with renal syndrome) have been well-contained.

At present, the Infectious Disease Control and Prevention Act has been implementing rules since its amendment in 2011. The Act aims to prevent the outbreak and epidemic of infectious diseases threatening national health, and prescribes the necessary measures for prevention and control, and then contributes to improving and maintaining public health. Accordingly, the central and local governments are required to respect and protect the rights of infected patients, suspected patients, and carriers of pathogens (hereafter "infectious disease patients"), and prevent discrimination and abuses such as employment restrictions, without lawful regulations. Obligations of the Authority include: 1) prevention of infectious disease and control, 2) care and protection of infectious disease patients, 3) plan and implementation of vaccination program, 4) education and public campaign, 5) surveillance, 6) scientific research, 7) test, preservation and management of pathogen and drug-resistance monitoring, 8) professional human capacity building, 9) international cooperation, 10) stockpiling of medicines for treatment and prevention, 11) program evaluation, 12) investigation, research, and making strategies against infectious diseases related to climate change, 13) supporting institutions or organizations that serve for prevention and treatment of Hansen's disease. In addition, the Act prescribes the duties and rights of medical personnel and the general public, and mandates the development and implementation of the plan for infectious disease prevention and control every 5 years.[9]

9. "Infectious disease control and prevention act." Republic of Korea 2012. Print.

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Chapter 2

Outcome Evaluation of Infectious Disease Surveillance System in Korea

Outcome Evaluation of Infectious Disease Surveillance System in Korea

1. Assessment of Outcomes Against Targets at the Time of Establishment

1.1. Outcomes of the Infectious Disease Surveillance System in Korea

The results of Korea's infectious disease surveillance system will be able to influence the reduction of mortality due to a decrease in the occurrences of communicable diseases and related deaths. The occurrence of infectious diseases has increased due to varicella and H1N1 observed recently. Overall, however, the occurrence of acute diseases has seen a drastic reduction compared to 50 years ago. Similarly, in the case of water and food-borne disease, as well as vaccine preventable diseases that were more prevalent around 2000, these occurrences have also been greatly reduced compared to 50 years ago [Figure 2-1].[10]

Meanwhile, tuberculosis, among the chronic infectious diseases that have dramatically decreased compared to 50 years ago, has recently shown a continued increase.[11] Pertussis, which is the representative among vaccine preventable diseases, has witnessed a downward trend compared to other OECD countries.[12]

10. Ministry of Health and Welfare, Republic of Korea. "Infectious Diseases Surveillance Yearbook 2012." Ed. Prevention, Korea Centers for Disease Control and Prevention. Republic of Korea: Korea Centers for Disease Control and Prevention, 2012. Print.
11. KCDC. Annual report on the notified tuberculosis patients in Korea, 2012. 2013.
12. OECD. Statistics, Health status, morbidity [cited 2014 Jan 10]. Available from: ttp://stats.oecd.org/Index.aspx?DataSetCode=HEALTH_STAT.

Figure 2-1 | Number of Reported Cases of Acute Infectious Diseases: 1960~2012

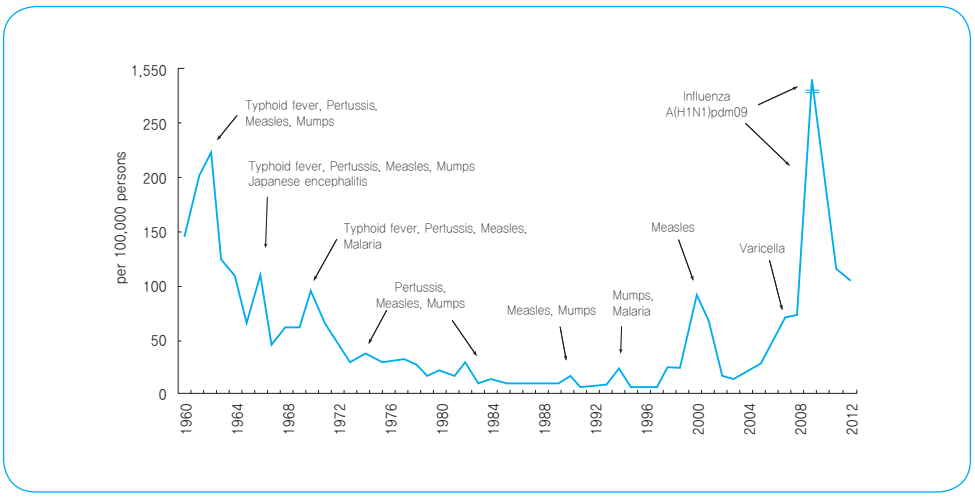


Figure 2-2 | Number of Reported Cases of Water and Food-borne Infectious Diseases: 1960~2012

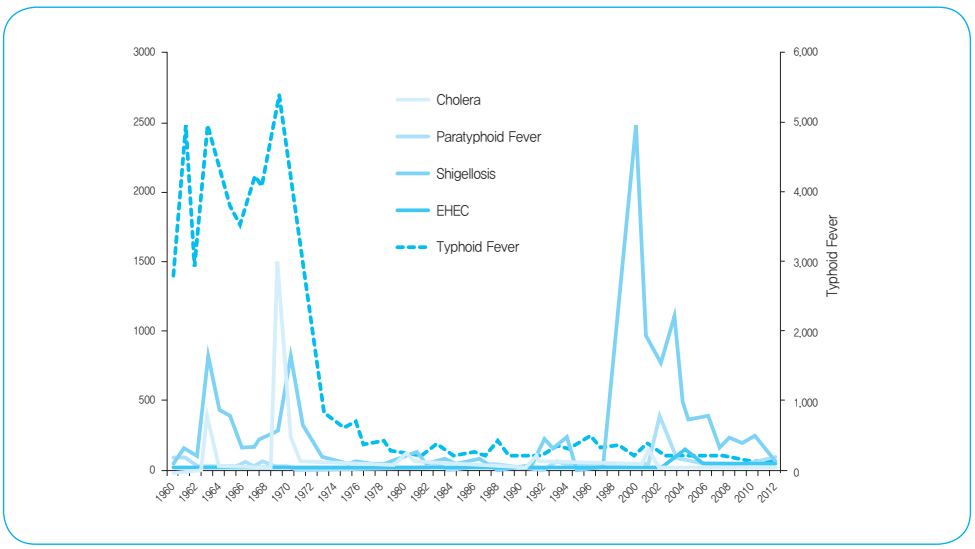


Figure 2-3 | Number of Reported Cases of Vaccine Preventable Diseases: 1960~2012

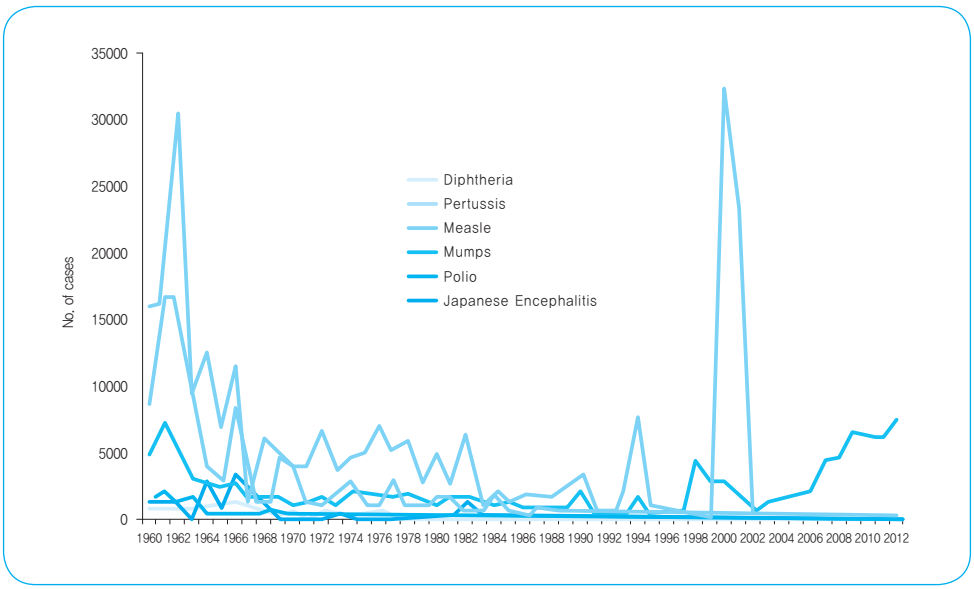


Figure 2-4 | Number of Reported Cases of Tuberculosis: 1965~2012

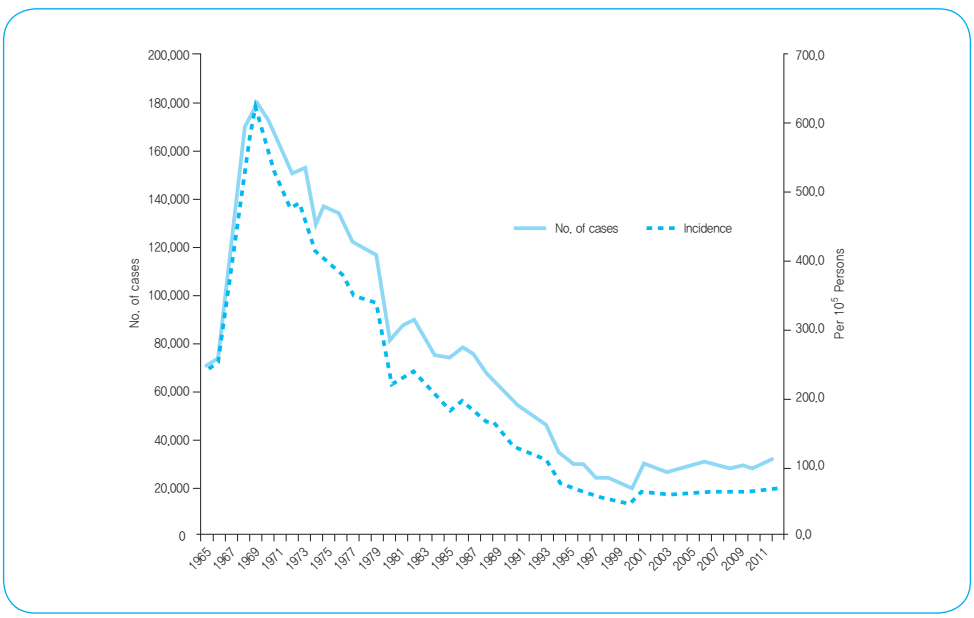
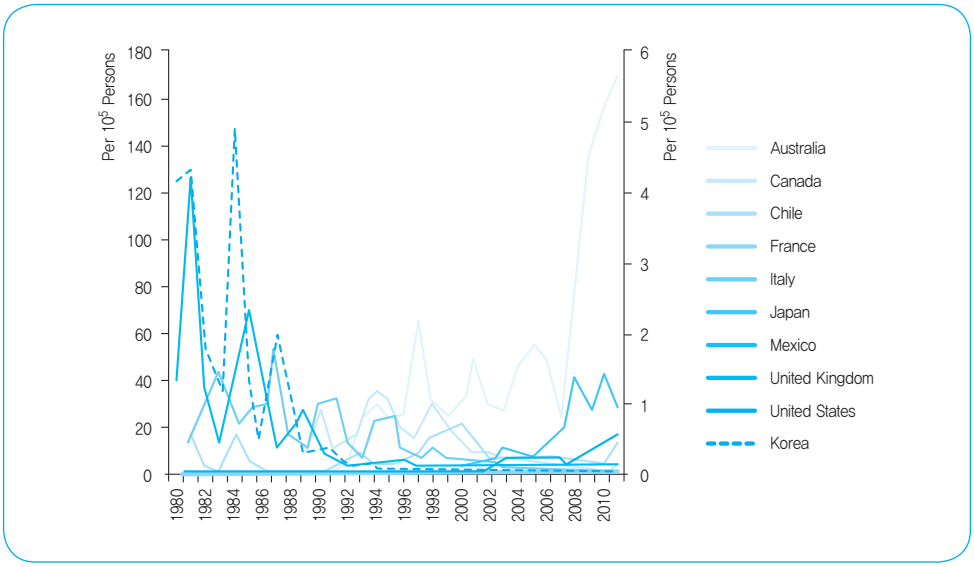


Figure 2-5 | Number of Reported Cases of Pertussis among OECD Countries: 1980~2012



The overall mortality rate by infectious disease in Korea was reduced continuously during the last 60-70 years. Particularly four diseases including cholera, typhoid fever, paratyphoid fever, and shigellosis were shown to have declined dramatically compared to 50 years ago. Burden of infectious diseases in 2010 have also declined compared to 20 year ago.[13]

13. IHME. Global burden of disease study 2010-South Korea[cited 2014 Jan 10]. Available from: http://ghdx.healthmetricsandevaluation.org.

Figure 2-6 | Mortality Rate of Water and Food-borne Infectious Diseases (Group I): 1960~2012

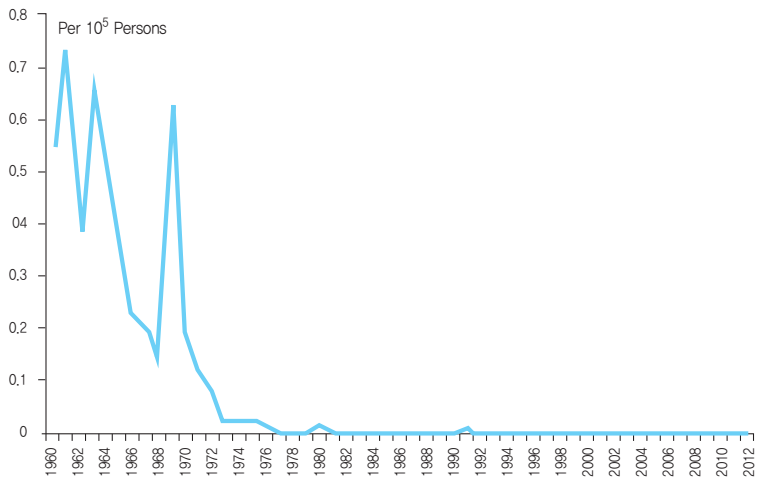
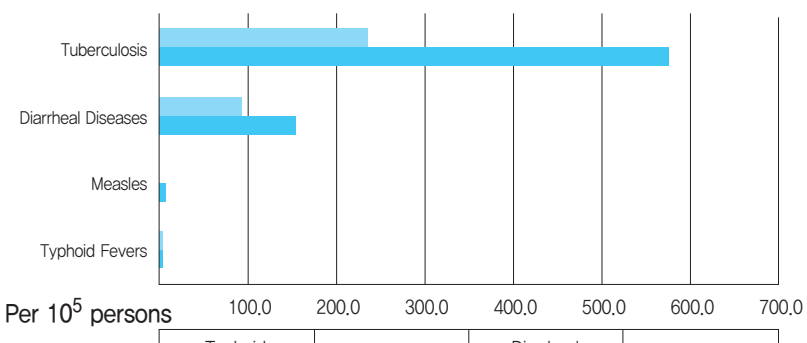


Figure 2-7 | QALY Changes in Specific Infectious Diseases between 1990 and 2000



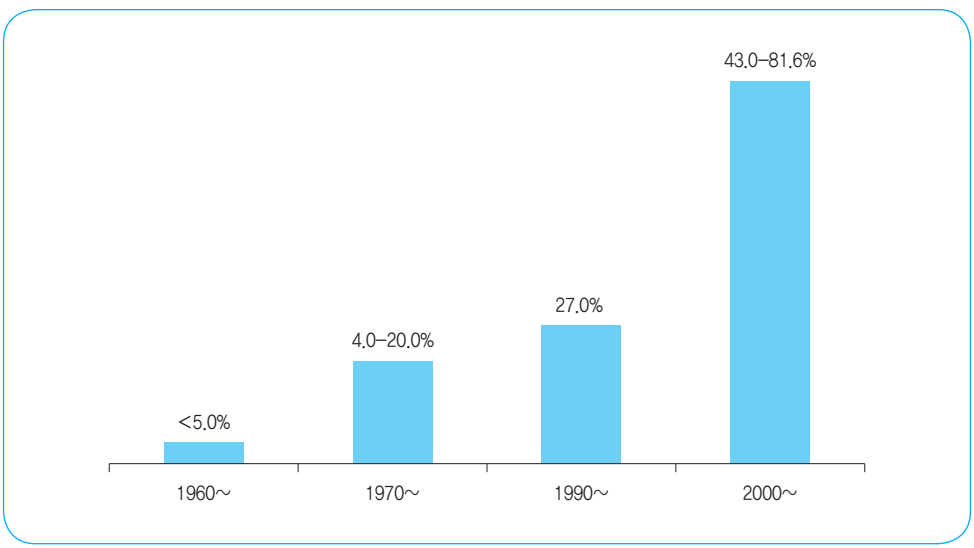
	Typhoid Fevers	Measles	Diarrheal Diseases	Tuberculosis
2010	2.2	0.8	92.6	234.0
1990	3.0	7.8	154.3	575.7

2. Qualitative Evaluation of the Infectious Disease Surveillance System in Korea

For a qualitative evaluation of the infectious disease surveillance system, indexes including timeliness, data quality, usefulness, sensitivity, specificity, simplicity, positive predictive value, flexibility, acceptability, representative and stability are used. But a quality assessment of the surveillance system in Korea can be roughly grasped through existing literature or annual surveillance reports on infectious diseases.

The reporting rate in particular is a major element of the disease surveillance system, and its capacity was limited to only five percent 50 years ago. In the case of tuberculosis, the disease has a special system built in that is linked to the national health insurance, alerting the system when payment is made, and allowing for the surveillance system to manage infectious diseases even more efficiently.

Figure 2-8 | Trends in Reporting Rate of National Notifiable Infectious Diseases in Korea



The reporting rate of infectious diseases by year is as follows:

- 1960s: 0.9~6.3%, vaccine preventable diseases including pertussis, measles, and diphtheria.[14]
- 1980s: 12~20%, typhoid fever and 2~12%, vaccine preventable diseases[15]
- 1990s: 27%, group I and II of legal infectious diseases[16]
- 2000s: 43.0~81.6%, group I, II, III and group IV of legal infectious diseases[17]

In terms of flexibility of the surveillance system, since group IV includes "emerging infectious diseases syndrome," it is possible to respond quickly to any emerging infectious diseases. In the case of designated infectious diseases, it is possible to flexibly add or delete diseases by amending the monitoring settings. Timeliness and data quality have been improved by computerizing the reporting system, education and public relations for doctors, and job training of officials that report diseases to the Korea Centers for Disease Control and Prevention (KCDC). In the case of timeliness, the median time for reporting frequent infectious diseases from onset to registration at the local level ranged between 2 and 15 days in the early 2000s.[18] But the median time from diagnosis to notification, and from notification to reporting are now almost within one day (24 hours). In light of these facts, it can be concluded that almost all infectious diseases are reported or notified quickly, so Korea's infectious disease surveillance system is rated excellent in timeliness.

14. Han ST, Kim YW, Cha MH, Park NY. Epidemiological study of pertussis, measles and diphtheria. The Report of NIH 1964;1 (1):54~66.
15. Kim JS. Estimation of reporting rate and accuracy in infectious disease surveillance data. Korean J Epidemiol 1987;9 (2):157~160.
16. Shin E, Meng KH, Shin H, Park YG, Park K, Lee JK. Estimation of report rate of acute communicable diseases legally notifiable in Korea. Korean J Epidemiol 1996;18 (1):18~26.
17. Shin E. Evaluation and Improvement Strategy for Communicable Diseases Surveillance System. KCDC, 2003.
18. Yoo HS, Park O, Park HK, Lee EG, Jeong EK, Lee JK, Cho SI. Timeliness of national notifiable diseases surveillance system in Korea: a cross-sectional study. *BMC Public Health* 2009;9:93.

Table 2-1 | Timeliness of Notifying and Reporting National Notifiable Infectious Diseases (Group I, except hepatitis A)

Diseases	Diagnosis to Notification		Notification to Reporting		Diagnosis to Notification		Notification to Reporting	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Typhoid	1.0	0.0	0.7	0.0	1.0	0.0	0.7	0.0
Paratyphoid	0.9	0.0	0.7	0.0				
Shigellosis	0.6	0.0	0.7	0.0				
EHEC	1.3	0.0	0.4	0.0				

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Chapter 3

Background and Necessity of Korea's Infectious Disease Surveillance

Background and Necessity of Korea's Infectious Disease Surveillance

1. Background and Main Reasons for Introducing an Infectious Disease Surveillance System

Korea has operated some type of an infectious disease surveillance system since 1954, dating back to the enactment of the "Prevention of Contagious Diseases Act."

When Korea was under the U.S. military administration, in May to November of 1946, Cholera was rampant all over the country, claiming up to 10,000 lives for a fatality rate that reached 65.1%. In the case of Japanese encephalitis in 1948, there were 5,548 patient cases, and 2,429 deaths (43.78% of fatality rate). The National Institute for Communicable Diseases Control and Prevention in charge of managing and controlling national diseases produced vaccines to the amount of 37,751,050cc, which was enough for 18,875,525 people with the cooperation and aid of the U.S. military administration consultative committee. In 1949, as the Central Institute for Communicable Diseases Control and Prevention (formerly the National Institute for Communicable Diseases Control and Prevention) dispatched researchers to the field and succeeded in cultivating a serum, Korea produced a vaccine for Japanese encephalitis for the first time by itself and without any aid from other countries. Since then, Korea has produced vaccines for smallpox, typhoid fever, epidemic typhus, pertussis and other diseases.[19]

When the Korean society was confronted with negative changes due to the outbreak of the Korean War, however, the 1950s was a time when war victims, including war orphans, witnessed a high volume of acute infectious diseases such as typhoid fever. Most health care

19. SOK, YEO IN. "A History of Disease Control in Modern Korea and Its Main Achievements 1." Ed. Prevention, Korea Centers for Disease Control and. Republic of Korea: Korea Centers for Disease Control and Prevention, 2008. Print.

resources were destroyed during the War. Therefore, the production of vaccines slowed, and it was impossible to make vaccines until 1953. Gastrointestinal infectious diseases such as salmonella, smallpox, and epidemic typhus were constant. In particular, children whose immune systems were not yet fully formed, suffered from the measles and pertussis at epidemic rates. Also, hemorrhagic fever with renal syndrome, hepatitis and re-emerging malaria became big problems. Malnutrition due to the war was a major cause of tuberculosis and an epidemic typhus outbreak. According to the report, during difficult times, the management of infectious diseases was one of the most important health policies. Treating acute infectious diseases like smallpox, cholera, typhoid fever, malaria and shigellosis was a top priority.[20]

On September 25, 1951, the Act for national health care was enacted and promulgated during the war. And on February 2, 1954, the "Prevention of Contagious Diseases Act" was promulgated in order to prevent the infectious diseases seen during the postwar days. At the time of the second five-year plan for economic development, public health centers focused on the management and prevention of tuberculosis and controlling venereal diseases, epidemic typhus and Japanese encephalitis. The Tuberculosis Prevention Act was promulgated in 1967, and the government took over the investigation system of infectious diseases by the Korea National Institutes of Health, mainly performing research on and investigations of infectious diseases for public health improvement. In the case of Japanese encephalitis, which had been researched since 1949, the number of related deaths decreased to within 10 people or fewer by 1980.

The Korea government confirmed that HIV, one of the World's most problematic diseases, also existed in Korea when it detected the first case of HIV in 1985. As a result, the "Acquired Immune Deficiency Syndrome (AIDS) Prevention Act" was promulgated in November 1987, and the "division of diagnosis of endemic diseases" was renamed the "division of AIDS" to strengthen the research, prevention and management capacity of the illness. As the school lunch program had expanded to a nationwide program, the outbreaks of food poisoning and shigellosis began to occur more frequently. After the number of shigellosis cases peaked at 800 people in 1970, the prevalence of the disease has since dramatically decreased. It was only 11 people in 1997, but rose again to 4,577 cases of food poisoning and 4,461 cases of shigellosis in 1998. Shigellosis had spread from Okcheon county to the entire nation. This epidemic required active and efficient countermeasures for the disease with the accumulated information of epidemic investigations and surveys.[21]

20. Working Group for Community Health Improvement. "60-year footsteps of Community Health." 2012.

21. Kim, Joung Soon et al. "Development of National Strategy for Emerging and Reemerging Infectious Disease." Final Report on Health R&D Program. Ministry of Health and Welfare (HMP-99-p-0006). 2000.

The reporting system regarding infectious diseases in Korea was contingent upon the "Prevention of Contagious Diseases Act" until 1999. It was difficult to assess the exact incident based on the reporting system due to the low reporting rate. Therefore, in 1999, Ministry of Health and Welfare Ordinance No. 112 and Presidential Decree No. 16356 created the department of infectious diseases in the Korea National Institutes of Health to maximize its comprehensive and national response capability. The Korea Centers for Disease Control and Prevention (KCDC) has been organized and operated under the Minister of Health and Welfare since 2003. Accordingly, national research and management of infectious diseases enjoyed much momentum for development from these changes.

Table 3-1 | Disease Outbreak Status in the 1950s

1951	1) Sexually transmitted disease tests a. Syphilis bacteria tests 976 cases (positive 223, negative 753) b. Gonorrhea tests 329 cases (positive 62, negative 267) 2) Pathogen Toxicity tests a. Epidemic typhus pathogen separated: 1 patient out of 2 obscure military hospital patients b. Specimens were collected from 6 encephalitis-like patients in Geoje-do which was found to be tubercular meningitis after animal testing c. Dongnae-county soldiers' sanitarium: 1 encephalitis-like patient, which was found to be Meningitis influenza d. 10 heat patients with unclear cause during the summer season 3) Intestinal bacteria tests a. Widal Test b. Patients' stool and blood culture test: 74 cases c. Carriers' stool test: 300 cases 4) Parasite Stool tests: 1,189 cases 5) Various drug tests a. Typhoid vaccine verification: 13 cases b. Cholera vaccine verification: 1 case c. Various diagnostic liquid verification: 4 cases d. Various diagnostic serum verification: 2 cases e. Vaccine test: 28 cases f. Phenol purification and verification: 11 cases g. Outpatient specimens tests verification: 10 cases

1952	1) Food and bacteriological examination: 170 cases 2) Beverage bacteriological examination: 236 cases 3) Kitchen bacteriological examination: 110 cases 4) Bacteriological examination of various: 1,590 cases 5) Cooks' bacteriological examination: 371 cases 6) Stool parasites: 1,275 cases 7) Encephalitis: 707 cases 8) Sexually transmitted diseases (Gonorrhea 461 cases, Syphilis 736 cases): 1,197cases 9) Mycobacterium tuberculosis: 2,000 cases 10) Requested test: 50 cases

2. Reasons for Introduction

Infectious disease is a typical example of having external effects on the health sector. For example, if a typhoid fever carrier prepares food without washing his/her hands, people eating the food are very likely to contract the fever. In other words, the typhoid fever carrier results in negative impacts on society. Therefore, the government should be required to intervene in controlling infectious diseases so as to maximize the positive external effects such as immunization. As a part of intervention in infectious disease, the government should perform vaccination projects to maximize their positive outcomes. Moreover, the government should set up a system for compensating victims of the side effects of required vaccinations. As another part of intervention in infectious diseases, the government should figure out and take measures to block the negative external effects of typhoid.[22]

Not only do infectious diseases impact and directly harm public health, but the indirect social burden also aggravates the treatment and management of infectious diseases, inflicting a social sanction on infected persons. This weighted social burden has brought about significant national loss so that the government is obliged to carry out continuous systematic management before the national loss becomes even greater.

When an epidemic rapidly spreads throughout a country, this can jeopardize national security. Therefore, infectious disease management policy should be one of the basic policies of a single country. For efficient management of infectious diseases, the government is required to take appropriate precautionary measures for preventing the epidemic of new infectious diseases. When the epidemic has spread, it needs feasible measures to end the epidemic. When the disease has become endemic, it is necessary to take efficient measures

22. Institute, Local Government Officials Development. "2012 Training Book Epidemiology and Management of Infectious Diseases." Ed. Institute, Local Government Officials Development. Republic of Korea: Local Government Officials Development Institute, 2012. Print.

to prevent further transmission. In this sense, the most important basis for controlling infectious diseases is thorough or intensive surveillance systems that can identify continuous occurrences of infection. To ensure such an intensive surveillance system is implemented effectively, it is conducive to explore the prevalence of the disease (for example, the discovery of antibiotic-resistant bacteria), discover a new health problem in a variety of fields where the system is utilized, discover the factors involved in the propagation of the spread of the disease, understand the disease processing aspect, grasp the scale of disease, and understand the natural history of the disease and its associated outbreaks.

3. Problems with Infectious Disease Surveillance in Korea

Korea was freed from the rule of Japanese imperialism in 1945. However, hygiene management had been transferred to the Ministry of Health and Social Affairs from the sanitary police in the beginning of the 1960s, and even the official names of infectious diseases had not been revised until 1976. In addition to the names, the public health administration also continued to utilize the same content as the sanitary police. The sanitary police focused on the crackdown, penalties, and forcible actions of diseases instead of raising awareness, education, or self-protection of the population. Under the old system, therefore, surveillance of infectious diseases is conducted by medical personnel and is of a passive position in which the public is monitored for occurrences. This framework of for controlling infectious diseases had been used even after the Republic of Korea government was established, for almost half a century, and was an obstacle to setting up a new and more effective infectious diseases surveillance system.

The Prevention of Contagious Diseases Act has been amended regularly with the changing landscape of social issues in the 1980s and 1990s. The Act was completely revised and promulgated in 2000, extending our own framework beyond the shadows of the Japanese sanitary police system. This is a meaningful milestone in the management of infectious disease in that Korea realized progress its own way by overcoming what had been followed for more than half a century. The norms regarding controlling infectious diseases such as the role of the central and local governments providing objective diagnostic criteria of national notifiable infectious diseases and consideration of the human rights aspect, as well as the role of voluntary medical participations for sample surveillance of patients were set up at that time.

Korea has been trying to build and monitor a variety of systems, as well as to strengthen the feedback and analysis of monitoring data since 2000. In addition, Korea has been trying to build a new surveillance system in cooperation with organizations of health workers

while continuing to promote awareness and education of the surveillance system. As a result of such efforts, various surveillance systems have been constructed, and the report rate of infectious diseases has improved continuously.[23] However, medical personnel still lack understanding of KCDC's reporting criteria for infectious diseases and the amended Act, calling for continuous education and promotion of the system. Also experts in the field of infectious disease management were shortage in supply. An arrangement of sufficient professionals at each local government to build a sub-structure of the network for infectious disease management on a national scale is necessary. Those professionals are required not to be experts of microbiology or infectious disease physicians, but experts in infectious disease management to continue to lead the management of infectious diseases in a comprehensive manner (for instance, epidemic intelligence service officers). Lastly, there was a scarcity of professionals who have the capacity to analyze and utilize information regarding infectious diseases. Therefore, it is necessary to put forth continuous efforts to specialize in analyzing surveillance data and to improve the utilization of its data. The KCDC has been expanding its staff of professionals in pursuing a variety of analytical techniques and strengthening the association among data from each surveillance system. Further efforts and studies are needed to perform the periodic assessment of the surveillance system, to understand the problems of existing surveillance systems, to provide a reform measure and to take advantage of statistics, mortality data or data from the Korea National Health Insurance.

23. Ok Park, Bo Youl Choi. "Introduction and Evaluation of Communicable Disease Surveillance in the Republic of Korea." J Prev Med Public Health 40.4 (2007). Print.

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Chapter 4

Strategies and Systems for Infectious Diseases Surveillance

1. Strategies
2. Surveys and Surveillance Systems of Infectious Diseases

Strategies and Systems for Infectious Diseases Surveillance

1. Strategies

1.1. Key Policy, Institutions and Projects in the Development Process

1.1.1. "Prevention of Contagious Diseases Act" Proclamation

The "Prevention of Contagious Diseases Act" was promulgated on 308 arcs on 2 February 1954. In particular, the importance of managing infectious diseases was highlighted. The government divided the national notifiable infectious diseases into three types. Group I covered 12 diseases including cholera, the plague, typhoid fever, epidemic typhus, dysentery, paratyphoid fever, scarlet fever, diphtheria, smallpox, epidemic cerebrospinal meningitis, recurrent fever and eruptive fever. Group II included acute anterior poliomyelitis, pertussis, measles, mumps, epidemic encephalitis, rabies and malaria. Group III had tuberculosis, sexually transmitted diseases and Hansen's disease. In the case of the first Group, recurrent fever and eruptive fever were added to the original type classification of the "Japanese Prevention of Contagious Diseases Decree," but the nomenclature was still written in the Japanese format. Proclamation of the "Prevention of Contagious Diseases Act" also addressed the report timing of the disease. The first and second Groups were to report immediately after the occurrence while the third was to be reported once a month. Also, the Act included facts about the need for routine immunizations for smallpox, diphtheria, pertussis, typhoid fever, epidemic typhus, paratyphoid fever, and tuberculosis by the metropolitan governor and city, town, and village mayors.[24]

24. Chun, Byung Chul. "Public Policy and Laws on Infectious Disease Control in Korea: Past, Present and Prospective." Infection and Chemotherapy 43.6 (2011): 474. Print.

1.1.2. Establishment of the "Department of Infectious Diseases" in the Korea National Institutes of Health

In 1999, in order to quickly and effectively manage various infectious diseases in Korea, the "department of infectious diseases" was established in the Korea National Institutes of Health with Presidential Decree No. 16356 and the 112nd Ordinance of the Ministry of Health and Welfare. The Department included the Division of Communicable diseases control and prevention that was transferred from the Health and Human Services Department, the Division of Epidemic Investigation, and the Division of Planning and Statistics. The establishment of the Department of Infectious Disease was expected to maximize a unified and national response for infectious disease. Due to the amendments and sub-amendments of the Prevention of Contagious Diseases Act, diseases that should be reported as a kind of epidemic extended from 29 to 54. Sexual transmitted diseases, including seven specific kinds, were not reported previously, and hepatitis B, influenza, and international epidemic diseases were counted under the sentinel surveillance system. Also, about 2,500 sentinel surveillance health facilities were obligated to report to the health authority. A division in charge of information was necessary for data collection, analysis and feedback. Hence, the Korea National Institutes of Health closed the Masan city branch office and newly established the Division of Communicable Diseases Information Management with the staff.

1.1.3. Amendment of the Prevention of Contagious Diseases Act in 1999

As the "Prevention of Contagious Diseases Act" was amended in 1999, the classification system of national notifiable diseases was still maintained. Also, a nationwide communicable diseases surveillance system with sentinel doctors was launched on 1 August 2000 due to the new provision of designating doctors and health facilities for emerging, reemerging and major infectious diseases surveillance.

1.1.4. Expansion and Reorganization to the Korea Centers for Disease Control and Prevention (KCDC)

The Korea National Institutes of Health was launched in 1963 from the integration of independent operating agencies like the National Institute for Communicable Diseases Control and Prevention, National Institute for Chemical Laboratory, National Institutes of Health, and National Medicinal Plants Laboratory. And the National Institutes of Health expanded and revamped to the Korea Centers for Disease Control and Prevention in 2004, operating 13 National Quarantine Stations and the Korea National Institute of Health. After reorganizing several times to run research projects more efficiently as a

national Disease Research Organization, the current Korea Centers for Disease Control and Prevention have been developed as a central agency for national research and management of infectious diseases and bioscience research. The main functions are responding to and preventing infectious diseases, diagnosing, investigating, and researching infectious diseases, establishing a chronic diseases surveillance system, and setting up labs for and researching infectious diseases, chronic diseases, rare incurable diseases and injuries. The expansion and reorganization of the Korea Centers for Disease Control and Prevention itself was particularly meaningful because this enabled the centralized support for disease management with the integration of the Korea National Institutes of Health and Quarantine Stations right after the SARS outbreak.

1.1.5. Introduction of Sentinel Surveillance System

The Korea National Institutes of Health (the former of KCDC) launched the sentinel surveillance system for major infectious diseases in 1999. At the time, the targeted infectious diseases for surveillance were six disease groups and 23 individuals.

Table 4-1 | Infectious Diseases for Sentinel Surveillance Systems in 1999

Classification	Subjects of Infectious Diseases
Infectious diseases of the digestive system (ex: Diarrhea)	Shigellosis, cholera, typhoid fever, food poisoning, viral infectious diseases of the digestive system
Respiratory infectious diseases accompanied by skin rash, high fever	Exanthem Subitum, HFMD (hand, foot and mouth disease), aseptic meningitis and vaccine preventable diseases such as measles, mumps, rubella
Hepatitis accompanied by jaundice	Type A, B, C, D, E
Infectious diseases in rural communities accompanied by high fever	Malaria, hemorrhagic fever with renal syndrome autumn), leptospirosis, scrub typhus (oriental tsutsugamushi)
Sexually transmitted diseases	Syphilis, gonorrhea, chlamydia infections, HIV/AIDS
Infectious diseases due to biological agents and unknown causes	

The contents of these sentinel surveillance systems included: 1) education for 4,500 private health facilities and training guidelines, 2) isolation of causative agents for major infectious diseases from sentinel surveillance, epidemiological investigations, and

development of countermeasures, 3) rapid feedback of information and publicizing the occurrence of infectious diseases through an analysis of patient information collected from surveillance and weekly distributed CDMR (Communicable Diseases Monthly Report), 4) support for regional standard laboratory equipment for rapid testing on infectious diseases at metropolitan/provincial Health and Environmental Research Laboratories, 5) accumulation and management of a digital database of infectious diseases related to genetic information, and building on international cooperation for exchanging information, 6) a national computerized surveillance system on infectious diseases and emergency communication network, 7) identification of herd immunity levels from individual interviews and serum immunological testing of patients, and 8) linking the sentinel surveillance system on infectious diseases and the EDI (Electronic Data Interchange) of the National Health Insurance.

1.1.6. Conversion of Tuberculosis Research from Survey to Surveillance

To identify trends and the prevalence of tuberculosis, the Korea Tuberculosis Association conducted its first national survey of tuberculosis in 1965 with the administrative support of the government, the WHO's technical support, and equipment from UNICEF. The survey has been performed every five years since this time. However, the effectiveness of the tuberculosis survey has decreased with the decline in tuberculosis cases. The survey was stopped in 2000 and then continued after strengthening the tuberculosis monitoring and reporting mechanisms–becoming the so-called "Tuberculosis Information Monitoring System (KTBS)."

Table 4-2 | Comparison between Survey and Sentinel Surveillance

Division	Survey	Sentinel Surveillance
Operational Environment	- Lack of health care systems - Low reporting rate of cases - Lack of standardization diagnostics	- Well-developed health care systems - Settlement of cases reported - Standardization of diagnostics
Operational Countries	Developing countries	Developed countries
Advantages (pros)	High accuracy and reliability	Possibility of constant and ongoing monitoring
Disadvantages (cons)	High cost	Accuracy and reliability relying on report rate and standardized level of diagnosis
Epidemiological lindicators	Infectivity of tuberculosis, prevalence of tuberculosis, etc.	Incidence of tuberculosis

1.1.7. Introduction of Epidemic Intelligence Service Officers

To prevent the spread of infectious diseases, early detection of the infection pathway through a timely epidemiological investigation is important. To do this, experts for the management of infectious diseases is the most important factor. But to secure epidemiology experts with field experience was not easy in the past. To solve this problem, the KNIH (former of KCDC) started a program for investigators' development in the epidemiological field in 1999. The programs aims to nurture epidemiological experts by providing professional and academic information on infectious disease epidemiology by public health doctors interested in epidemiology and infectious disease. The course includes educational training and field practice for two years in the form of On-the-Job-Training (OJT) at the KCDC and metropolitan/provincial health headquarters. The epidemiological experts (EIS officers) usually perform research and tasks related to public health and infectious disease surveillance systems. If an outbreak/epidemic occurs in the field, the officers immediately investigate the epidemiological events.

1.1.8. Launching the Web-based Infectious Disease Surveillance System

In facilitate effective management, various activities take place in the field in the process of disease management in a systematic fashion. For this reason, it is necessary for relevant organizations to communicate quickly about each activity related to the management of diseases to carry out the necessary strategies. In this regard, the Korea Centers for Disease Control and Prevention set up a variety of monitoring systems at the national level for the propose of constant development of the disease management area. The passive surveillance (monitoring) based on reports by doctors and oriental medicine doctors has been operated since 1954. In the year 2000, the sentinel surveillance system was introduced as a part of active surveillance. In 2006, legal evidence for monitoring laboratories was provided. Moreover, an analysis of monitoring results has been released through the "CDMR (Communicable Diseases Monthly Report)" since 1992 and "Public Health Weekly Reports" since 2008. In addition to this, the "Center for Infectious Disease Control" played an important role in the early settlement of computerized epidemic surveillance systems compared to other countries. The Center established and stabilized various systems for infectious disease monitoring, such as the surveillance system for national notifiable infectious diseases and sentinel diseases by the Division of Infectious Disease Surveillance, quarantine information management system by the Division of Quarantine Support, integrated and computerized network building by the Division of Infectious Disease Control, and the surveillance system for bioterrorism by the Division of Bioterrorism Preparedness and Response. In particular, Electronic Data Interchange (EDI) based on a client-server generated system was developed in 2000 and has been operated since that time. From January 2007, the system has been

reorganized and operated as a "web-based report system" and has served as a significant achievement for computerized report systems for all infectious disease surveillance in the public health sector (city/county/district public health centers-metropolitan/provincial health headquarters - central government).

1.1.9. Legislation of the Prevention and Management of Infectious Diseases

A new Act on the prevention and management of infectious diseases (as of 30 December 2010) effectively combined two previous Acts: the "Parasitic Diseases Prevention Act" and the "Prevention of Contagious Diseases Act." The new Act changed the term "contagious disease" to "infectious disease" so that it could include non human-to-human transmitted infections. While the environment of the health sector changed, new emerging diseases were targeted for monitoring in the World Health Report by the WHO. This new legislation in 2010 can be seen as a shift to the national level. The "Management Board of Infectious Diseases" was instituted to review and discuss the prevention and control of infectious diseases. Also, contracts to purchase or reserve drugs and equipments in advance were permitted to effectively tackle the concerned outbreaks and pandemic infections. Additionally, the new "Act on Infectious Disease Prevention and Control" enlarged the categories of infectious diseases to five groups, previously 4 groups, and specific diseases were added and deleted as well.[25]

1.2. Institutional and Organizational Transitions (Chronological)

1.2.1. Organizational Change in Korea's Infectious Disease Surveillance System

○ (Early) National Institute for Communicable Disease Prevention and Control (Formerly the Korean Institute for Communicable Disease Prevention and Control)

- 09. 1945: Established as the Korean Institute for Communicable Disease Prevention and Control
- 10. 1945: Renamed the National Institute for Communicable Disease Prevention and Control
- Tuberculosis department and filterable micro-organisms (virus) department were primarily responsible for managing infectious diseases

25. Lee, Jin Young. "Development of Guideline for Infectious Disease Management in Korea." Ed. Prevention, Korea Centers for Disease Control and. Republic of Korea: Korea Centers for Disease Control and Prevention, 2011. Print.

Table 4-3 | Organization 1946.2~1949.12.6

Institute (year)	Organization (details)
(Early) National Institute for Communicable Disease Prevention and Control (1946.2~1949.12.6)	- Entero bacteria department (Diagnostic unit): Laboratory 1 and 2, production room - Antitoxin department (penicillin unit): Penicillin laboratory - Toxin serum department: Diphtheria laboratory, Tetanus laboratory, and production room - Vaccines department: Typhoid laboratory, Cholera laboratory, Pertussis laboratory, micrococcus laboratory, and production room - Tuberculosis Department: Tuberculin laboratory, BCG laboratory, and production room - Filterable micro-organisms department (typhus unit): Laboratory 1 and 2, production room

○ Central Institute for Communicable Disease Prevention and Control

- Renamed in 1949 from the Korean Institute for Communicable Disease Prevention and Control
- For the development of scientific technology on the prevention and treatment of infectious diseases, the Central Institute was built by the command of the Ministry of Public Health
- Medical, epidemiological and microbiological research was performed related to the basis of human infectious diseases
- Biological research for the prevention and treatment of infectious diseases
- Controls on herbal medicine and verification

Table 4-4 | Organization 1949.12~1959.12

Institute (year)	Organization (details)
Central Institute for Communicable Disease Prevention and Control (1949.12~1959.12)	- Research unit 1: Research & studies of bacteriology and diagnostics - Research unit 2 : Research & studies of toxicology, serology and filterable micro-organisms - Research unit 3: Research on antitoxin, biochemistry, parasites, spirilla, fungi and other studies - Research unit 4: Verification of products of epidemiological and microbiological research and studies on communicable diseases - Department for Bacteria: Production of products relating to bacterial/tuberculosis prevention and diagnosis - Department for Virus and serum: Production of toxin serum and filterable micro-organisms - Department for Animal management: Animal management for other departments and laboratories, animals and immunization - Department for vaccines: Production of various vaccines

○ (Late) National Institute for Communicable Disease Prevention and Control

- Renamed from Central Institute for Communicable Disease Prevention and Control in 1959
- Mainly divided into two departments: production and verification

* Divisions of Production:

- Perform research projects as part of the yearly plan, investigating the cause and aspects of numerous communicable diseases that occur sporadically or accidentally all over the country
- Identify distomiasis, other parasites, encephalitis, typhoid fever, etc.
- New construction of a tissue culture room and pathology room
- Expand and enhance physical and chemical or biological rooms
- Numerous research performed on basic diseases, encephalitis prevention, distomiasis prevention, pathogens of domestic occurred communicable diseases, diagnostic improvement, etc.

Table 4-5 | Organization 1959.12~1963.12

Institute (year)	Organization (details)
(Late) National Institute for Communicable Disease Prevention and Control (1959.12~1963.12)	- Production Department: production of medicines/vaccines for diagnosis and prevention, diagnostic serum for human infectious diseases - Bacteria Division's gastrointestinal lab and pertussis lab, Serum Toxin Division's toxin lab and serum lab, Animal Management Division and its breeding function, Bacteria Division's tuberculosis lab and BCG lab - Verification department: diagnostic studies and verification of serum on human communicable diseases - Unit 1 (Typhoid fever, E. coli, etc.), Unit 2 (Diphtheria, Tetanus, etc.), Unit 3 (Rabies, Smallpox, Eruptive typhus, and Japanese encephalitis etc.)

○ (early) Korea National Institute of Health

- Launched in 1963 from the integration of independent operating agencies like the National Institute for Communicable Diseases Control and Prevention, National Institute for Chemical Laboratory, National Institutes of Health, and National Medicinal Plants Laboratory
- Renamed the Korea National Institute of Health (& Research in Korean) in 1967
- Abolition of the verification department
- Establishment of a hygiene department (consisting of the divisions of food analysis, food additives, pollution, parasites and insects)
- Encephalitis Institute established in 1969
- Divisions of administration, setting up toxicology tests, vector-borne diseases, and epidemiology studies
- Encephalitis Institute was abolished in 1970
- Establishment of the department of pathogens and toxins including functions for encephalitis study and infectious diseases, and department of radiation control

○ (Late) Korea National Institutes of Health

- Renamed again in 1981 as the Korea National Institutes of Health ("and research" removed from the Korean title)

- Raised the need for strengthening the management of HIV/AIDS infection, followed by the proclamation of Presidential Decree No.12504 for HIV/AIDS control in 1988
- Renamed from the division of endemic diagnosis to the division of AIDS for the purpose of strengthening research, diagnosis and prevention
- In 1999, the department of infectious diseases was established by Presidential Decree No.16356 to quickly and effectively manage various infectious diseases at the national level
- Department of infectious diseases: Division of communicable diseases control and prevention, division of epidemic investigation, division of planning and statistics
- Amendment of the Prevention of Contagious Diseases Act: Reported communicable diseases 29 → 54 kinds
- The KNIH had been reorganized several times and finally expanded to the Korea Centers for Disease Control and Prevention (KCDC)

Table 4-6 | Transition of the KNIH 1961.11~2003.12

1981.11~1987.12	- Secretariat: Affairs, verified Management Division, Public Health Notification division and Management Division - Department of training: Teaching, Health Administration Officer, Epidemiology Officer, Health Officer Cap, Sanitary Engineering Officer, Nursing Officer of Health, Oral Health Officer, Family Planning Officer - Department of Microbiology: epidemiological studies, bacteria, microorganisms, chemicals, products, fungi, and serum diagnosis division - Department of disease and poisoning: General, neurological, respiratory disease and parameters, and insects, parasites, endemic diagnosis division - Drug Department: Standard drugs, biological drugs, antibiotics, drug testing, analysis of herbal, herbal specifications division - Department of Hygiene: Food analysis, food additives, nutrition, food standards division - Research department of stability: Safety assessment, toxicity and biological measurements, laboratory animal management and pathologic studies division - Department of Radiation Standards: Standard, defense, equipment division - Masan city Branch

1989.12~1992.2	- Endemic diagnosis division was renamed the division of AIDS - Creation of Water quality testing division
1992.2~1994.4	- Division of AIDS diagnosis was renamed the immunodeficiency laboratory
1996.6~1999.5	- Creation of infectious disease epidemiology division within the Department of Bacterial Diseases
1999.5~2003.12	- Creation of the Department of infectious disease - Consisting of the Division of communicable diseases control and prevention, division of epidemic investigation, division of planning and statistics

○ Korea Centers for Disease Control and Prevention (KCDC)

- The Korea Centers for Disease Control and Prevention were instituted on December 18, 2003, under a presidential decree and officially began in January 2004
- The objectives of the KCDC are prevention, investigation, quarantine, laboratory test and research, research services on infectious and special diseases, and health workers training for the improvement of public health
- As the central agency for performing research and management on national infectious diseases and life sciences, numerous kinds of activities were carried on to prevent the inflow of infectious diseases and the spread to other countries
- Management of infectious diseases based on the active (sentinel) and passive surveillance system
- In 2007, major management systems for infectious diseases are reorganized as a web-based information system, and then promoted to a more efficient operation of the holistic Infectious Diseases Surveillance System

Table 4-7 | KCDC Main Duties

Main Activities
• Operation of various national and international surveillance systems for infectious diseases - International cooperation for surveillance systems with regional countries - Infection Professional Network (EDI etc.)/Operation of National Surveillance System (Sentinel surveillance, etc.) - Prevention of human infection of avian influenza (AI) and strengthen influenza pandemic preparedness - Secure isolation beds, reserve antiviral drugs, AI laboratory diagnostic capacity building, promoting human AI infection prevention - Enhanced intensive care towards contact, food borne infectious diseases - Development of diagnostic methods for pathogens causing diarrheal diseases - Enhanced laboratory surveillance - Establishing pan national hand washing campaign headquarters • Strengthening zoonoses management system - Definition of zoonoses added to the infectious disease prevention and Control Act - Installation and operation of joint task force zoonoses and specialized subcommittees - Installation of laboratory dedicated to the Creutzfeldt-Jakob disease and Autopsy Center • Management of vector-borne infectious diseases (Malaria eradication project, seasonal (autumn) fever related disease prevention program, etc.) • Reinforcement surveillance of emerging infectious disease - Operating emergency department syndromes surveillance for early detection of symptoms related to new epidemic diseases like acute hemorrhagic fevers, acute respiratory symptoms, acute diarrheal symptoms, etc. - Continued operation of seasonal influenza surveillance system focused on 100 single-day participating institutions for national influenza surveillance to monitor occurrences of H1N1 influenza • Strengthening quarantine for overseas travelers

Table 4-8 | Surveillance System 2007.2

Classification	Reporting System
Population-based Surveillance System	Every hospital and clinic → city/county/district public health centers → metropolitan/provincial health headquarters → Korea Centers for Disease Control and Prevention
Sentinel Surveillance System	Sentinel health facilities (3,442) → city/county/district public health centers → metropolitan/provincial health headquarters → Korea Centers for Disease Control and Prevention
	Sentinel health facilities (69) → Korea Centers for Disease Control and Prevention

Classification	Reporting System
Voluntary Surveillance System	Participating Schools (70) → KCDC
	Participating pediatric clinics (180) → KCDC
	Participating ophthalmology clinics (80) → KCDC

1.2.2. History of Infectious Disease Surveillance System in Korea

a. Notification and Reporting of Infectious Diseases

The infectious disease surveillance system in Korea has been advanced by the reporting and notification functions of national notifiable infectious diseases. These functions underwent many changes. Enacted on February 2, 1954, the "Prevention of Contagious Diseases Act" was partially revised eight times before it was fully amended in January 2000.

a) Enactment of the Prevention of Contagious Diseases Act (1954)

The Prevention of Contagious Diseases Act was enacted to protect the public from infectious diseases that were prevalent after the war and now serves as the skeleton for disease control regulation. The Act classifies infectious diseases into three types. In addition to Types 1 and 2, the Act includes reporting Hansen's disease patients, tuberculosis and sexually transmitted diseases – which were also to be reported at least once a month. Moreover, routine immunization was implemented for diseases such as smallpox, diphtheria, pertussis, typhoid fever, epidemic typhus, and tuberculosis.

b) First Amendment (1963.2.9)

This amendment changed the classification of encephalitis from type 1 to type 2, added rabies and malaria to type 2, and excluded Hansen's disease from the Group of Immediate Reporting. Also, tuberculosis vaccinations for newborns became compulsory.

c) Second Amendment (1976.12.31)

This amendment saw the reclassification of eruptive fever, scarlet fever and relapsing fever, and cerebrospinal meningitis from Type 1 to Type 2 infectious diseases, added yellow fever Type 1, and added epidemic hemorrhagic fever and tetanus to Type 2 diseases. Doctors were to examine pathogens holders or deaths caused by type 1. Reporting procedures included going through a director of a specific public health center.

Paratyphoid fever and epidemic typhus as diseases requiring long-term vaccinations were deleted from the list with zero occurrences since 1967, and Cholera and tetanus were added to the target list for long-term vaccinations. Moreover, several disease names were renamed from Japanese to the Korean nomenclature.

d) Third Amendment (1983.12.20)

Smallpox, typhoid, and cholera were excluded from the target disease list for long-term vaccination with zero occurrences of smallpox since 1961, and a decreased occurrence of typhoid because of improvements in environmental sanitation, better overall hygiene, and increased water supply rate. Polio and measles were added to the list. Also, those who did were not checked for sexually transmitted diseases suffered employment restrictions.

e) Fourth Amendment (1986.5.10)

Unified notation of Han characters related to Oriental Medicine.

f) Fifth Amendment (1993.12.27)

Smallpox was excluded from Type 1 infectious diseases such as AIDS, leptospirosis and scrub typhus, and added to Type 2. Regulations other than reasonable prohibitions against congregations around infected patients, school education requirements, migration restrictions and other guidelines, were abolished. In fact those who managed facilities under the presidential command were required to perform disinfection.

g) Sixth Amendment (1994.8.3)

The sixth amendment focused on the designation of infectious diseases that should be vaccinated and recommended the creation of a vaccination evaluation committee to investigate methods and criteria for vaccinations and compensation for injuries caused by vaccinations. If a person died or were injured because of a vaccination, the victim should be able to get compensation from the government through the Prevention of Contagious Diseases Act. This policy reduces distrust and the evasion phenomenon, increasing the efficiency of vaccination services.

h) Seventh Amendment (1995.1.5)

Key issues of the seventh amendment were about preventing hepatitis B by adding chronic hepatitis B to the type 3 infectious disease category. It is currently estimated that hepatitis B currently affects 7-10% of the total population. Hepatitis B was included as a target disease for long-term vaccination.

i) Eighth Amendment (1999.2.8)

Recovering from the economic crisis of 1998 was the primary issue at the time this amendment took effect. The crisis influenced the public health arena in ways such as simplification of the notification process for infectious diseases to public health center directors. Certain requirements such as those obligating diagnoses of Hansen's disease and tuberculosis, as well as mandatory vaccinations outside of emergency situations, were eliminated. Though this improved reporting system, the disinfection industry went from a permission-based system to a reporting system.

b. Transition to an Internet-based Information Network for Infectious Diseases

A computer network was created between the Korea National Institutes of Health and all cities on 13 August 1998, and metropolitan public health centers in August 1998, followed by network connections among the Korea National Institutes of Health - Public Health and Environment Institute – Quarantine - related associations. This implemented efficient information delivery and sharing systems in infectious disease areas. For these reasons, from October 1999, the Korea National Institutes of Health was able to aggregate statistical information on infectious disease occurrences in real-time (http://dis.mohw.go.kr).

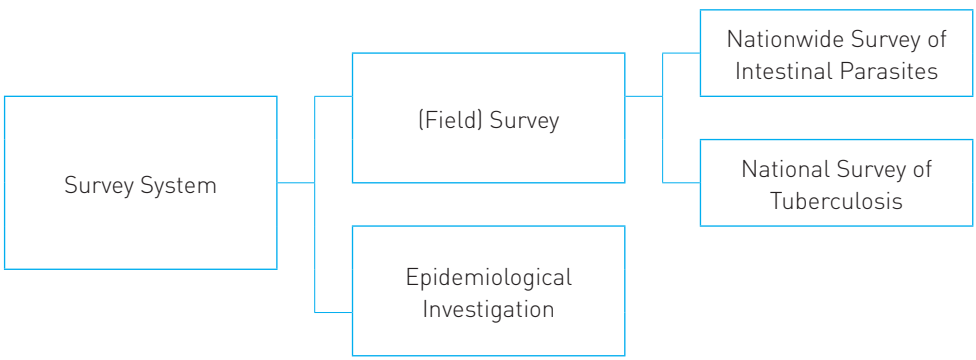
2. Surveys and Surveillance Systems of Infectious Diseases

2.1. Overview of Surveys and Surveillance Systems

2.1.1. Overview and Classification of the Survey System

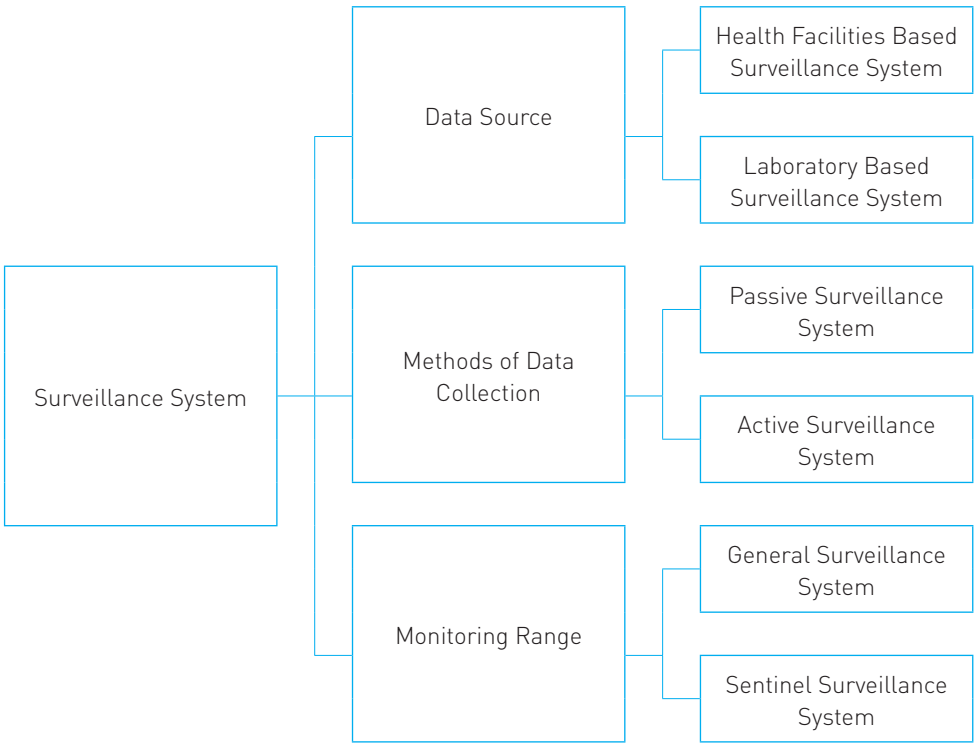
Infectious disease surveillance typically captures incident cases. This can be complemented by surveys to periodically assess the prevalence of chronic infectious diseases, and epidemiological investigations to detect additional cases among those in contact with the index patients.

Table 4-9 | Overview of the Survey System



2.1.2. Overview of the Surveillance System

Table 4-10 | Overview of the Surveillance System



The usability of surveillance systems has been proven, and numerous kinds of surveillance systems have been developed and operated. The World Health Organization (WHO) has built a worldwide surveillance system of infectious diseases. The surveillance system can be classified into several types by notification and reporting criteria and is usually reported as infected individual cases. For instance, it can be classified as regional and case units according to the reporting units. Most of the surveillance systems are being reported as case units. Depending on the scope of the informant, it can be classified as a total informant based system and a selected cases-based system. The latter is the so-called sentinel surveillance system. According to the characteristics of the notifiers, classification can be made based on a health facilities based surveillance system and laboratory based surveillance system. Also, the surveillance system can be classified as a group-based system and a particular disease-based system. For example, there is the influenza surveillance system (FluNet) operated by the WHO, surveillance for HIV/AIDS and sexually transmitted diseases, surveillance for antibiotic resistant bacteria, surveillance for food borne diseases (FoodNet) by the U.S.

CDC and surveillance for congenital anomalies (BDMP). Also, the system can be classified by the activeness and methods of data collection as passive or active surveillance systems.

a. Classification of the Surveillance System by Data Collection Methods

a) Passive Surveillance System

The passive surveillance system works as public health experts (e.g., doctors) discover diseases guided by existing laws or regulations and declared by the operating agencies without any special effort from the surveillance system. The system maintains itself easily at a low cost. Most of the cases have a low reporting rate, but highly focused disease notification can be overly reported given the following systems: surveillance of national notifiable infectious diseases, monitoring and surveillance of the side effects of vaccinations, and the registration system for cancer patients.

b) Active Surveillance System

An active surveillance system works as the operator visits areas where infectious diseases have occurred, collecting from the source to perform an epidemiological investigation and survey. Compared to the passive surveillance system, there is a higher cost and level of effort required in the active system. The active surveillance system is performed under the following conditions: 1) epidemic disease occurrences, 2) discovery of new emerging diseases, 3) necessity of an investigation for discovering new transmission pathways, 4) possibility of a pandemic spread, and 5) new detections of a particular disease in a new population or region. Generally, a passive surveillance system starts from the medical experts in the public health field, while the active surveillance system mostly comes from the agencies operating surveillance systems.

b. Method of Data Collection

The surveillance system for national notifiable infectious diseases consists of notification and report methods. Notification is when health facilities or doctors first notify local public health centers of a reportable infectious disease. This report then gets transferred to other agencies (e.g. Metropolitan/provincial health headquarters, Korea Centers for Disease Control and Prevention).

2.2. Survey System

2.2.1. (Field) Survey

a. Nationwide Survey of Intestinal Parasites[26]

a) Introduction

The nationwide survey of intestinal parasites is a government project based on the Parasitic Diseases Prevention Act which started in 1971. Since then, the survey has been performed every 5-8 years. The purpose of the survey is to identify the status of intestinal parasites among Koreans. More specifically, the survey identifies infection status by parasites or by region to provide standard data that could be used to set the direction of the Parasites Management Project.

b) Regulations – Parasitic Diseases Prevention Act

On April 19, 1966, the Parasitic Diseases Prevention Act was declared. With the Act, the entire population came under scrutiny for parasitic infection at the national level. Enforcement of the law symbolized the determination of the Korean government to actively control the status of parasitic diseases. Fecal checks were performed twice a year at every elementary, middle and high school. Treatment yielding positive test results was mandated by law. The Parasitic Diseases Prevention Act has since been abolished, its role taken over by the Act on Prevention and Control of Infectious Diseases.[27]

c) Organization

The Korea Centers for Disease Control and Prevention carry out the overall survey and execute such details as planning, statistical applications, promotion and collection, and laboratory diagnostic procedures. The survey was organized to include several institutes and agencies like the Ministry of Health and Welfare, Statistics Korea, local governments and the Korea Association of Health to handle investigations.

(1) Korea Centers for Disease Control and Prevention

- Statistics and survey funding authorization requests
- Contract research services
- Analysis of sample designs or survey areas, and statistical analysis of results (statistical professional organizations)

26. KCDC, NIH. "The Statistics of Nationwide Survey of Intestinal Parasites." Ed. KCDC, NIH. Republic of Korea: KCDC, NIH, 2013. Print.

27. Lee, Soon-Hyung. "Transition of Parasitic Diseases in Korea." J Korean Med Assoc 50.11 (2007). Print.

- Administrative support and supervised research projects

(2) Statistics Korea

- Cooperation for approval of survey statistics for intestinal parasite infection
- Sampling support for surveying the study area

(3) Administrative agencies (local government)

- Local administrative agencies of the investigation subject (City·county·district offices and public health centers, etc.)
- Survey administration and public relations support for the cooperation of the local community
- Census and promoting the national survey
- Collection of stool samples (cooperation from government offices, public health centers, public health care branch offices, and public health clinics, etc.)

(4) Korea Association of Health(16 Divisions/Branches)

- General service for application and contract
- Planning and implementing the survey
- Selection of results analysis and academic advisory committees for the survey
- Specimens (stool) test→after checking the specimens, shipped to the Malaria parasites division at the Korea Centers for Disease Control
- Results analysis and reports submission

d) Data Collection – Collection of Survey Information and Specimens

The government carried out eight surveys since 1971, performed every 5 or 8 years until 2012. The eighth national survey of the prevalence of intestinal parasites with stool tests and surveys of all subjects and bacterial urine tests among 10 year olds and younger were added to the process. Stool tests were diagnosed by detecting the eggs of 11 species of intestinal parasites (Clonorchis sinensis, intestinal flukes, paragonimus westermani, ascaris lumbricoides, enterobius vermicularis, trichuris trichiura, hookworms, gymnophalloides seoi, Diphyllobothrium latum, taenia sp., and trichostrongylus orientalis). The survey questionnaire was mainly about diet and level of intake of raw freshwater and fish, beef, and pork. Bacterial urine tests for children were conducted by using the perianal smear method to detect the existence of eggs of 11 species of intestinal parasites.

e) Data Analysis and Distribution

The results of the first survey to the eighth year were presented by comparing the status of parasites infection by year and parasite. Additionally, the results produced a map of infection status, making the reports more user-friendly and convenient. The report and statistics are accessible online at the Korea Centers for Disease Control and Prevention's homepage (http://cdc.go.kr).

f) Manpower - Educating Investigators

(1) Conducting pre-training for the actual survey

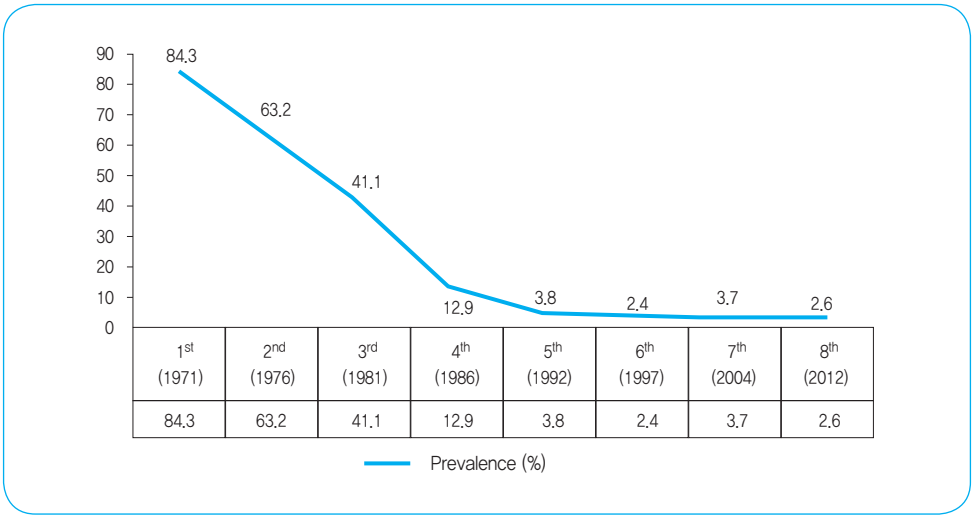
(2) Education is conducted based on the functional status of investigators

- Investigation of the local population
- Explaining the purpose of the study to the residents and soliciting cooperation for requests
- How to collect specimens and proper usage of the containers

g) Survey Purpose and Significance

The project of the government-led national targeted intestinal parasite survey was conducted first in 1971, and then every 5~8 years until 2012. A total of eight primary research projects were carried out. Through eight rounds of surveys, the status concerning the prevalence of intestinal parasites among the Korean population was identified, and a lot of statistical data was compiled, providing a basis for setting and planning fluctuations and trends in the national health control system. In addition, this research project is considered a success story due to the resulting decrease in the population infected with intestinal parasites to almost the eradication level. Looking at the positive rate of intestinal parasites from the first survey in 1971 to the 7th survey in 2004, the rate decreased continuously – the most drastic drop occurring between 1971 and 1986. [Figure 4-1].

Figure 4-1 | Progress in Intestinal Parasite Positive



Data on intestinal parasite testing has made it possible for the government to diagnose the situation in a country, establish policies and set aside resources to address the level of intestinal parasites infection. So far, Korea is the only country to have conducted a large-scale survey sampling on a regular basis to identify and target the parasite infection.

b. National Survey on Tuberculosis[28]

a) Introduction

From 1965 to 1995, Korea conducted seven "National Tuberculosis Surveys" in the past 30 years accompanied by five-year period plans to understand and change the scope of the tuberculosis problem in the country.

b) Regulations - Tuberculosis Prevention

By preventing tuberculosis and applying appropriate medical care for TB patients, regulations in January 1967 to mitigate the personal and social impacts of tuberculosis contributed to promoting the health of the people. In particular, the Tuberculosis Prevention Act (Act no. 1881) was established.

The Tuberculosis Prevention Act defines the responsibilities of central and local governments for identifying TB patients and mandating medical examinations, vaccinations

28. Korea Foundation for International Healthcare. "Development of ODA Program Model for Tuberculosis Elimination of Korea." Ed. Prevention, Korea Centers for Disease Control and. Republic of Korea: Korea Centers for Disease Control and Prevention, 2011. Print.

against tuberculosis and treatment of infected patients, as well as outlining legal support by the Korea Tuberculosis Association and other organizations.

In addition to developing an overall TB control plan based on the Tuberculosis Prevention Act and continuously managing patient care and business statistics, examinations were carried out to screen for weaknesses in the monitoring system so as to prevent the further spreading of TB. In fact, the Tuberculosis Prevention Act was completely revised in January 2010 in order to improve the monitoring system overall and strengthen related measures.

c) Organization

After the Korean War, the Tuberculosis Prevention Association of Jo-Seon, the Korea National Tuberculosis Association, the Christian Medical Association, the Task Force of the Department of Health Tuberculosis, and other private organizations were integrated into the Tuberculosis Association of the Republic of Korea. Its functions focused on enlightenment activities, academic activities, mobile X-ray screening special projects, bacteriological examinations and technical assistance to the National Tuberculosis Management Project, health care projects and other activities. International organizations such as the WHO and UNICEF provided support for the technology and equipment to tuberculosis management projects at that time. The WHO contributed greatly to improving the situation with tuberculosis problems in Korea. Also, in 1962, with the support of the WHO, the government set up the Tuberculosis Management Project using nationwide public health centers. Free treatment was provided for patients registered with the public health centers and for the patients' families. Various tests and vaccinations were also carried out. In addition, the government created a center dedicated to managing tuberculosis within the health and human department for national TB control (now the Ministry of Health and Welfare).

d) Data Collection

Local residents were tested through a sampling method using a stratified multistage probability process. Indicators were analyzed for the prevalence of X line pulmonary tuberculosis, to determine the infection rate of cities and counties, and identify the positive rate of the disease by gender and age.

e) Data Analysis and Distribution

Analysis of the results basically pointed to the current status of the tuberculosis infection rate by year, in particular, by gender, age and region. Also, the data pointed to the annual rate of tuberculosis infection, the prevalence of pulmonary tuberculosis, the BCG vaccination rate, and the drug tolerance and mortality rate of tuberculosis.

f) Manpower

The government created a department in charge of tuberculosis management at the city and provincial levels, implementing education and training for personnel associated with the management of tuberculosis in each division. In addition, women workers, mostly nurses, carried out the prevention projects for tuberculosis as management personnel of public health centers and clinics and therapeutic management, as well as case detection officials. By order of execution, the Korea Tuberculosis Association promoted the establishment of the system of tuberculosis specialists for efficient TB control projects in the country. Additionally, due to the Department of Public Health's recognizing the need for a system of tuberculosis experts, the system to educate tuberculosis experts was enacted in September 1969. Administrative personnel, such as medical professionals and those engaged in the tuberculosis business, train and gain the knowledge and skills necessary for carrying out an efficient tuberculosis management operation and fully understanding the scope of the tuberculosis issue in the country.

g) Survey Purpose and Significance

The tuberculosis survey captured the heart of the reality of the suffering associated with the disease and is claimed to be one of the most innovative management projects in international history. So far, the prevalence of tuberculosis has been declining steadily according to the figures shown in the survey. Through the first survey of 1965, the statistical prevalence of tuberculosis among Koreans was revealed to be about 5.1%. The second survey in 1970 showed the prevalence of tuberculosis having decreased by 4.2%, continuing to decrease to 3.3% in 1975 (results of the third survey). The fourth and fifth survey results showed decreased rates of 2.0% and 2.2%, respectively. This outcome was half of the prevalence rate of the first survey. The most recent survey that was performed also showed a clear decline in the prevalence rate, recording 1.03%. This reduction in the prevalence rate of tuberculosis is attributed to the introduction of short-term treatments of about 6 months in the mid-1980s, improved accessibility to medical institutions all over the country, and other government support.

h) Information Technology

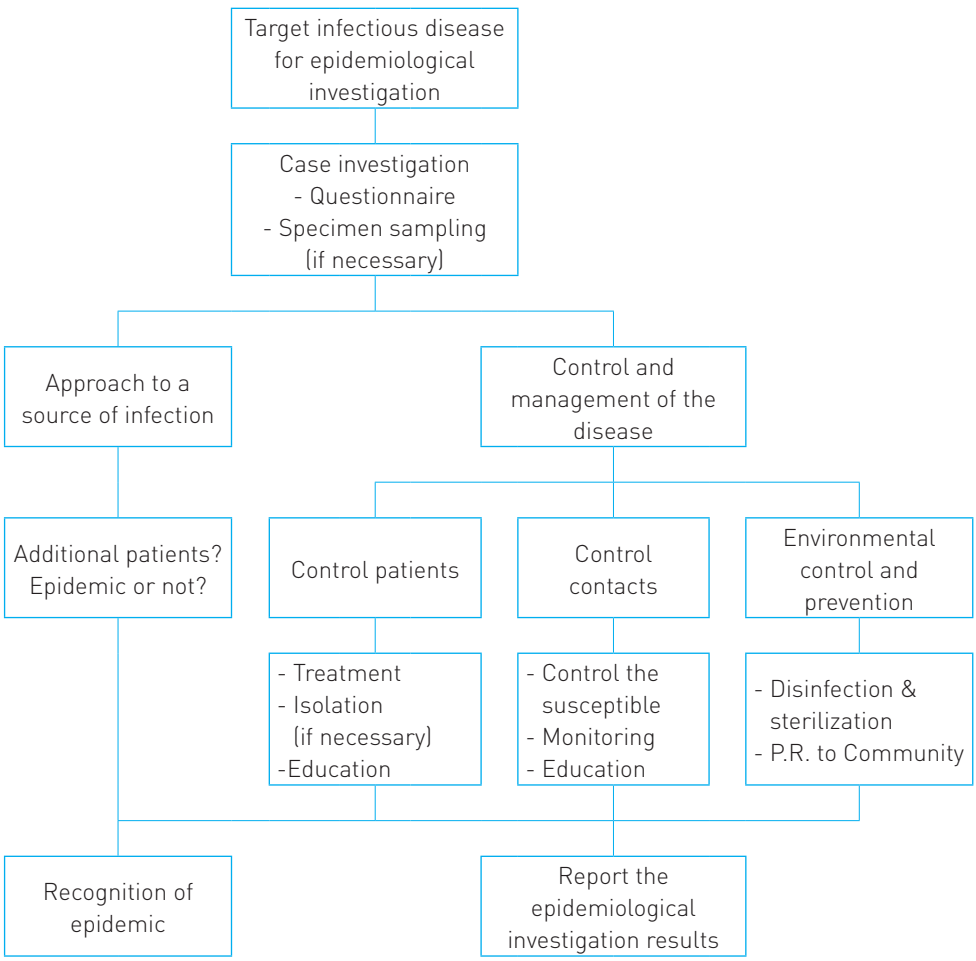
As the prevalence of tuberculosis decreased, the number of samples required by the surveys incurred a significant expense. There were also limitations to the epidemiological data collected. From June 1, 2000, Korea was able to identify trends and the magnitude of problems of tuberculosis based on the patient report of routine doctors and their tuberculosis information monitoring system (KTBS: Korean Tuberculosis Surveillance System , build http://TBnet.nih.go.kr). The KTBS is a computer TB surveillance system based on a comprehensive tuberculosis database for the entire country. Information is collected from

standardized tuberculosis outbreak information from medical departments, both public and private. The system can also establish measures for public health problems by quickly reflecting the results of the analysis to policy-makers and public health officials on the frontline.

2.2.2. Epidemiological Investigations

Once a national notifiable infectious disease has been reported, an epidemiological investigation should be performed to track the source of infection. Epidemiological investigations must be carried out effectively because the results could block the transmission and proliferation of the infectious disease based on scientific evidence.

Figure 4-2 | Flow of Epidemiological Investigations



As shown in the above figure, the framework for managing infectious diseases is quickly and accurately solidified through an epidemiological investigation.

The design of the study depends on the KCDC and its interviews with patients, parents, contacts, and attending physicians, the specimen collected, the definitive diagnosis based on diagnostic tests, and recommendations from specialists. Specific contents of the epidemiological investigation are:

1. Personal information of infected patients
2. Place and date of the patients
3. Infection source and pathways
4. Medical records of the patient
5. Other matters related to identifying the cause of the infectious disease

To carry out these epidemiological studies, the Korea Centers for Disease Control and Prevention organize a central unit for an epidemiological investigation, and metropolitan cities and provinces also have units with supporting city, county, and district epidemiological investigation units.

First, the central unit operates missions as indicated in the below table when an epidemiological investigation is needed in more than two different metropolitan cities and provinces at the same time. Also, the unit should have a role if a study of abnormal reactions and side effects is urgently needed after the vaccination, or if the epidemiological investigations of local units are insufficient or impossible.

Table 4-11 | Mission of the Central Epidemiological Investigation Unit

Central Epidemiological Investigation Unit (KCDC)	- Epidemiological investigation planning, implementation and evaluation - Development of standards to conduct epidemiological investigation - Education and training for metropolitan cities and provinces' epidemiological investigation units, and city, country, and district epidemiological investigation units - Epidemiological studies on infectious diseases - Data collection/analysis/feedback 1) Onset/outbreak/spreading of infectious diseases 2) Abnormal reaction and side effects after vaccination - Evaluation and technical support for local epidemiological investigation units

The main responsibilities of the metropolitan city and provincial units are contained in <Table 4-12>. The accountable local unit for investigations depends on where the patient lives according to the Korean Identification Registration system.

Table 4-12 | Mission of Metropolitan City and Provincial Epidemiological Investigation Units

Metropolitan Cities and Provinces Epidemiological Investigation Units	- Epidemiological investigation planning, implementation and evaluation in the jurisdiction - Development of detailed standards to conduct Epidemiological investigation in the jurisdictions - Reporting the results of local epidemiological investigations to the central unit - Data collection/analysis/feedback 1) Onset/outbreak/epidemic of infectious diseases 2) Abnormal reactions and side effects after vaccination in the jurisdictions - Evaluation and technical support for city, county, and district epidemiological investigation units

Table 4-13 | Target Infectious Diseases for Epidemiological Investigations by Agencies in Charge

Classification	Main Body for Epidemiological Investigations		
	City/County/District Public Health Center Units	Metropolitan Cities and Provincial Units	+ KCDC's Central Unit
Group I	Cholera, typhoid fever, paratyphoid fever, shigellosis, EHEC (Enterohemorrhagic *Escherichia coli*), hepatitis A		
Group II	Mumps, chicken pox, acute hepatitis B (sporadic)	Measles, rubella, tetanus, pertussis, Japanese encephalitis, acute B hepatitis (epidemic), Hib (Haemophilus influenzae type b)	Diphtheria, poliomyelitis

Classification	Main Body for Epidemiological Investigations		
	City/County/District Public Health Center Units	Metropolitan Cities and Provincial Units	+ KCDC's Central Unit
Group III	Malaria, scrub typhus, hemorrhagic fever with renal syndrome, leptospirosis, murine typhus, meningococcal meningitis, *Vibrio vulnificus* sepsis, tuberculosis, HIV/AIDS	Scarlet fever, brucellosis, legionellosis, (eruptive) typhus, CJD, vCJD	Rabies
Group IV	Dengue fever, Lyme borreliosis	Q fever, West Nile fever, tick-borne encephalitis, melioidosis, Chikungunya fever, bioterrorism infectious diseases, SFTS (Severe fever with thrombocytopenia syndrome)	Yellow fever, SARS (Severe acute respiratory syndrome), animal influenza human infection, Novel influenza, Emerging infectious disease syndrome
Designated		HFMD(Hand, Foot and Mouth Disease), imported parasitic infections	

The timing of when the investigation is launched differs between individual and epidemic. The individual investigation case should be done immediately to three days, and the epidemic investigation should begin at once. Once the investigation is complete, the responsible unit reports the results to the network system of epidemiological investigations. If the disease is not included in the network system, the unit can report it to the KCDC via a health headquarters of the metropolitan city or province.

The system for reporting a national notifiable infectious disease (as Groups) is as follows.

Table 4-14 | Epidemiological Investigation System of National Notifiable Infectious Diseases

Classification	Infectious Diseases	Responsible Unit for Investigation		Timing of Investigation	Accountable Division of KCDC
		Sporadic	Epidemic		
Group I	Typhoid fever, Paratyphoid fever, Shigellosis, Cholera, EHEC,	City/county/ district	City/county/ district (Metropolitan cities/provinces)	Immediately	Division of Epidemic Intelligence Service
	Viral hepatitis A	City/county/ district*			
Group II	Diphtheria, Poliomyelitis	Central	Central	Immediately	Division of Vaccine Preventable Diseases control & National Immunization Program
	Measles, Japanese encephalitis, Pertussis, Rubella, Tetanus, *Haemophilus influenzae type b*	Metropolitan cities/provinces	Metropolitan cities/provinces	Immediately	
	Viral hepatitis B(acute)	City/county/ district	Metropolitan cities/provinces	Immediately	
	Chicken pox, Mumps	City/county/ district*	Metropolitan cities/provinces	Immediately	
Group III	Malaria	City/county/ district	Metropolitan cities/provinces	Within 3 days	Division of Epidemic Intelligence Service
	Scrub typhus	City/county/ district	Metropolitan cities/provinces	Within 3 days	
	HFRS, Leptospirosis, Murine typhus	City/county /district	Metropolitan cities/provinces	Within 3 days	
	Scarlet fever*	Metropolitan cities/provinces*	Metropolitan cities/provinces	Within 3 days	
	Meningococcal meningitis	City/county/ district	Metropolitan cities/provinces	Within 3 days	
	Brucellosis	Metropolitan cities/provinces	Central	Within 3 days	
	Vibrio vulnificus (sepsis)	City/county/ district	Metropolitan cities/provinces	Within 3 days	
	Legionellosis, Epidemic typhus	Metropolitan cities/provinces	Central	Within 3 days	
	Rabies*	Central	Central	Within 3 days	

Classification	Infectious Diseases	Responsible Unit for Investigation		Timing of Investigation	Accountable Division of KCDC
		Sporadic	Epidemic		
Group III	Syphilis	-	-	-	Division of HIV and Tuberculosis Control
	Tuberculosis	City/county/district	City/county/district (Metropolitan cities/provinces)	Within 7 days	
	Hansen's disease	-	-	-	
	HIV/AIDS	City/county/district	Metropolitan cities/provinces (Central)	Immediately	
	CJD, vCJD	Metropolitan cities/provinces (Central)	Central	Within 3 days	Division of Infectious Disease Control
Group IV	Yellow fever	Central	Central	Within 3 days	Division of Epidemic Intelligence Service
	Dengue fever	City/county/district	Metropolitan cities/provinces	Within 3 days	
	Q fever	Metropolitan cities/provinces	Central	Within 3 days	
	West Nile fever	Metropolitan cities/provinces	Central	Within 3 days	
	Lyme borreliosis	City/county/district	Metropolitan cities/provinces	Within 3 days	
	Tick-borne encephalitis	Metropolitan cities/provinces	Metropolitan cities/provinces	Within 3 days	
	Melioidosis	Metropolitan cities/provinces	Metropolitan cities/provinces	Within 3 days	
	Chikungunya fever	Metropolitan cities/provinces	Central	Within 3 days	
	SFTS (Severe fever with thrombocytopenia syndrome)	Metropolitan cities/provinces*	Central	Within 3 days	
	SARS (Severe Acute Respiratory Syndrome)	Central	Central	Immediately	Division of Public Health Crisis Responses
	Animal influenza infection in humans	Central	Central	Immediately	
	Novel influenza	Central	Central	Immediately	

Classification	Infectious Diseases	Responsible Unit for Investigation		Timing of Investigation	Accountable Division of KCDC
		Sporadic	Epidemic		
Group IV	New emerging infectious diseases and syndromes	Central	Central	Immediately	Division of Infectious Disease Control & Division of Public Health Crisis Responses
	Bioterrorism infectious diseases (Anthrax (Group III), Botulism, The plague, Viral hemorrhagic fever, Small pox, Tularemia)	Metropolitan cities/provinces	Metropolitan cities/provinces (Central)	Immediately	Division of Bioterrorism Preparedness & Response
Group V	Parasitic infection	-	-	-	Division of Malaria & Parasite
Designated diseases	Viral hepatitis C	-	Central	within 3 days	Division of Epidemic Intelligence Service
	Hand, foot and mouth disease	Metropolitan cities/provinces*	-	within 3 days	
	Healthcare-associated infections (VRSA, VRE, MRSA, MRPA, MRAB, CRE)	Central	Central		Division of Infectious Disease Control
	Intestinal infectious diseases	-	Follows separate reference	Immediately	Division of Epidemic Intelligence Service
	Sexually transmitted diseases (Gonorrhea, chlamydia, chancroid, genital herpes, condyloma acuminatum)	-	-	-	Division of HIV and Tuberculosis Control
	Acute respiratory infection	-	-	-	Division of respiratory virus & Division of Bacterial Respiratory Infections
	Imported parasitic infections	Metropolitan cities/provinces	Metropolitan cities/provinces	within 7 days	Division of Epidemic Intelligence Service

Classification	Infectious Diseases	Responsible Unit for Investigation		Timing of Investigation	Accountable Division of KCDC
		Sporadic	Epidemic		
Others	Severe adverse effects after vaccination	Metropolitan cities/provinces		Immediately	Division of Vaccine Preventable Diseases control & National Immunization Program
	Non-severe adverse effects after vaccination	Metropolitan cities/provinces		as request of compensation	

* "Central" refers to the central unit of the KCDC that directly supports the local units for epidemiological investigations.
* If the city, county or district unit's investigation includes a special situation (e.g. death, severe complications, abnormal status), the metropolitan/provincial unit has the responsibility of an in-depth investigation (clinical progress, doctor interviews, cause of death, unit discussions, etc.) with the exception of certain diseases: tuberculosis, HIV/AIDS, chicken pox, and mumps.
* Viral hepatitis A: The case investigation is an epidemiological study of individual cases limited to the workers of restaurants and communal mass feeding companies and sites, as well as searches of food by the Food Sanitation Act .
* Scarlet fever: The case investigation is limited to cases of death, carried out by the metropolitan/provincial unit.
* Hand, foot, and mouth disease: The central unit should first confirm the clinical course (recovery/sequela/death) of the patient with neurological complications. The unit would then order the metropolitan/provincial units to investigate the case of death or severe complications.
* Chicken pox & mumps: The city/county/district unit investigates the sporadic cases (death, severe complication, atypical case, research) and the individual cases from an epidemic situation. The metropolitan/provincial units investigate the epidemics.
* SFTS: In the case the patient has died, was hospitalized in the ICU (Intensive care unit), or diagnosed from the laboratory, the case investigation is performed by the metropolitan/provincial unit.

The system of epidemiological investigation (responsible for the main body, timing, and methods) is diverse according to the groups and individual diseases. But the overall framework and flow would be reviewed via the investigation system for water and food-borne diseases and adverse effects after vaccination.

a. System of Epidemiological Investigation for Water and Food-borne Epidemics

a) Awareness of Epidemic

After recognizing the situation in advance with various routes (e.g. medical reports, press releases, patient reports, etc.), an epidemiological officer completes and submits the "epidemic notification form."

b) Report and Input on the Occurrence of Epidemics

After the epidemiological officer and reporter have submitted the form, the investigation unit should be dispatched to the site as soon as possible.

c) Determining the Study Design and Collection of Basic Data

The epidemiological officer collects basic data, including patient numbers, onset date and information, and reports the results to the EIS (Epidemic intelligence service) officer who works at the provincial/central level. The EIS officer advises personnel on the study design and standard format for the investigation. The responsible public health center for the investigation is also decided at this time.

d) Field Investigation

The division of infectious diseases and division of food hygiene will collaborate as part of a unified epidemiological investigation team. The team surveys patients, contacts (Group I infectious diseases), cooks, drinking water, foods, preserved foods, food materials and distribution channels.

e) Decision of Epidemic Situations

After completing the epidemiological investigation in the field, the metropolitan/provincial unit decides whether or not the event should be considered an epidemic. If the unit and field teams conclude non-epidemic, the official document with supporting justification should be reported to the division of the EIS, KCDC.

f) Epidemiological Investigation Report Submission

Investigators complete all epidemiological information without the exception of time, space and person, and submits the report to the public health center of the municipality within 14 days of the end of the epidemic.

g) Review and Feedback

The KCDC reviews the report and can request additional investigations and re-analysis of data if necessary.

h) Epidemiological Investigation Completion and Submission of the Final Report

The KCDC accepts the final report, thereby ending the investigation process. The KCDC then evaluates the report and provides feedback to all of the local units and the public.

2.3. Surveillance System

2.3.1. General Surveillance System

a . Exhaustive Surveillance System of National Notifiable Infectious Diseases

a) Group of National Notifiable Infectious Diseases

The government monitors all infectious diseases in the country. The "Infectious Diseases Control and Prevention Act" is a special law empowering authorities of the ministry to engage in infectious disease management. Infectious diseases listed in the Act are subject to national intervention, also previously referred to as "national communicable diseases." In the narrow sense, because physicians are also required to report patient information to health authorities, the national notifiable infectious diseases are also known as "Notifiable Infectious Diseases."

(1) Classification criteria for national notifiable infectious diseases

○ Group I:

- Includes mainly water and food-borne infectious diseases
- It is necessary to establish quarantine measures immediately to prevent an epidemic

○ Group II:

- Management of the diseases is possible through vaccination
- Vaccination projects are conducted in the country

○ Group III:

- Potential outbreaks of sporadic diseases
- Monitoring outbreaks on an ongoing basis is required

○ Group IV:

- Infectious diseases are likely to be newly generated or occur in-country
- Infectious diseases could possibly be carried in from abroad and fall under the jurisdiction of the Ministry of Health and Welfare

○ Group V:

- Infectious diseases occurring from being infected with parasites
- Infectious diseases can be regularly controlled by the ordinance of the Ministry of Health and Welfare

○ Designated infectious diseases: Monitoring activities to investigate whether the epidemic falls under Groups I through V, and if it is addressed by the Ordinance of the Ministry of Health and Welfare

(2) Patient classification criteria

○ Infectious patients:

- People exhibiting symptoms of the pathogen of the infectious diseases
- Patient confirmed through an inspection for an infectious disease by doctors or oriental medicine doctors in line with regulations and diagnosis standardization guidelines as suggested in the Act by the Ordinance of the Ministry of Health and Welfare ("Infectious Disease Control and Prevention Act", Article 11, Paragraph 5)

○ Patients with a suspected infectious disease:

- People identified in the stages preceding the official status of a confirmed infectious disease
- Pathogen of infectious diseases has infected or is suspected of having entered the human body

○ Diseases carriers:

- People with no clinical symptoms yet possess the pathogen for the infectious diseases

Table 4-15 | Classification of National Notifiable Infectious Disease[29]

Classification	Class I (6)	Class II (11)	Class III (19)	Class IV (18)	Class V (6)	Designated Diseases (17)
Type	A. Cholera B. Typhoid fever C. Paratyphoid fever D. Shigellosis E. Enterohemorrhagic *Escherichia coli* F. Viral hepatitis A	A. Diphtheria B. Pertussis C. Tetanus D. Measles E. Mumps F. Rubella G. Poliomyelitis H. Viral hepatitis B I. Japanese encephalitis J. Varicella K. *Haemophilus Influenzae Type B* (Hi B)	A. Malaria B. Tuberculosis C. Hansen's Disease D. Scarlet fever E. Meningococcal meningitis F. Legionellosis G. *Vibrio Vulnificus* sepsis H. Epidemic typhus I. Murine typhus J. Scrub typhus K. Leptospirosis L. Brucellosis M. Anthrax N. Rabies O. HFRS P. Influenza Q. AIDS R. Syphilis S. CJD and vCJD	A. Plague B. Yellow fever C. Dengue fever D. Viral hemorrhagic E. Smallpox F. Botulism G. SARS H. Animal influenza infection in humans I. Novel Influenza J. Tularemia K. Q fever L. West Nile fever M. Emerging infectious disease syndrome N. Lyme Borreliosis O. Tick-borne Encephalitis P. Melioidosis Q. Chikungunya fever R. Severe Fever with Thrombocytopenia syndrome (SFTS)	A. *Ascaris lumbricoides* infection B. *Trichuris trichiura* infection C. *Enterobius vermicularis* infection D. Clonorchiasis E. Paragonimiasis F. Intestinal trematodas	A. Viral hepatitis C B. Hand, foot and mouth disease C. Gonorrhea D. Chlamydia E. Chancroid F. Genital G. Condyloma acuminata H. VRSA infection I. VRE infection J. MRSA infection K. MRPA infection L. MRAB infection M. CRE infection N. Gastrointestinal infections O. Acute respiratory infections P. Imported parasitic infections Q. Enterovirus infection
Notification Time	Immediately	Immediately	Immediately	Immediately	Within 7 days	Within 7 days

b. Sentinel Surveillance System of National Notifiable Infectious Diseases

a) Definition and Purpose

(1) Definition

- The method for monitoring infectious diseases is based on activities that prevent infectious diseases and promote health by monitoring and analyzing on an ongoing basis the outbreak of infectious diseases around the controlling agency of specific specimens

- Cases for monitoring include: 1) when reporting the number of infectious diseases is nearly impossible (influenza, sexually transmitted diseases), and 2) diseases that require early detection in the management of infectious diseases (influenza, designated infectious diseases)

29. Reference as of November 2013.

(2) Purpose

○ Understanding the occurrence level (incidence) of infectious diseases

○ Understanding patterns of changing occurrences of infectious diseases

○ Understanding high-risk groups of infectious disease occurrences

b) Range of Notification and Type of Sentinel Surveillance-oriented National Notifiable Infectious Diseases

The type of surveillance-oriented national notifiable infectious diseases and scope of notification (patient, physician, patient and pathogen holders of infectious diseases) is outlined in <Table 4-16>.

(1) Operation of sentinel surveillance

• Public health centers notifying sentinel surveillance of infectious diseases

Table 4-16 | Sentinel Surveillance Reported by Public Health Centers
(Target Infectious Diseases, Purpose, Designation Criteria, Reporting Time and Procedure)

Target Infectious Disease	Purpose	Designation Criteria	Notification Time and Procedure
Hepatitis C	Understand epidemic scope and trend	Medical institutions (higher than hospital level) - 1 institution/200 thousand person - except specialized hospitals (psychological hospital, sanatorium)	- Notification time: within 7 days - Report time: Weekly - Procedure Sentinel surveillance institutions ↓ monthly report City/county/district Public health centers ↓ monthly report Metropolitan/provincial health headquarters ↓ monthly report KCDC
Hand, foot and mouth diseases with complications	Conduct surveillance	Higher general hospitals	
Sexually transmitted diseases	Understand infections scope and changing trend	- Public health centers - Primary/Secondary health care institution w/dermatology, urology, and ob/gyn	
Imported parasitic infections	- Understand actual conditions of importing, and trend - Find high risk area and countries	College of medicine with parasitology lab.	

• Korea Centers for Disease Control and Prevention (KCDC) directly notifying with sentinel surveillance of infectious diseases

Table 4-17 | Sentinel Surveillance Notified by the KCDC
(Target Infectious Disease, Purpose, Designation Criteria, Reporting Time and Procedure)

Target Infectious Disease	Purpose	Designation Criteria	Notification Time and Procedure
Influenza	- Investigate outbreak/ epidemic earlier by conducting surveillance continuously - Estimate outbreak/epidemic trend and effect of vaccine by pathogen isolation - Consider counterplan for influenza control	- Primary/Secondary health care institution w/pediatrics, internal department, family medicine department, and otolaryngology - Health facilities w/intention of lab. surveillance	- Notification time: within 7 days - Procedure Sentinel surveillance institutions ↓ monthly report KCDC
Parasitic diseases	Understand infection scope and trend	- City/county/district Public health centers - Institute of public health and environment - Korea association of health promotion	
Hand, foot and mouth diseases	Understand outbreak/epidemic scope and changing trend	Primary/Secondary health care institution w/pediatrics	
Health care-associated infections	Understand present condition of outbreak/epidemic	Higher general hospitals	
Gastrointestinal infections	Understand present condition of outbreak/epidemic and examine pathogen	Medical institutions (hospital level)	
Acute respiratory infections	Understand present condition of outbreak/epidemic and examine pathogen	50% of Sentinel surveillance institutions for virus influenza virus	
Enterovirus infection	Understand present condition of outbreak/epidemic and examine pathogen	Medical institutions (hospital level)	

c. Laboratory Surveillance System

- Identification and trend analysis are readily available with the laboratory disease surveillance system for a wide range of disease pathogens

- The laboratory disease surveillance system plays a major role in determining the case for a suspected disease that is difficult to diagnose through only a clinical diagnosis

- The laboratory disease surveillance system works as information on the biological sample is passed to the health authorities via the health care institution
- The laboratory disease surveillance system suits cases of Salmonellosis and Shigellosis, which are clinically less specific
- The system emphasizes the role of the doctor for specimen collection and patient diagnosis
- Accuracy of the diagnosis of a disease outbreak/epidemic is important to the comprehensive nature of the surveillance system. Therefore, a high degree of accuracy in defining cases is required in epidemiological studies of disease, region, time, and comprehensive reference point
- The advantages of a laboratory surveillance system are that the data is based on a laboratory diagnosis of infection, so accuracy is high. Also, detailed information about region, date, sex, age, and clinical characteristics are easily accessible and easy to reflect in the investigation

a) Acute Respiratory Infectious Disease

- Acute respiratory infections such as a cold place a major financial burden on Korea's health care system while also constituting the main reasons for prescribing antibiotics. The lack of analytical data, however, makes this group of infections difficult to evaluate
- Results garnered through laboratory surveillance systems have contributed significantly in the form of valuable data to analyzing such diseases as acute pharyngitis/laryngitis and community acquired pneumonia.

b) Acute Diarrheal Disease

- EnterNet-Korea is an active surveillance system with the purpose of establishing a rapid and accurate diagnosis of acute diarrheal disease pathogens (shigellosis EHEC (enterohemorrhagic Escherichia coli), norovirus, etc.) that spread quickly
- Since 2005, 16 city and state institutes of health and environment have been operating in conjunction with primary and secondary health facilities (2010, 106 hospitals)
- Target pathogens: Five species of bacteria (Salmonella spp., Vibrio spp., E. coli, (EHEC, ETEC), Campylobacter spp.), five kinds of viruses (Rotavirus, Norovirus, Astrovirus, enteric adenovirus, Sapovirus) and three kinds of parasites (Cryptosporidum parvum, Entamoeba histolytica, Giardia lamblia)

- The system aims to provide basic data for preventing diarrheal disease by identifying the distribution of pathogens and its regional, national and seasonal characteristics

c) VRSA(Vancomycin Resistant Staphylcoccus Aureus)

- After VRSA was designated for sentinel surveillance in 2000, laboratory surveillance for VRSA went into effect annually for 8~12 weeks
- VRSA was not detected during the monitoring period of eight years. After the change in the decision criteria for CLSI/NCCLS in 2006, however, 22 cases of vancomycin moderate-resistant Staphylococcus aureus (Vancomycin Intermediate Staphylcoccus aureus, VISA) were reported. For these reasons, the importance of laboratory surveillance is growing
- Laboratory Surveillance for VRSA has the purpose of preventing the growth of VRSA by continuously monitoring the emergence of strains that have poor susceptibility against vancomycin under the provisions of Article 3 of the Infectious Diseases Control and Prevention Act

d. High-risk Group Survey of Zoonoses

- Zoonosis is a disease that can be transmitted from a human to an animal or from animals to humans in a broad sense
- According to the World Health Organization, zoonoses have been identified for 30 years – from 1973 to 2003 – and many of the infectious diseases of new species were identified as zoonoses[30]
- Zoonoses are more efficiently managed by focusing on high-risk groups. For this reason, the KCDC carries out an annual survey on targeted high-risk groups such as dairy farmers, veterinarians and deer farm workers[31]

30. World Health Organization (WHO). The Control of Neglected Zoonotic Diseases (Report of the JointWHO/DFID-AHP Meeting; WHO/SDE/FOS2006.1). Geneva, Switzerland: World Health Organization. 2006.
31. Acha PN, Szyfres B. Zoonoses and communicable disease common to man and animals. 2nd ed. Sci Publ No. 503. Washington DC: PAHO, 1987.

Table 4-18 | Surveys Related to Zoonoses

Year	Research Title	Subjects	Number	Target Diseases
2005	Development of Epidemiological investigation methodology and pilot study for brucellosis	Livestock farmers in North Gyeongsang-province, Veterinarians, Insemination technicians	1,075	Brucellosis
2006	A study on preliminary survey and the development of the epidemiological investigation for the human brucellosis	Livestock farmers, Veterinarians, Insemination technicians nation wide	6,361	Brucellosis
2007	A Survey on the Status of Zoonoses for Risk Population	Workers related to butchery, nation-wide	1,731	Brucellosis, Q fever, Enterohemorrhagic Escherichia coli
2008	A Survey on the Status of Zoonoses for Risk Population	Dairy population in Gyeonggi-province	719	Brucellosis, Q fever, Enterohemorrhagic Escherichia coli
2009	A Survey on the Status of Zoonoses among the Veterinarians Related to Public Affairs	Veterinarians related to public affairs and worked at veterinary service laboratory, nation-wide	946	Brucellosis, Q fever, Enterohemorrhagic Escherichia coli, Toxoplasmosis
2009	A Survey on the Status of Q fever, Lyme borreliosis, and E. coli O-157 for Deer farmers	Deer farmers	516	Q fever, Lyme borreliosis, Enterohemorrhagic Escherichia coli
2010	A Survey on the Status of Zoonoses in Dairy Population	Dairy population, nation-wide	527	Brucellosis, Q fever, Enterohemorrhagic Escherichia coli
2012	A Survey on the Status of Zoonoses in slaughterhouse workers	Workers related to butchery, nation-wide	1,883	Brucellosis, Q fever, Hepatitis E
2013	A Survey on the Status of Zoonoses in a Livestock Farmers	Livestock farmers in North Gyeongsang-province, epidemic control commissioners, inspectors	1,146	Brucellosis, Q fever

e. Disease Information Monitoring Network

a) Purpose

To ensure the prevention and spread of numerous infectious diseases, a monitoring network operates year-round and promptly and accurately identifies and analyzes the outbreak or epidemic of various infectious diseases.

b) Configuration and Operation of Disease Information Monitoring Network

(1) Roles (by institutes)

○ Korea Centers for Disease Control and Prevention:

- Ensuring monitoring of the outbreak of infectious diseases and cooperation throughout all networks in the country

○ Metropolitan cities and provinces:

- Reviewing the reporting time of infectious diseases and cooperation monitoring networks made up of city, county, and district agencies

○ City/County/District:

- Reviewing reports of infectious diseases in jurisdictions through cooperation of the monitoring network and the monitor status of site management and other key players

(2) Monitoring post

○ Medical institutes (health care facilities) such as hospitals and clinics

○ In the case of hospital-grade institutions or higher, monitoring is conducted for all medical centers

○ Clinics: Selected based on the unique local circumstances mainly focused on internal medicine, pediatrics and family medicine

○ Pharmacy: Pharmacies that are not included in the regulation on separation of pharmacy and clinic

○ Schools (health teachers), social welfare facilities (nursing homes, orphanages) and communal feeding facilities in companies (health managers), etc.

○ A specific range of the upper section is to include more than 10% of the total number of facilities in each class (specify one place in the case of less than 10 locations)

○ Others: Individuals as required by the public health center directors

(3) Monitoring management

○ Performing compulsory education for staff involved in the monitoring mission

○ To support the promotion of prevention items as a priority and as a way of considering incentives for disease information monitoring posts

○ Monitoring management and post-designation

- Public health centers: monitor settings and update status within the jurisdiction, and report to the metropolitan cities and provinces with situational updates

- Create and position the current state of monitoring by metropolitan city and province, by the city-county-district, and request for monitoring cooperation

(4) Monitoring

○ Ordinary times: reported only when infectious diseases occur

○ At the time of transition to the emergency service system: report to the upper institution as soon as possible at the time of notification or outbreak (including non-national notifiable infectious diseases)

c) Specification of Responsible Monitoring Management Personnel by Public Health Centers

○ Seoul, Busan, Daegu, Incheon and Gyeonggi provinces: 2 managers per public health center, 1 per public health center for other metropolitan/provinces

○ Ensuring education of monitoring activities, promoting infectious diseases and securing a communication system within the jurisdiction

○ Monitoring the occurrences and trends in patients for epidemic conjunctivitis, influenza

d) Prediction Target

○ Central (headquarters):

- National forecasts on infectious diseases

- With particular regard to Japanese encephalitis, malaria, influenza, and other new emerging diseases, surveys and an analysis of generational transitions from the center is required before the forecasts

○ Metropolitan cities and provinces:

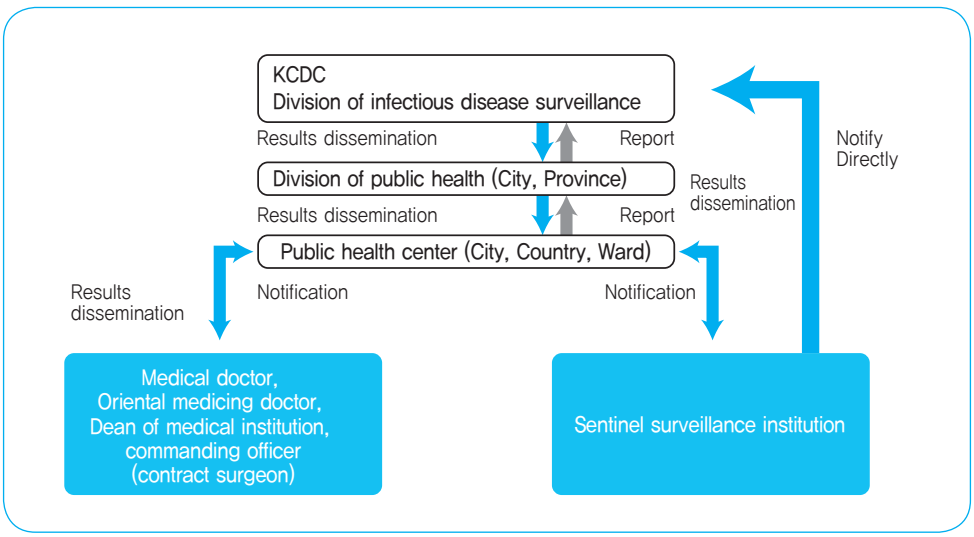
- After conducting research on a voluntary basis on the disease or regional infectious diseases, report a prediction of the disease to the center and then share with the general public

f. Prediction Method

○ Taking advantage of media of various types, including neighborhood associations, organizations and gatherings, to inform the public

2.3.2. Surveillance System Process

Figure 4-3 | Surveillance System Work Process



a. Report system

a) A Report Obligator

(1) Doctor, Oriental Medicine Doctor, Director of Medical Institution

Doctor or Oriental Medicine Doctor should report to the Chief of the Medical Institution. The Chief should report to the city/county/district public health center. (Doctor or Oriental Medicine Doctor who are not included in any medical institution should directly report to the public health center)

(2) The Commander

A doctor with the army, navy, air force, or military under the direct control of the Ministry of National Defense should report to the commander at his unit. The commander should report to the city/county/district public health centers

(3) Others

- Group 1, 2, 3, 4 infectious diseases
- Head of household or family member
- Administrator or representative: school, hospital, government office, private office, public performance, religious facility, transportation facility for ships, flights, and trains, restaurant, lodging, or other public places

※ Penalty Provisions

False or incomplete reports may result in a maximum penalty of KRW2,000,000, according to the "Infectious Disease Control and Prevention Act"

b) Reporting Time

(1) Group 1, 2, 3, 4 infectious diseases

- Notification of occurrence: Immediately
- In the case of diagnosing patients, suspected patients, and diseases carriers
- Examination of the infected dead body
- Case of death from infectious diseases

(2) Influenza, Group V infectious diseases, designated infectious diseases, infectious diseases for sentinel surveillance

- Outbreak report: within 7days
- In the case of diagnosing patients, report suspected and disease carrying cases

Table 4-19 | Notification Range and Time of National Notifiable Infectious Diseases

Classification	Diseases	Range of Notification			Notification Time
		Patients	Suspected Patients	Disease Carriers	
Group I	Cholera	O	O	O	Immediately
	Typhoid fever	O	O	O	Immediately
	Paratyphoid fever	O	O	O	Immediately
	Shigellosis	O	O	O	Immediately
	Enterohemorrhagic *Escherichia coli*	O	O	O	Immediately
	Viral hepatitis A	O	X	X	Immediately

Classification	Diseases		Range of Notification			Notification Time
			Patients	Suspected Patients	Disease Carriers	
Group II	Diphtheria		O	O	X	Immediately
	Pertussis		O	O	X	Immediately
	Tetanus		O	X	X	Immediately
	Measles		O	O	X	Immediately
	Mumps		O	O	X	Immediately
	Rubella		O	O	X	Immediately
	Poliomyelitis		O	O	X	Immediately
	Viral hepatitis B	Acute	O	X	Immediately	Immediately
		HBsAg positive maternity	O	X	Immediately	Immediately
		Perinatal	O	X	Immediately	Immediately
	Japanese encephalitis		O	O	X	Immediately
	Varicella (Chicken pox)		O	O	X	Immediately
	Haemophilus influenzae (type b)		O	O	X	Immediately
Group III	Malaria		O	X	O	Immediately
	Tuberculosis		O	O	X	Immediately
	Hansen's Disease		O	X	X	Immediately
	Scarlet fever		O	O	X	Immediately
	Meningococcal meningitis		O	X	O	Immediately
	Legionellosis		O	O	X	Immediately
	Vibrio Vulnificus sepsis		O	O	X	Immediately
	Epidemic typhus		O	O	X	Immediately
	Murine typhus		O	O	X	Immediately
	Scrub typhus		O	O	X	Immediately
	Leptospirosis		O	O	X	Immediately
	Brucellosis		O	O	X	Immediately
	Anthrax		O	O	X	Immediately
	Rabies		O	O	X	Immediately
	HFRS		O	O	X	Immediately

Classification	Diseases	Range of Notification			Notification Time
		Patients	Suspected Patients	Disease Carriers	
Group III	Influenza	O	O	X	Immediately
	AIDS	O	X	O	Immediately
	Syphilis	O	X	X	Immediately
	CJD and vCJD	O	O	X	Immediately
Group IV	Plague	O	X	X	Immediately
	Yellow fever	O	X	X	Immediately
	Dengue fever	O	O	X	Immediately
	Viral hemorrhagic fever	O	O	X	Immediately
	Smallpox	O	O	X	Immediately
	Botulism	O	O	X	Immediately
	SARS	X	O	X	Immediately
	Animal Influenza infection in humans	O	O	X	Immediately
	Novel Influenza	O	O	X	Immediately
	Tularemia	O	O	X	Immediately
	Q fever	O	O	X	Immediately
	West Nile fever	O	O	X	Immediately
	Emerging infectious disease syndrome	O	O	X	Immediately
	Lyme Borreliosis	O	O	X	Immediately
	Tick-borne Encephalitis	O	X	X	Immediately
	Melioidosis	O	X	O	Immediately
	Chikungunya fever	O	X	X	Immediately
	SFTS	O	O	X	Immediately
Group V	*Ascaris lumbricoides* infection	O	X	X	Within 7days
	Trichuris trichiura infection	O	X	X	Within 7days
	Enterobius vermicularis infection	O	X	X	Within 7days
	Clonorchiasis	O	X	X	Within 7days
	Paragonimiasis	O	X	X	Within 7days
	Intestinal trematodas	O	X	X	Within 7days

c) Report Process

Reporting has been facilitated with the availability of such technology and equipment as the facsimile, computer communications and the internet (http://is.cdc.go.kr).

b. Report System

a) Report Obligator

(1) Director of public health centers in cities, counties and districts

After reviewing the description of the situation in the report, the director should revise and complement the submission by consulting with the doctor in charge of the report. The director should then report to the district public health center, and the center should report to each Minister of Health and Welfare representative and governor in the district.

(2) Managing director and EIS officer

After reviewing the report, the director and EIS officer should report to the KCDC if the report is appropriate. If it is not appropriate, they should consider rejecting the report and requesting that the report preparer revise and resubmit the report.

(3) Report time

- Group I, II, III, and IV infectious diseases: Immediately (excluding influenza)
- Influenza (Group III), Group V, and designated infectious diseases: Weekly

(4) Report process: On the website (http://is.cdc.go.kr)

c. Analysis and Feedback System

The analysis and feedback system of surveillance data contain analyses of the reported data and provides the results to the sentinel surveillance institutions (posts), related organizations and the general public periodically to support the prevention of infectious diseases. In addition, the participation rate of sentinel surveillance institutions has improved with the provision of information on infectious disease occurrences to the related organizations.

Table 4-20 | Institutions, Analysis, and Disseminatino Methods According to Analysis Range

Range	Institutions	Contents	Dissemination Methods
City·county·district	Public health centers	Number of patients by sex and age within institution	- Dissemination time: weekly - Dissemination targets: Sentinel surveillance institutions, Medical association, Education offices, Medical institutions etc.
Metropolitan cities·provinces	Division of public health	Number of patients by sex, age, and City·county·district	- Dissemination time: weekly - Dissemination targets: Public health centers
Country	KCDC	Number of patients by sex, age, and metropolitan cities·provinces	- Dissemination time: weekly - Dissemination medias: KCDC homepage, Disease web statistics system, Public Health Weekly Report (PHWR) etc. - Dissemination targets: Public health centers, Division of public health, Institutes of public health and environment, KFDA, related academic society etc.

2.3.3. Organization of Surveillance System

a. System and Budget

a) Related Legislation – "Prevention and Control of Infectious Diseases Law"

b) Budget Execution Details for Each Section

Table 4-21 | KCDC Budget

Classification	Subsection	Amounts ($)
The total budget	Total	311,966,102
	General accounts	83,442,561
	National health promotion fund	225,465,160
	Emergency medical fund	3,058,380
General accounts	Total	83,442,561
	Personnel expenses (KCDC/Quarantine office)	13,847,458/13,450,094
	Basic expenditure (KCDC/Quarantine office)	1,457,627/2,527,307
	Operating system expenditure (KCDC/Quarantine office)	0/81,921
	Support invigorating organ donation	3,963,277

Classification	Subsection	Amounts ($)
General accounts	Study for cardio-cerebrovascular diseases	125,235
	Control quarantine	5,419,021
	Informatization of KCDC	2,773,070
	Control Hansen's disease	12,176,083
	Control zoonoses	613,936
	Bacterial and viral diseases	1,640,301
	Control infectious diseases	6,967,043
	Control research planning	2,406,780
	Establishment utilizing basis for data resources	4,028,249
	Relocate KCDC	0
	Establishment of research infra-structure	6,811,676
	KCDC money for replacing revenue	847,458
	R&D	470,810
	Control quarantine and chronic diseases	3,241,055
	Establishment of bioethics basis	595,104
National health promotion fund	Total	225,465,160
	Control international cooperation	0
	Control blood safety	873,823
	Education of preventing adult diseases	13,366,290
	Support national cancer control	557,439
	Support patients of rare diseases	31,326,742
	Fortify response system for novel infectious disease	4,356,874
	Control vaccination	68,899,247
	Fortify response system for bio-terrorism	5,182,674
	Control sexually transmitted diseases and AIDS	8,517,891
	Control tuberculosis	36,795,669
	R&D	16,007,533
	Survey and surveillance for chronic diseases	13,281,544
	International cooperation for control diseases	654,426
	Survey and research for control diseases	19,427,495
	Informatization of KCDC	2,259,887
	Establishment of infra-structure for infectious diseases diagnosis	3,675,141
	Health control for climate changes	282,486

Classification	Subsection	Amounts ($)
Emergency medical fund	Total	3,058,380
	Poisons and injury surveillance system	1,293,785
	Expansion and maintenance of isolation bed for novel infectious diseases patients	1,355,932
	Management of isolation institutions for novel infectious diseases	408,663

The exchange rate: $1 = ₩ 1062 (2014 1.17).

b. Organizing and Managing Systems

a) Central: Principal Duties of Divisions of Infectious Disease Surveillance, KCDC

Establishing plans for infectious disease surveillance

Investigating and studying infectious disease surveillance

Managing and disseminating statistics related to infectious diseases

Developing and operating the web system of infectious disease surveillance

Educating and training infectious disease surveillance personnel

Overseeing surveillance medical institutions for infectious diseases

Producing and publicizing information related to infectious diseases

b) Mega-polis: Surveillance Work of the Division of Public Health, Metropolitan City and Province

(1) Report of outbreaks, division of public health at the city and provincial level

After examining the outbreak report of infectious diseases at each public health center, the division of public health should report to the KCDC.

(2) Analyzing and applying information related to infectious diseases

- Analysis of the status of outbreak/epidemics of national notifiable infectious diseases at the metropolitan city and province levels

Data regarding infectious disease outbreaks/epidemics at each metropolitan city and province is drawn up weekly or monthly. The outbreak/epidemic state is reported to the governor of each metropolitan city and province after analyzing the data and a case-examination meeting.

• Feedback on infectious disease information

The areas' infectious diseases outbreak/epidemic status and analyzed data should be shared with public health centers at the city, county, and district levels. Also, the epidemiology investigation report should be shared with the responsible public health centers. If an epidemic is spreading, the city/county/district public health centers, medical institutions, schools, and local residents should be the primary recipients of public awareness campaigns regarding the epidemic infectious diseases and prevention measures.

c) Region: City/county/District Public Health Center Surveillance Duties

(1) Infectious diseases reporting and notification

After reviewing the report (patient group classification and diagnosis), the director should revise and complement the report by consulting with a doctor in charge of the report. The director should record and manage the document and status of the outbreak in accordance with the ordinance of the Ministry of Health and Welfare.

(2) Analyzing information on infectious diseases

• Analysis of outbreak/epidemic of national notifiable infectious diseases

When drawing up a report on the outbreak/epidemic status of national notifiable infectious diseases, data should be analyzed more than once a month. The public health centers discuss prospective ways for controlling and examining the outbreak status of infectious diseases. Also, the officer in charge of infectious diseases (epidemiological personnel of public health centers) should report the outbreak status of infectious diseases to the governor of the city, county or district.

• Case-examination meetings at public health centers

Such meetings discuss and analyze the outbreak status of infectious diseases, examining potential control factors such as epidemiology investigations.

• Dissemination of information on infectious diseases

Investigation results regarding notifiable diseases should be regularly provided to clinics, medical institutions and schools. The feedback period is more than once a month. Upon the occurrence of a communicable disease, public health centers have to provide information on the disease and publicize prevention measures.

d) Private Funding and Subsidy Projects

The KCDC funds various projects to develop networks of collaboration with health professional associations such as the Korea Medical Association, Korean Medical Record

Association, Korean Association of Infection Control Nurses, and Korean Health Teachers Association. These projects support seminars, continuing education programs, workshops, and other academic activities to promote health professionals' roles for surveillance system functions.

c. Training System

a) Field Management Training Program, FMTP

(1) Goal of training

The goal of training is to develop the leadership of health authorities and infection administrators; to train specialized personnel to ensure the healthy life of people through rapid initiatives that correspond with the prevention and control of infectious diseases, and to strengthen the role and disease management system by ensuring a rapid response in the event of an infection occurrence with clearly defined roles for health authorities and a well-constructed nationwide infrastructure.

(2) Course Goals

Table 4-22 | Objectives of Education and Training Courses

Courses	Objectives
FMTP Course	Produce community directors of health as capable and professional field managers for infectious disease control through leadership development programs for infectious disease control and improvements in crisis management abilities
FMTP II Course	Enhance the capabilities of employees in charge of infectious diseases and fortify the response abilities of community infectious disease control centers by promoting practical knowledge and techniques for major infectious diseases
Health Teacher Intensive Course	Prevent infectious disease outbreaks and fortify prompt response capabilities by maintaining knowledge of and practical abilities in infectious diseases control-related areas, including those of the school age population and health teachers

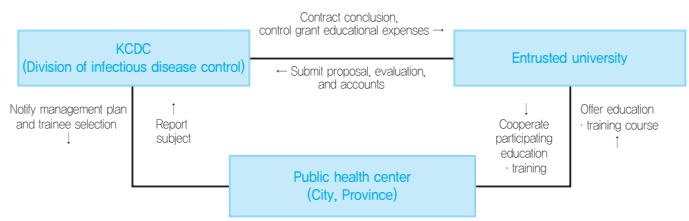
(3) Operation Principals

With the goal of maintaining a curriculum or consistency in the education of infectious disease control, the government must set standards for selected universities in their training of high quality experts, and then implement these standards with the education commission. In order to respond to the educational needs of the community, the government must strengthen education in the field centers by carrying out ex-

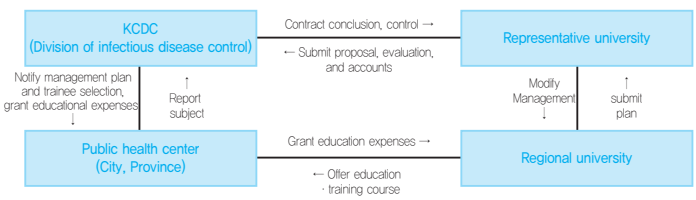
post management of education, promote cooperation with continuing education, and elevate the morale of participants using awards for those who graduate with excellent performance.

(4) Education Promotion System

Figure 4-4 | Education Promotion System



〈Intensive training course of infectious disease control for field manager and nurse-teacher〉



〈Infectious disease control EMTP II〉

(5) Overview of specific training courses

- Courses for managers of surveillance systems for communicable diseases

First, training courses must select topics concerning the social and major policy issues surrounding the management of infectious diseases. Trainers are educated with lectures by experts, through deep discussions, by acquiring basic knowledge, and in the workshop setting for sharing best practices and real-life experiences – all of which lend to improved management of infectious diseases and better problem-solving ability.

- Management of infectious diseases, FMTP II

<Central Policy Education>

This policy is intended to promote specific training for key areas that are considered necessary for directing central government policies related to public health, particularly during the transition period of infectious disease prevention and management strategies.

<Field Education>

Introduce courses on infectious disease and prevention

- Further training on infectious disease management for school health teachers

Based on the understanding of government policies regarding infectious diseases through lectures and discussions, students should be trained on prevention of infectious disease and application.

b) Field Epidemiology Training Program, FETP

(1) Goal of training

Epidemiologists are able to obtain a professional education regarding epidemiological studies to improve their performance capability and knowledge of communicable diseases. The training offers recent information on infectious diseases, as well as the opportunity to share field experiences and develop their own epidemiological professional abilities.

(2) Overview of training courses

• Introductory Course

The introductory course is for experts in related fields such as infectious disease targets and public health investigators. The purpose of the course is to educate specialists on the epidemiology of infectious disease, provide basic knowledge and sharpen skills for running a disease control system. The curriculum consists of epidemiology, statistics, research methodology, surveillance and management methodology of infectious disease, lectures, field placement and other related topics.

• On-the-Job Training

On-the-Job Training is for central and metropolitan city or provincial investigators as well as quarantine officers. The purpose of the course is to study the epidemiological perspective which includes detailed task-specific expertise, learning, discussion and information, and to share practices in epidemiological investigations. The operation is entrusted to professional education on such fields as monitoring systems, infectious disease management, reporting and discussion of activities related to the latest knowledge and information acquired in infectious diseases. The training is designed to enhance

one's expertise through the exchange of experience in the field and involves a regular evaluation of work performance matters, infectious diseases, and adverse reactions after vaccination through case presentations and epidemiological studies.

c) Job Training for a New Epidemiological Investigator

The target of this training are municipal government investigators who are learning how to report an infectious diseases outbreak, investigate epidemiological surveys and prepare investigation reports.

d) Job Training for the Metropolitan City and Province

This scope of job training covers infectious disease control personnel, school health teachers, nursing staff, food industries, hospitality dispensaries, collective catering facilities and welfare facilities. This course focuses on the skills of planning infectious disease management and job training in cities and provinces.

e) Additional Training for Public Health Officers

The Korea Human Resource Development Institute for Health and Welfare (KOHI) is a specialized institution for personnel development in health and welfare and provides regular training courses on the utilization of web-based surveillance systems and on-line courses.

d. Information and Communication Technology, ICT

The strength of a country can be traced to a monitoring system involving ICT technology, which has the capability of inputting information for web reports on infectious diseases. This system has been conducive to solving web-related problems such as missing or delayed reports, and also enjoys higher report and notification rates.

Figure 4-5 | Data Input Screen for Web-based Notification System

Other people besides those required to prepare reports could benefit from the statistics system that tracks communicable diseases on the website. It is possible for users to calculate and identify treatments for diseases based on a search of certain variables, including disease-specific factors, region, gender, age, and other identifiers. The web system services are user-friendly thanks to improved technology.

2013 Modularization of Korea's Development Experience
Establishment of Korea's Infectious
Disease Surveillance System

Chapter 5

Success Factors and Limitations in Korea's Infectious Diseases Surveillance System

1. Success Factors Analysis
2. Infectious Disease Surveillance System: Limitations and Successes
3. Comparison with Other Countries

Success Factors and Limitations in Korea's Infectious Diseases Surveillance System

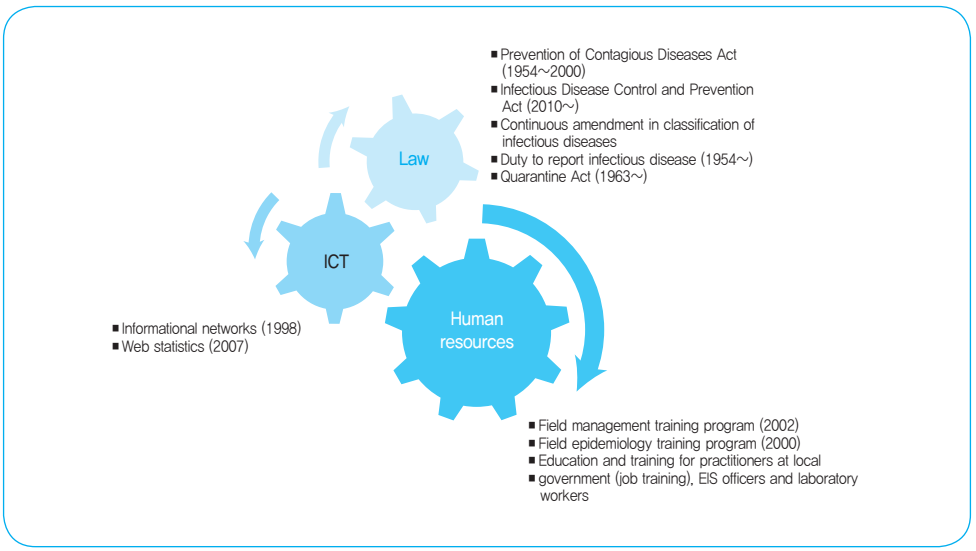
1. Success Factors Analysis

1.1. Success Factors of the Infectious Disease Surveillance System

Overall, the success of the infectious disease surveillance system in Korea can be attributed to the harmony among various elements: the monitoring system and related regulations and Acts, ICT, education and training for health staff (human capacity building) and other factors. By passing the Prevention of Contagious Diseases Act (1954) and Infectious Disease Prevention and Control Act (2010), the government obligates reporting of communicable/infectious diseases and monitoring of inflows with international exchanges through the Quarantine Act. Tuberculosis and HIV/AIDS, parasitic and other diseases are also administrated through special regulations. With respect to information technology, surveillance system networks utilizing a high-speed internet access environment were constructed in 1998. The KCDC provides data regarding infectious diseases and contributes to real-time information distribution to public health officers or through infectious disease websites (2007).

The government continuously prepares appropriate measures against outbreaks or epidemics of infectious diseases through personnel, education and training for practitioners at local governments (epidemiological investigation, FMTP, and on-the-job training), EIS officers and laboratory workers. Furthermore, the reporting rate, timeliness, completion and flexibility of the infectious disease system are continuously improved upon. Given these success factors, Korea is able to realize a purposeful and effective system.

Figure 5-1 | Success Factors in Korea's Infectious Disease Surveillance System



1.1.1. Changes in the Law Related to Infectious Diseases in Korea

Laws concerning the surveillance system of communicable diseases are primarily represented by the "Infectious Disease Control and Prevention Act" and "Quarantine Act."

a. Infectious Disease Control and Prevention Act (Prevention of Contagious Disease Act)

Korea's infectious disease surveillance system is based on the legal duty of notification and reporting infectious diseases as well as classification of communicable diseases. These obligations for notification and reporting have been implemented since 1954 and played an important role in Korea's infectious surveillance system. The administrative agency promulgated the "Cholera disease prevention rule," "Cholera disinfection rule," "Cholera disease prevention and disinfection rule" and other regulations (1895) from the end of the 19th century. The "Prevention of Infectious Diseases Rule (1899)," specified smallpox, typhoid fever, typhus, Cholera, shigellosis, diphtheria and other diseases, while the kinds of diseases were expanded from six to nine(1915). In 2000, the list of infectious diseases (from 82 to 75 species) and categories (from 5 to 6) was dramatically reorganized according to purpose in the control of infectious disease. Through this Act, infectious diseases were classified as follows: group I (immediate control measures needed, six diseases), group II (vaccine preventable diseases, nine diseases), group III (monitoring and public campaigns needed, 18 diseases), and designated infectious diseases (monitoring and surveillance

needed, nine diseases). In addition, through an introduction of the sentinel surveillance system, doctors became volunteers in the infectious disease surveillance system. A brief overview of the history of lawmaking in infectious diseases over time reveals a significant increase in the number of infectious diseases, as well as many changes in the features of the system, correlating with Korea's own economic growth.

Table 5-1 | Historical Changes in National Notifiable Infectious Diseases

Name	Year	Diseases	No.
Prevention of Contagious Disease Rule	1899	Smallpox, typhoid fever, typhus fever, Cholera, shigellosis, diphtheria	6
Prevention of Contagious Disease Decree	1915	Smallpox, typhoid fever, typhus fever, Cholera, shigellosis, diphtheria, paratyphoid fever, scarlet fever, plague	9
Prevention of Contagious Disease Act	1954 (1957)	1: Cholera, plague, epidemic typhus, murine typhus, typhoid fever, paratyphoid fever, smallpox, scarlet fever, diphtheria, dysentery (the bacterial and amoebic), relapsing fever, epidemic cerebrospinal meningitis, epidemic encephalitis (13) 2: Acute anterior poliomyelitis, pertussis, measles, mumps (4) 3: Tuberculosis, leprosy, sexual transmitted disease (3)	20
	1963	epidemic encephalitis (group 1 → 2), rabies, malaria (group 2)	22
	1976 (1977)	1: Cholera, plague, epidemic typhus, typhoid fever, paratyphoid fever, smallpox, diphtheria, shigellosis, yellow fever (9) 2: Polio, pertussis, measles, mumps, Japanese encephalitis, rabies, malaria, murine typhus, scarlet fever, relapsing fever, amebic dysentery, meningococcal meningitis, hemorrhagic fever with renal syndrome, tetanus (14) 3: Tuberculosis, sexually transmitted disease, leprosy (3)	26
	1993 (1994)	Addition of AIDS, leptospirosis, scrub typhus (group 2)	29
	1995	Addition of chronic Hepatitis B (group 3)	30
Prevention of Contagious Disease Act	2000	1: Cholera, Plague, typhoid fever, paratyphoid fever, shigellosis, enterohemorrhagic *Escherchia coli* infection (6) 2: Diphtheria, pertussis, tetanus, measles, mumps, rubella, polio, hepatitis B, Japanese encephalitis (9) 3: Malaria, tuberculosis, leprosy, sexual transmitted disease, scarlet fever, meningococcal meningitis, legionellosis, *Vibrio vulnificus* sepsis, epidemic typhus, murine typhus, scrub typhus, Leptospirosis, Brucellosis, anthrax, rabies, hemorrhagic fever with renal syndrome, influenza, AIDS (18)	54

Name	Year	Diseases	No.
Prevention of Contagious Disease Act	2000	4: Yellow fever, dengue fever, Marburg hemorrhagic fever, Ebola hemorrhagic fever, Lassa hemorrhagic fever, leishmaniasis, babesiasis, African sleeping sickness, cryptosporidium, schistosomiasis, Yaws, pinta, emerging infectious disease syndrome (13) Designated infectious diseases: hepatitis A, hepatitis C, vancomycin resistant *staphylococcus aureus* (VRSA) infection, Chagas disease, angiostrongylosis, Gnathostomiasis, filariasis, Hydatidosis (8)	54
	2002	Smallpox and botulism (group 4) Creutzfeldt-Jakob disease (CJD) and variant Creutzfeldt-Jakob disease (vCJD) (sentinel)	57
	2005	Chicken pox (group 2)	58
	2006	- Severe acute respiratory syndrome, avian influenza infection, tularemia, Q fever (group 4) - Laboratory surveillance (bacterial enteral infection disease 11, viral enteral infection disease 4, protozoal enteric infection disease 2)	62 (79)
	2008	West Nile fever (sentinel)	63 (80)
	2009	Hand-foot-and-mouth disease and enterovirus infection (sentinel)	63 (82)
Infectious Disease Control and Prevention Act	2009 (2010)	1: Cholera, typhoid fever, paratyphoid fever, shigellosis, enterohemorrhagic *Escherchia coli* infection, hepatitis A (6) 2: The diphtheria, pertussis, tetanus, measles, mumps, rubella, Polio, hepatitis B, Japanese encephalitis, chicken pox (10) 3: Malaria, tuberculosis, leprosy, scarlet fever, meningococcal meningitis, Legionellosis, *Vibrio vulnificus* sepsis, epidemic typhus, murine typhus, scrub typhus, Leptospirosis, Brucellosis, anthrax, rabies, hemorrhagic fever with renal syndrome, influenza, AIDS, syphilis, Creutzfeldt-Jakob disease (CJD) and variant Creutzfeldt-Jakob disease (vCJD)(19) 4: Plague, yellow fever, dengue fever, viral hemorrhagic fever, small pox, botulism, severe acute respiratory syndrome, avian influenza infection, H1N1 Influenza, tularemia, Q fever, West Nile fever, emerging infectious disease syndrome, Lyme borreliosis, tick-borne encephalitis, melioidosis, chikungunya heat (17)	75 (114)

Name	Year	Diseases	No.
Infectious Disease Control and Prevention Act	2009 (2010)	5: *Ascaris lumbricoides* infection, *Trichuris trichiura* infection, *Enterobius vermicularis* infection, Clonorchiasis, Paragonimiasis, Intestinal trematodas (6) Designated infectious diseases: hepatitis c, hand-foot-and-mouth disease, gonorrhea, Chlamydia, sexually transmitted disease, genitalia herpes simplex, condyloma acuminata, vancomycin resistance *staphylococcus aureus* (VRSA) infection, Vancomycin-Resistant Enterococci infection (VRE), methicillin-resistant *staphylococcus aureus* (MRSA) infection, Multidrug-Resistant *Pseudomonas aeruginosa* infection(MRPA), Multidrug-Resistant *Acinetobacter baumann* II infection(MRAB), Carbapenem-Resistant Enterobacteriaceae infection (CRE), Gastroentestinal infections, acute respiratory infection, Imported parasitic infections , enterovirus infection (17)	75 (114)
	2013	*Haemophilus B influenzae* Severe fever with thrombocytopenia syndrome (SFTS)	77 (115)

b. Quarantine Act

Infectious diseases for quarantine in Korea are designated in the "Quarantine Act." Through the announcement by the Ministry of Health and Welfare, the kinds of infectious diseases for quarantine has been modified. Now the 'Quarantine Act' includes such diseases as cholera, plague, yellow fever, severe acute respiratory syndrome, avian influenza infection in humans, H1N1 Influenza, emerging infectious disease syndrome, enterohemorrhagic *E.coli* infection and polio. Various activities for quarantine have allowed efficient control of infectious diseases. Now there are 13 quarantine stations (two international airports and 11 ports) and 10 quarantine branches (three airports, six ports and one land) in Korea. The number of airplanes and passengers (Koreans and foreigners) has increased astronomically compared to the first stage of quarantine (1950s). The KCDC was also established (2004) by integrating the quarantine services, enabling an even more efficient quarantine system.

1.2. Changes in Informational Networks for Infectious Diseases

The Project for developing the informational networks for infectious diseases began as an inter-departmental initiative related to the project of establishing the infrastructure for a high-speed communication network since 1995. The Korea National Institutes of Health (the KNIH expanded to the KCDC) developed an infectious disease reporting system and input laboratory results into the program, developed informational networks for infectious diseases in English, infectious disease database management and analysis programs, statistical information program, infectious disease GIS system, infectious disease statistics

management and analysis programs. Finally, a reporting system of infectious diseases based on the web and statistics programs was completed in 2007. This system made the dissemination of infectious disease information to the public more accurately and timely, benefiting all users.

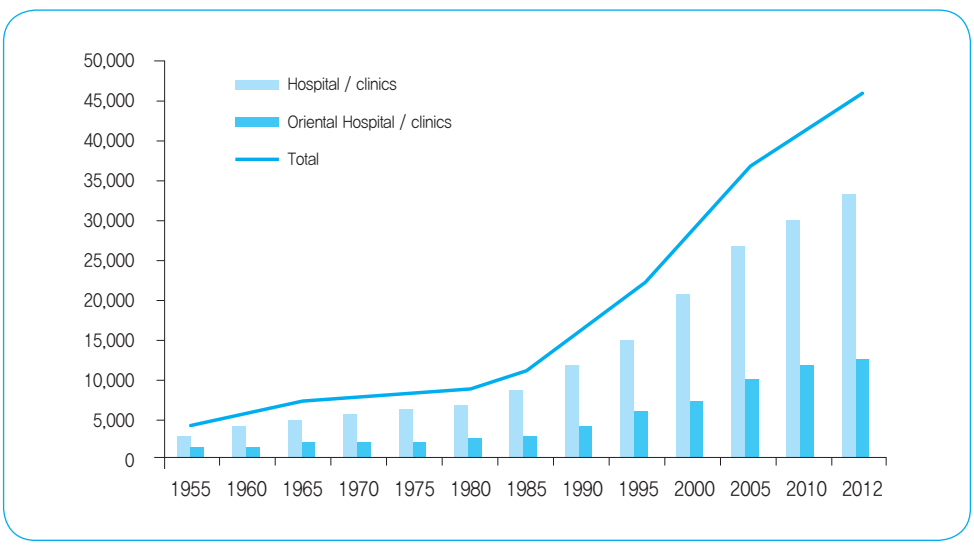
Table 5-2 | History of Informational Networks for Infectious Diseases

Year	Main Project Contents	Availability
1996	The infectious disease surveillance information system (first project) ○ Development of high-speed service system with the Ministry of Information and Communication initiated ○ Developing task analysis and input program of target organization ○ Beginning to build informational nation-wide networks for infectious diseases	National quarantine station (1) Public institute of health and environment (1) Public health centers (40) KCDC
1997	Infectious disease surveillance information system (second project) ○ Preparation period for developing a reporting program for infectious diseases, closing communication networks between the KNIH and cities and provinces, inputting program for examination, and assessing reporting rates	
1998	Infectious disease surveillance information system (third project) ○ Development of integration system of laboratory results in KNIH ○ Server expansion of informational networks for infectious disease ○ Establishment of English informational networks for infectious disease ○ Development of management program for patients infected with AIDS	Cities and provinces, and quarantine department of KNIH (16)
1999	The infectious disease surveillance information system (forth project) ○ Developing DB management and analysis programs of infectious diseases ○ Developing a statistical information program ○ Building the malaria database and an infectious disease GIS system ○ Expanding and upgrading the website	Public health centers (242)
2000	Infectious disease surveillance information system (fifth project) ○ Increasing number of diseases reported: 29 → 60 diseases ○ Sentinel surveillance system construction and EDI ○ Tbnet (tuberculosis) and HIV/STI surveillance system ○ Developing supporting programs in the Korean National Institutes of Health ○ Developing infectious disease statistics management and analysis programs	Public health centers (242) Sentinel institutions (2,000)
2007	Infectious disease web statistics ○ Accurate and rapid distribution of infectious disease information to the public ○ Promoting user benefits by servicing web statistics	

1.3. Quantitative Gorwth of Institutions in Notifying and Reporting Surveillance Systems

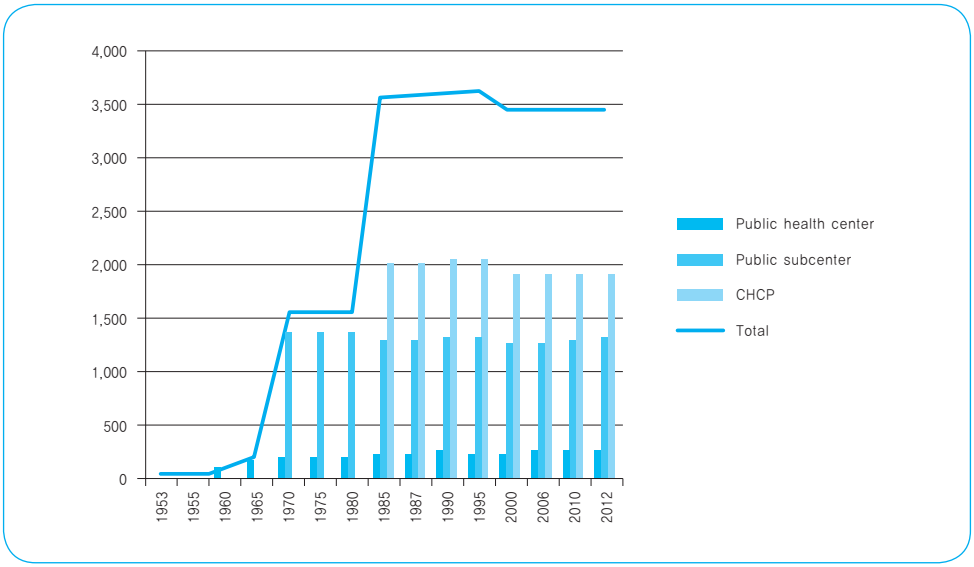
In the early stages of the implementation of the Prevention of Contagious Disease Act, the number of hospitals and clinics numbered 4,364, and the number of doctors and oriental doctors numbered 6,228 persons. Thereafter, the increase in manpower and facilities was accelerated by economic development. As recently as 2012, the number of hospitals and clinics totaled 45,929, and the number of doctors and oriental doctors totaled 127,963 persons. The number of institutes and persons notifying the government of infectious diseases increased by 10 times and 20 times, respectively, compared to 1950s. The number of public institutions (public health centers) reporting diseases to the KCDC was 15 in 1953. Since 1962, public institutions have increased continuously, and the number of public institutions totaled 254 places in 2012. With increasing public health centers, public sub-centers (1970s) and primary health care posts (1980s), medical care institutions monitoring infectious diseases became widely established, making Korea's infectious surveillance systems more nationally comprehensive.[32]

Figure 5-2 | Number of Medical Institutions by Year



32. Ministry of Health and Welfare. Health and welfare statistical year book.1953~2013.

Figure 5-3 | Number of Public Health Institutions by Year



1.4. Introduction of the Sentinel surveillance System for Infectious Disease

Korea's sentinel surveillance system was introduced in 2000 based on the revised "Prevention of Contagious Diseases Act," and had significant meaning for Korea's disease reporting systems in both an active and passive way – that is, through the voluntary reporting of diseases by doctors. The influenza sentinel surveillance system was first implemented for 70 medical facilities in 1997. Now, infectious diseases for sentinel surveillance include viral hepatitis (A, B and C type), influenza, sexually transmitted disease (syphilis, gonorrhea, chlamydial infection, non-gonococcal urethritis, chancroid, genitalia herpes simplex and condyloma acuminatum), vancomycin-resistant staphylococcus aureus (VRSA) infection, imported infectious diseases (Chagas disease, angiostrongylosis cantonensis, Gnathostomiasis, filariasis and echinococcosis), Creutzfeldt-Jakob disease, West Nile virus and hand-foot-and-mouth disease, and other diseases.

Table 5-3 | Infectious Diseases for the Sentinel Surveillance System

Year	Diseases
2000	1. Hepatitis type B 2. Sexual transmitted diseases and influenza 3. Designated infectious diseases: viral hepatitis A and C, vancomycin resistant *Staphylococcus aureus* (VRSA) infection, Chagas disease, *angiostrongylosis cantonensis*, Gnathostomiasis, filariasis, echinococcosis, Creutzfeldt-Jakob disease(CJD) and variant CJD(vCJD), West Nile virus disease and hand-foot-and-mouth disease (11 diseases), sentinel diseases with pathogenic monitoring (infectious diseases by enteric bacteria 11, infectious diseases by enteric virus 4, infectious diseases by enteric protozoa 2 and enterovirus infection, total 18 diseases)
2010	1. Influenza 2. Designated infectious diseases: viral hepatitis C, hand-foot-and-mouth disease, gonorrhea, chlamydia, chancroid, genitalia herpes simplex, condyloma acuminata, vancomycin-resistant *Staphylococcus aureus* (VRSA) infection, vancomycin-resistant *E. coli* (VRE) infection, methicillin-resistant *Staphylococcus aureus* (MRSA) infection, multi-resistant *Pseudomonas aeruginosa* (MRPA) infection, multi-resistant *acinetobacter baumannii* (MRAB) infection, carbapenem-resistant Enterobacteriaceae (CRE) infection, enteric infection disease, acute respiratory infection, imported parasitic infections and enterovirus infection (17 diseases) 3. Group V: ascariasis, trichuriasis, oxyuriasis, clonorchiosis, paragonimiasis, and intestinal trematodiases (6 diseases)

Complementary sentinel surveillance systems performed school-based monitoring of infectious diseases in 2003, and ophthalmologic infectious diseases and pediatric infectious diseases were reported by volunteers in 2001.

Table 5-4 | Infectious Diseases for Voluntary Sentinel Surveillance Systems

Sentinel Surveillance (2012)	Diseases	Data Collection	Reporting Period	Year
Pediatric infectious diseases (182)	Measles, mumps, rubella, chicken pox, aseptic meningitis (5 kinds)	Pediatric physicians	weekly	2001
School based infectious diseases (409)	Absents by common cold/influenza, chicken pox, conjunctivitis, meningitis, mumps, pneumonia and measles, No. of students visiting infirmary with a cold symptoms (7 kinds)	Health teachers of sentinel schools	weekly	1997
Ophthalmologic infectious diseases (62)	Acute hemorrhagic conjunctivitis, epidemic keratoconjunctivitis (2 kinds)	Ophthalmologic physicians	weekly	2003

1.5. Expanding Dissemination of Infectious Disease Surveillance Data

Statistics on the outbreaks and epidemics of national notifiable infectious diseases were officially recognized by the National Statistical Office (NSO) based on the "Prevention of Contagious Diseases Act" in 1975. Up to the year 2000, statistics for infectious diseases were disseminated in an annual year book of the Statistics of Health and Social Affairs. Since 2000, an annual report on infectious disease surveillance has also been published. This statistics are disseminated through the CDWR (Communicable Diseases Weekly Report), CDMR (Communicable Diseases Monthly Report), and "Public Health Weekly Report (PHWR)". Additionally, statistics for sentinel surveillance systems are disseminated through weekly newsletters (influenza, pediatric infectious disease, ophthalmologic infectious diseases, school based infectious disease, etc.) and annual result reports.

Table 5-5 | Dissemination in Infectious Disease Surveillance System

Statistics	Year	Contents
Statistical yearbook of Japanese Government-General of Korea	~1943	http://kosis.kr/
Statistical yearbook of Korea	1944~1954	
The health statistical year book	1955	
The health society statistical year book	1956~1994	· Statistics of legal infectious diseases (since 1975)
Health & welfare statistical year book	1995~2012	
Infectious diseases surveillance year book	2001~	· Ministry of Health and Social Affairs year book, acute infectious disease statistics year book (before Aug, 2000) · White paper of diseases control (2004~) · Communicable Diseases Weekly (Monthly) Report (2001~2008) · Public Health Weekly Report (2008~) - Influenza, weekly sentinel surveillance report (2008~) - Pediatric infectious diseases, weekly (annually) sentinel surveillance report (2001~) - Ophthalmologic infectious diseases, weekly (annually) sentinel surveillance report (2003~) - School based infectious diseases, Weekly (Half-yearly, annually) sentinel surveillance report (2001~)

2. Infectious Disease Surveillance System: Limitations and Successes

Problems like a low reporting rate, equitable representation, inconsistent reporting standards or case definitions, and the time interval between diagnosis and reporting of the event have generally been weaknesses in the surveillance system.

In the case of low reporting rates, factors affecting this issue include low recognition of penalties, inaccurate diagnosis and standard criteria of reporting, and laborious administrative processes. In any kind of surveillance system, enhancing the reporting rate is always one of the top priorities.

The duty of reporting infectious diseases is legally obligated since the implementation of the "Prevention of Contagious Diseases Act" (1954). But the reporting rate in early 1970 was only around 10%. The rate did not improve until 2000. To improve the reporting rate, the KCDC has cooperated with the Korean Medical Association since 2001, and education and public relations efforts for doctors were intensified. In 2007, cooperation with the Association of Korean Medicine (Oriental Medicine) was initiated, using activities to educate and promote awareness of the reporting system. The reporting rate has since increased continuously.

With regard to dissemination to encourage analysis and utilization of the information from infectious disease surveillance, the information is produced in weekly, monthly and annual reports. But utilization of the information was not high until recently when the planning aspect of infectious disease control began to receive more attention at the local government level. In the past, an infectious disease was not reported until it was clearly diagnosed after manifestation, and this process usually required more than two months, making efficient management of infectious disease nearly impossible. However, while recent standard criteria for notifying and reporting diseases have been continuously developed, more suspected cases have been reported, and the timeliness of the reporting of the infectious disease has improved.

Comparisons in classification of infectious diseases have often been made between from mandatory and sentinel surveillance systems. For those of relatively high incidence rate, the sentinel surveillance system may be better than the mandatory system. In this respect, since developing countries have insufficient standards for disease notification and reporting, symptom-based reporting and voluntary monitoring networks would be considered as the pre-surveillance stage.

3. Comparison with Other Countries

3.1. Infectious Disease Surveillance System

The management of infectious diseases in the U.S. is controlled by the CDC (Center for Disease Control and Prevention), which is generally in charge of the Office of Infectious Diseases (OID). The OID is composed of the National Center for Immunization and Respiratory Diseases (NCRID), National Center for Emerging and Zoonotic Infectious Diseases (NCEZID), and National Center for HIV/AIDS, Viral Hepatitis, STD and TB Prevention (NCHHSTP). And the Office of Public Health Preparedness and Response (OPHPR) also cooperates with departments related to infectious disease management, state governments and local governments when a crisis including biological terrorism occurs. Particularly, the NCHHSTP of the CDC was established with the purpose of integrating AIDS, sexual transmitted diseases, and tuberculosis in 1994, adding viral hepatitis in 2006. The NCHHSTP deals with such diseases related to population, minority groups, homosexual communities, drug users, and other at risk populations. Populations with similar features and sharing certain social behavioral factors can serve as a basis for an integrated system. The NCHHSTP published its Strategic Plan 2010~2015 in 2010, setting a vision for prevention management and a purpose for the CDC concerning AIDS, venereal diseases, tuberculosis and viral hepatitis. The plan also put forth recommendations for conducting plans and assessments – representing the kind of momentum needed for improvements. In the guidelines of each division, the NCHHSTP Strategic Plan 2010~2015 proposed planning public health projects, treating and diagnosing patients, examining laboratories, counseling and preventing diseases, as well as other areas of addressing communicable diseases.

The number of infectious diseases for surveillance is similar to that of Japan, but the number is more than that of the U.K., and less than the U.S. The surveillance system of the U.S. includes chronic diseases, intoxication and injury cases. In the U.K., though the number of diseases is lower, many diseases are reported through the laboratory surveillance system.[33]

When reporting a disease (for example, tick-borne encephalitis), Korea uses groups to promote simpler surveillance of disease in Korea. This can be helpful in improving the timeliness of reporting, but the cooperation of doctors can still be a challenge.

As for the notification duty, the disease reported by the local government is not obligatory; and such are voluntarily notified to the CDC. Since infectious diseases in the surveillance system are not classified by severity, the system is unable to be efficient in the prevention of

33. Lee JY, Development of the guideline for infectious diseases management in Korea *funded by KCDC*, 2011.

epidemics based on severity. With respect to timeliness and accuracy, the reporting time of infectious diseases is uncertain in Korea. In the case of the U.S., severe cases are reported within 4 hours. The U.K. operates a lab surveillance system efficiently, and the country has in place a 24-hour reporting process for severe diseases.

Table 5-6 | Summary of the Sentinel Surveillance Systems for Japan, U.S. and U.K.

	Japan[34]	U.S.[35]	England[36]
Administrator	Infectious Disease Surveillance Center, IDSC	Centers for Disease Control and Prevention (Department of Health and Human Services)	Public Health England (PHE), Centre for Infections
Surveillance System	National Epidemiological Surveillance for Infectious Disease (NESID)	National Notifiable Diseases Surveillance System (NNDSS)	Notifications of infectious diseases (NOIDs) and sentinel reporting framework
Data Collection	■ Local public health centers ■ Prefectural public health institutes ■ Prefectural IDSC ■ National IDSC	■ Territorial health departments ■ State health departments ■ Centers for Disease Control and Prevention	■ Local Authority ■ Local Health Protection Unit ■ Centre for Infections
Data Source	■ Physician offices ■ Hospitals ■ Laboratory reports ■ Day-care clinics ■ Schools, etc.	■ Physician offices/hospitals ■ Health maintenance organizations ■ Blood transfusion centers/ banks ■ Health care organizations ■ Veterinarians ■ Health care practitioners ■ Laboratory departments ■ Schools/Prisons/reform schools ■ Dentist offices ■ Nursing care facilities ■ Medicolegal ■ Registration of vital statistics ■ Day-care clinics, etc.	■ Notifiable diseases ■ Laboratory reports ■ Clinician reporting ■ NHS Direct, etc.
Reporter	Doctors, laboratories, sentinels	Doctors, laboratories	Doctors, laboratories, sentinels
Reporting Method	Nationwide electronic surveillance system	National Electronic Disease Surveillance System (NEDSS) ELR	LabLink

34. Taniguchi K, Hashimoto S, Kawado M, Murakami Y, Izumida M, Ohta A, Tada Y, Shigematsu M, Yasui Y, Nagai M. J. Overview of infectious disease surveillance system in Japan, 1999-2005. Epidemiol 2007;17:S3-13.

35. Centers for Disease Control and Prevention. Protocol for Public Health Agencies to Notify CDC about the Occurrence of Nationally Notifiable Conditions, 2013.

36. Public Health England. Surveillance outputs [cited 2014 Jan 10]. Available from: http://www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/Surveillance/SurveillanceOutputs/.

	Japan[34]	U.S.[35]	England[36]
Dissemination	IDWR (Infectious Diseases Weekly Report), IASR (Infectious Agents Surveillance Report), SeroEpi (National Surveillance of Vaccine-preventable Diseases), etc.	Morbidity and Mortality Weekly Report (MMWR), etc.	Health Protection Report (HPR), etc.
Characteristics	■ Similarly with Korean surveillance system ■ Notifiable diseases and sentinel diseases ■ Laboratory surveillance system	■ Dual system: reportable disease, notifiable disease ■ Reportable: duty to report, different among states ■ Notifiable disease: voluntary notification, list of diseases are different among states ■ Nationally notifiable diseases are not the same as reportable diseases ■ Considered intentional release	■ Operated independently between surveillance systems by doctors and laboratory surveillance systems ■ Duty to report pathogens in any lab ■ Report suspected cases by doctors, confirmed pathogen by lab
Timeliness	■ Group I-IV: immediately reporting ■ Group V and sentinels: within 1 week	■ Within 4 hours: "Immediate, extremely urgent" ■ Immediate, urgent: within 24 hours ■ Standard: next reporting cycle	■ Not listed as reporting time ■ Within 24 hours or within 3 days
Notifiable Diseases and Other Characteristics	■ Sentinel diseases were Influenza, pediatric disease, eye disease, sexually transmitted disease etc, which were milder diseases and targeted disease ■ Voluntary surveillance system to Avian influenza will perform by online system ■ Antibiotic-resistant bacterial infection monitoring by sentinel system	■ Anthrax, botulism, plaque, paralytic poliomyelitis, SARS-associated coronavirus, smallpox, tularemia, viral hemorrhagic fever: reporting within 4 hours ■ If anthrax, botulism, plaque, tularemia, viral hemorrhagic fever were doubtful for infection naturally, you may be reporting in another time. ■ In case of non-paralytic type, polio must be reported within 24 hours ■ Natural anthrax, viral hemorrhagic fever, brucellosis, diphtheria, novel influenza A, measles, rubella, rabies, yellow fever: reporting within a day	■ Simplified such as Acute encephalitis, Acute meningitis, Food poisoning etc. by doctors ■ Easy to quick response ■ Pneumonia: lab. surveillance system ■ Collection of self-reported illness

3.2. Guidelines for Management of Infectious Diseases

Summary of guidelines for management of infectious diseases in the U.S., Japan and U.K. is as follows:[37]

Table 5-7 | Summary of Guidelines for Management of Water and Food-borne Infectious Diseases in Korea, Japan, U.S. and U.K.

Disease	Korea	Japan	USA	UK
Cholera	Isolation: Yes Releasing isolation: 2 consecutive negative faecal cultures, taken at least 24 hours apart, commencing at least 48 h after cessation of antibiotic therapy Restricted workers: food handlers, health care workers etc.	Isolation: No Restricted workers: food handlers, health care workers, etc. Releasing isolation: 2 consecutive negative faecal cultures, taken at least 24 hours apart, commencing at least 48 h after cessation of antibiotic therapy Releasing isolation in asymptomatic carrier: 2 consecutive negative faecal cultures	Admission: if severe cases Use Contact Precautions Releasing isolation: No	Isolation: Yes Releasing isolation: isolating 48 h after cessation of diarrhea, if needed, 2 consecutive negative faecal cultures, taken at least 24 hours apart
Typhoid Fever	Isolation: Yes Releasing isolation: 3 consecutive negative faecal cultures, taken at least 24 hours apart, commencing at least 48 h after cessation of antibiotic therapy Restricted workers: food handlers, health care workers etc.	Isolation: No Restricted workers: food handlers, health care workers etc. Releasing isolation: 3 consecutive negative faecal cultures, taken at least 24 hours apart, commencing at least 48 h after cessation of antibiotic therapy, after 1 month from symptoms arise Releasing isolation in asymptomatic carrier: 3 consecutive negative faecal cultures	Admission: if acute stage Use Contact Precautions F/U: 3 consecutive negative faecal cultures, taken at least 24 hours apart, commencing at least 48 h after cessation of antibiotic therapy, after 1 month from symptoms arise If positive, 3 consecutive negative faecal cultures, taken at least 1 month apart Contacts tracing: if food handler, 2 consecutive negative faecal cultures	Isolation: Yes Releasing isolation: group A-D patients, carriers, contacts 3 weeks after cessation of treatment 3 consecutive negative 3 times (group A, B, D), group C, 6 times consecutive negative faecal cultures 2 consecutive negative faecal cultures, taken at least 48 hours apart

37. Lee, Jin Young. "Development of Guideline for Infectious Disease Management in Korea." Ed. Prevention, Korea Centers for Disease Control and. Republic of Korea: Korea Centers for Disease Control and Prevention, 2011. Print. cited from Kim, Yui Suk. "Period of Group I Patients' Isolation and Analysis the related factors", 2010.

Disease	Korea	Japan	USA	UK
Shigellosis	Isolation: Yes Releasing isolation: 2 consecutive negative faecal cultures, taken at least 24 hours apart, commencing at least 48 h after cessation of antibiotic therapy Restricted workers: food handlers, health care workers, etc.	Isolation: No Restricted workers: food handlers, health care workers etc. Releasing isolation: 2 consecutive negative faecal cultures, taken at least 24 hours apart, commencing at least 48 h after cessation of antibiotic therapy Releasing isolation in asymptomatic carrier: 2 consecutive negative faecal cultures	Admission: if acute stage Use Contact Precautions Restricted workers: food handlers, health care workers etc. Releasing isolation: 2 consecutive negative faecal cultures, taken at least 24 hours apart, commencing at least 48 h after cessation of antibiotic therapy Contacts tracing: food handlers, health care workers, etc.	Isolation: Yes Releasing isolation: - S.sonnei: after 48 hours from cessation of diarrhea - S.dysenteriae, S.flexneri, S.boydii group A-D, contacts: 2 consecutive negative faecal cultures, taken at least 48 hours apart
Enterohemorrhagic Escherchia coli Infection	Isolation: Yes Releasing isolation: 2 consecutive negative faecal cultures, taken at least 24 hours apart, commencing at least 48 h after cessation of antibiotic therapy Restricted workers: food handlers, health care workers, etc.	Isolation: No Restricted workers: food handlers, health care workers etc. Releasing isolation: 2 consecutive negative faecal cultures, taken at least 24 hours apart, commencing at least 48 h after cessation of antibiotic therapy Releasing isolation in asymptomatic carrier: 1 consecutive negative faecal cultures	Admission: if acute stage Use Contact Precautions Restriction works: food handlers, health care workers etc. Releasing isolation: 2 consecutive negative faecal cultures, taken at least 24 hours apart, commencing at least 48 h after cessation of antibiotic therapy Contacts tracing: food handlers, health care workers, etc.	Isolation: Yes Releasing isolation: - group A-D: 2 consecutive negative faecal cultures, taken at least 48 hours apart - not high risk: until cessation of diarrhea

2013 Modularization of Korea's Development Experience
Establishment of Korea's Infectious Disease Surveillance System

Chapter 6

Implications for Developing Countries

1. Setting a Direction for an Infectious Disease Surveillance System in Developing Countries
2. Implications of Korea's Development Experiences

Implications for Developing Countries

1. Setting a Direction for an Infectious Disease Surveillance System in Developing Countries

1.1. International Health Regulations 2005

The reemerging infectious diseases noted in the early 1990s showed the limitations of IHR 1969. The IHR 1969 only applied to the traditionally "quarantinable" diseases of cholera, plague, and yellow fever after smallpox was eradicated. In addition, the IHR 1969 restricted surveillance of information provided by governments, lacked mechanisms to assess and investigate public health threats swiftly, contained no strategy to build up surveillance capacity and infrastructure, and failed to generate the participation of WHO member states.[38]

In response to these limitations of IHR 1969, 194 nations have agreed to implement the International Health Regulations (IHR) 2005. These binding instruments of international law entered into force on 15 June 2007.[39]

IHR 2005 expands the scope of the regulations' application, strengthens the WHO's authority in surveillance and response, contains more surveillance and response obligations of member states and the WHO, and applies human rights principles to public health interventions. Major changes in the details include the following: 1) to make it mandatory to notify the WHO of any health-related events which may be considered public health

38. Baker, Michael G., and David P. Fidler. "Global public health surveillance under new international health regulations." Emerging infectious diseases 12.7 (2006): 1058.

39. World Health Organization. "International health regulations (2005)." 2008.

emergencies of international concern, 2) to mandate that States Parties establish national IHR focal points and responsible authorities, 3) to allow the WHO to recommend and respond to public health risks even if the concerned State Parties do not desire collaboration, and 4) to state clearly that each State Party shall develop, strengthen and maintain the capacity to detect, assess, notify and report events. In terms of surveillance, these changes have very significant implications since the IHR 2005 is considered a new concept of surveillance that surpasses the contents of the IHR 1969.

Table 6-1 | Comparing the IHR 1969 and 2005

Area of focus	IHR 1969	IHR 2005
Type of threats	Specific infectious diseases	Any public health emergency of international concern (biological, radiological/nuclear, or other)
Obligation of responsible authorities and focal point	-	Mandates that States Parties establish national IHR focal points and responsible authorities
Response condition of WHO	Can respond with the consent and request of the government concerned	Possible to recommend and respond to public health risks even if the concerned State Parties do not desire collaboration
Focus of activities	Control disease outbreaks at ports and borders without hampering trade and travel	Detect, report, and contain any public health threats at ports, borders, and anywhere threats might occur within national borders to prevent international proliferation, while minimizing the impact on trade and travel
Risk assessment	Short list of diseases of historical significance (cholera, plague, yellow fever)	Decision instrument to evaluate the risks and potential impacts of the public health event, prompting notification to the WHO, where an emergency committee of experts evaluates risk

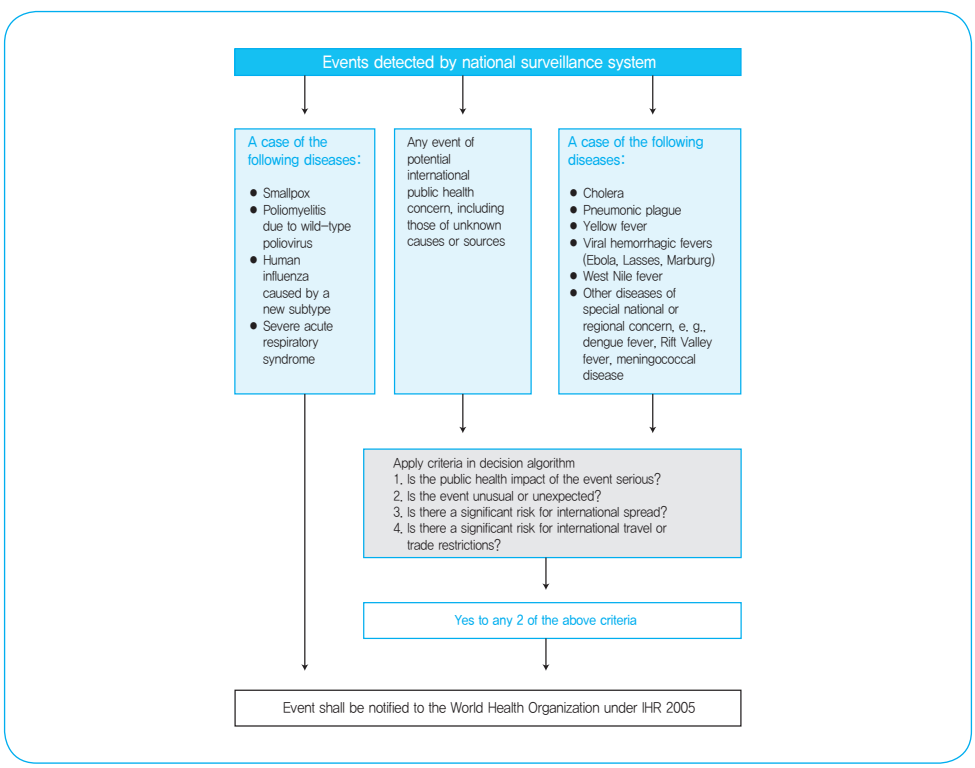
Modified from: Katzi, Rebecca, and Anna Muldoonii. "Negotiating the Revised International Health Regulations (IHR)." Rosskam and Kickbusch (2012) (2012): 77~99.

The purpose of IHR 2005 is "to prevent, protect against, control and provide a public health response to the international spread of disease in ways that are commensurate with and restricted to public health risks, and which avoid unnecessary interference with international traffic and trade". The purpose of the IHR (2005) is to focus on effectively responding to the threats of international communicable diseases. This is why the IHR (2005) requires all member states to develop, strengthen, and maintain core surveillance capacities (article 5.1).

The IHR (2005) demands that each member state report any health-related events, which may be considered public health emergencies of international concern (PHEIC) according to defined criteria, to the WHO. The scope of the events is not limited to specific diseases or manners of transmission, but covers "illness or medical condition, irrespective of origin of source, that presents or could present significant harm to humans."

There are three IHR 2005 reporting standards. First, the IHR 2005 includes a list of diseases for which a single case may constitute a PHEIC and must be reported to the WHO immediately. Second, the IHR 2005 contains a "decision instrument" (annex 2) that helps state parties to identify whether a health-related event may constitute a PHEIC or not and, therefore, requires formal notification to the WHO. The decision instrument focuses on the risk assessment criteria of public health importance including the seriousness of the public health impact and the likelihood of international proliferation. Finally, the IHR 2005 encourages state parties to consult with the WHO over events that do not meet the criteria for formal notification but may still be of public health relevance (article 8).

Figure 6-1 | IHR 2005 Decision Instrument (Simplified from Annex 2 of IHR)

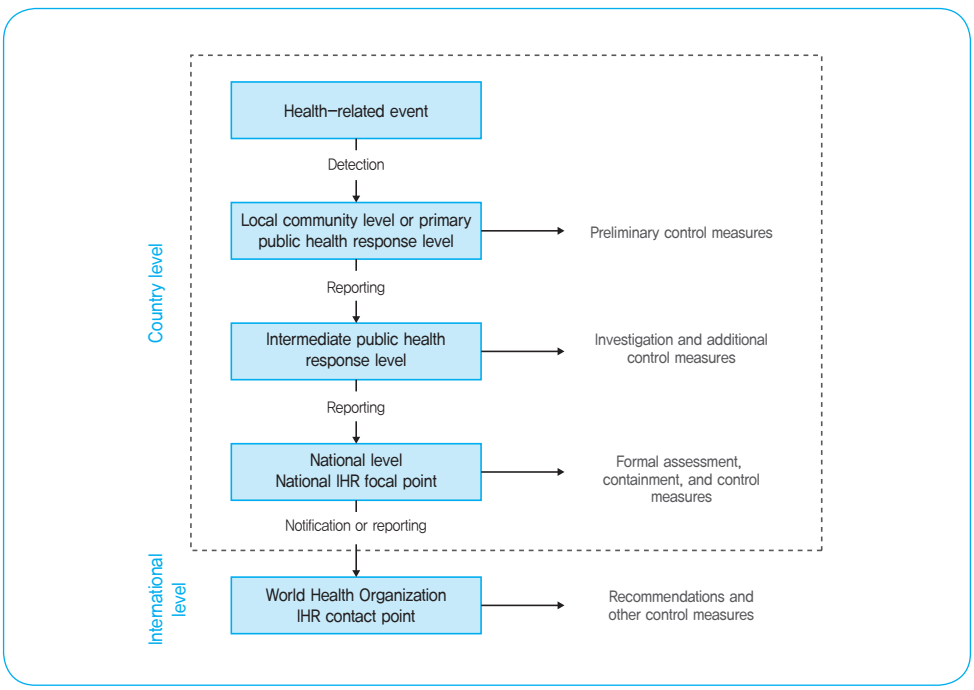


Source: Baker, Michael G., and David P. Fidler. "Global public health surveillance under new international health regulations." Emerging infectious diseases 12.7 (2006): 1058.

The IHR 2005's expansion of the range of reportable public health events under surveillance and its use of risk assessment criteria is possibly the most important surveillance advancement in the IHR 2005. This change greatly enhances effective surveillance of emerging infectious diseases, which are "infections that have newly appeared in a population or have existed but are rapidly increasing in incidence or geographic range".[40]

The IHR 2005 describes key aspects of the surveillance processes from the local to the global level. Core surveillance capacity requirements of the IHR 2005 demand that each state party develop and maintain capabilities to detect, assess, and report disease events at the local, immediate, and national levels (article 5.1, annex 1). The regulations mandate that the WHO establish focal points and WHO IHR contact points (article 4.3). Officials at the national level must be able to report through the national IHR focal point to the WHO when required under the IHR 2005 (article 4.2 and 6).

Figure 6-2 | Public Health Surveillance Structure and Processes Specified in IHR 2005



Source: Baker, Michael G., and David P. Fidler. "Global public health surveillance under new international health regulations." Emerging infectious diseases 12.7 (2006): 1058.

40. Morse, Stephen S. "Factors in the emergence of infectious diseases." Emerging infectious diseases 1.1 (1995): 7.

Establishing efficient global public health surveillance is at the heart of the IHR 2005. The IHR 2005 prescribes essential elements of a surveillance system and seeks to achieve the critical features of usefulness, sensitivity, timeliness, and stability. These features with other aspects of the IHR 2005 show the IHR 2005's potential for critical development for global health governance.

1.2. Integrated Disease Surveillance and Response[41]

In response to the emergence of severe outbreaks of largely preventable diseases in African countries during the 1990s, the 46 Member States of the WHO African Regional Office for Africa (WHO/AFRO) met in Zimbabwe in 1998 to adopt the Integrated Disease Surveillance and Response (IDSR) as a comprehensive regional framework for strengthening national public health surveillance and response systems in Africa. In 2006, the WHO/AFRO Member States recommended that the International Health Regulations (IHR 2005) be implemented using the IDSR framework, especially for strengthening core capacities for surveillance and response. Since 1998, when the Member States in AFRO adopted the IDSR strategy, the Centers for Disease Control and Prevention (CDC) has played a leading role in designing, developing, implementing, monitoring and evaluating the IDSR. With funding from USAID, the CDC's IDSR team led the development of the IDSR framework and the design and development of the Technical Guidelines for Integrated Disease Surveillance and the IDSR Training Modules.[42] This integrated strategy and concept is also adopted in non-African countries as an Integrated Disease Surveillance Project (IDSP).

Surveillance systems form the backbone of a health care system and provide an essential indicator for service provision performance.[43] For successful implementation of disease control and prevention programs, adequate resources must be dedicated to detecting a targeted disease, obtaining laboratory confirmation of the disease, and using thresholds to initiate action at the district level.

Traditionally, in most low- and middle-income countries, surveillance was interpreted and implemented as a vertical, single-disease surveillance activity. To date, several challenges have been identified with vertical surveillance strategies. The main drawback is that most vertical programs are designed to merely provide data to central levels with little or no coordination between those collecting it and those analyzing the data and those using it for

41. Centers for Disease Control and Prevention. "IDSR Technical guidelines" 2nd ed. 2010.

42. Centers for Disease Control and Prevention. "What Is Integrated Disease Surveillance and Response (IDSR)?" Centers for Disease Control and Prevention. Jan. 2012. Web. 10. Jan. 2014.

43. Phalkey, Revati K., et al. "Challenges with the implementation of an Integrated Disease Surveillance and Response (IDSR) system: systematic review of the lessons learned." Health policy and planning (2013): 1~13.

decision making.[44] There is also a general lack of resources, coupled with non-prioritization of surveillance in terms of budget allocation.[45]

Accordingly, the World Health Organization (WHO) Regional Office for Africa (AFRO) proposed an Integrated Disease Surveillance Response (IDSR) approach for improving public health surveillance and response in the African Region linking the community, health facility, district, and national levels. The IDSR seeks rational use of resources by integrating and streamlining common surveillance activities. Surveillance activities for different diseases share similar functions (detection, reporting, analysis, interpretation, feedback, and action), and often use the same structures, processes, and personnel.

The IDSR takes into account the *One World-One Health* perspective, which is a strategy that addresses events at the intersection of human, domestic animal, wildlife, and ecosystem health. Surveillance systems need to address not only humans but also the surrounding environment because 75% of recently emerging and re-emerging infectious diseases such as HIV/AIDS and avian influenza are of animal origin.

IDSR coordinates and streamlines all surveillance activities. Rather than using scarce resources to maintain separate vertical activities, resources are managed in integrated ways to collect information from a single focal point at each level.

Several surveillance activities are combined into one integrated activity and take advantage of similar surveillance functions, skills, resources, and target populations. For example, surveillance activities for acute flaccid paralysis (AFP) could be utilized for surveillance for neonatal tetanus, measles, and other diseases or unusual events. Thus, health workers who routinely visit health facilities to supervise AFP cases should also review district and health facility records for information about other priority diseases in the area.

The district level is the focus of integrated surveillance functions. This is why the district level is the first level in the health system with staff dedicated to all aspects of public health such as monitoring health events in the community, mobilizing community action, encouraging national assistance and accessing regional resources to protect the district's health. Surveillance focal points at the city, provincial and national levels collaborate with epidemic response committees at each level to plan relevant public health response actions and actively seek opportunities for combining resources. The focus is on the creation of an overall public health surveillance system with sufficient capacity for detecting, confirming and responding to communicable and non-communicable disease threats.

44. Franco, L. M., J. Setzer, and K. Banke. "Improving performance of IDSR at district and facility levels: experiences in Tanzania and Ghana in making IDSR operational." (2006).

45. Lukwago, Luswa, et al. "The implementation of Integrated Disease Surveillance and Response in Uganda: a review of progress and challenges between 2001 and 2007." Health policy and planning 28.1 (2013): 30~40.

Integration refers to harmonizing different methods, software, data collection forms, standards and case definitions in order to prevent inconsistent information and maximize efforts among all disease prevention and control programs and stakeholders. Where possible, countries use a common reporting form, a single data entry system for multiple diseases, and common communication channels. Training and supervision are also integrated, a common feedback system is used, and other resources such as computers and vehicles are shared.

Coordination refers to working or acting together effectively for the rational and efficient use of available but limited resources such as Health Management Information System (HMIS) and various disease programs. Coordination involves information sharing, joint planning, monitoring and evaluation in order to provide accurate, consistent and relevant data and information to policy-makers and stakeholders at the regional, inter-country and national levels. To facilitate coordination and collaboration, a national, provincial and district multi-sectoral, multidisciplinary co-ordination body or committee is constituted. It is responsible for coordination of surveillance activities in close collaboration or synergy with the committee set up for an epidemic response.

A matrix describes a complete system in which all the skills and activities are in place. Each level supports activities at other levels and reinforces the opportunity for successful decision-making at corresponding levels and functions. In an IDSR system under development, the matrix provides a systematic framework for improving and strengthening the system.

Moreover, the matrix illustrates several key assumptions about surveillance systems. If one or more of the elements at each level is not present or is being performed poorly, the risk of failure increases for achieving surveillance and control objectives. An effective system will be supported at each level from the levels above and below. A complete system minimizes any delay in taking public health actions. The functions of detection, analysis, investigation, response, feedback and evaluation are interdependent and should always be linked.

Figure 6-3 | IDSR Core Functions and Activities by Health System Level

WORLD HEALTH ORGANIZATION Regional Office for Africa

DRAFT | August 2010

IDSR CORE FUNCTIONS AND ACTIVITIES BY HEALTH SYSTEM LEVEL

	Identify	Report	Analyze and Interpret	Investigate and Confirm	Respond	Communicate (Feedback)	Evaluate	PREPARE
Community	•Use simple case definitions to identify priority diseases, events, conditions or other hazards in the community	•Report essential information on priority diseases, events, conditions, or hazards to health facility and appropriate authorities	•Involve local leaders in observing, describing and interpreting disease patterns, events and trends in the community •Undertake verbal autopsies on causes of deaths	•Support event investigation activities	•Assist local authorities in selecting response activities •Ensure community seeks care immediately in case of emergency and danger signs of disease, events and conditions •Participate in response activities including home based care •Mobilize resources appropriate for the activity •Carry out community health education for behavior change	•Give feedback to community members about reported cases,events and prevention activities	•Verify if public health interventions took place as planned •Verify the community response to the public health action	•Participate in disaster or emergency preparedness and managment committees •Participate in risk mapping of potential hazards •Conduct community based surveillance •Manage eventual contingency emergency stock •Participate in training including simulation exercise
Health Facility	•Use standard case definitions to detect, confirm and record priority diseases or conditions •Collect and transport specimens for laboratory confirmation •Use local laboratory capacity to confirm cases or to initiate confirmation of cases if possible	•Report case-based information for immediately notifiable diseases •Report summary data to next level •Report laboratory results from screening of sentinel populations •Report laboratory results to next level	•Prepare and periodically update graphs, tables, and charts to describe time, person and place for reported diseases and conditions •From the analysis, report immediately any disease or condition that: (1) exceeds an action threshold (2) occurs in locations where it was previously absent (3) presents unusual trends or patterns. •Interpret results. Initiate possible public health actions with local authorities	•Take part in investigation of reported outbreaks •Collect, package, store and transport specimens for laboratory confirmation	•Manage cases and contacts according to standard case management guidelines •Take relevant additional control measures	•Communicate with community members about outcome of reported cases and prevention activities	•Assess community participation •Conduct self assessment on the surveillance and response activities •Monitor and evaluate programme targets and indicators for measuring quality of the surveillance system •Monitor and evaluate programme timeliness and completeness of reporting from health facilities in the district •Monitor and evaluate timeliness of response to outbreaks •Monitor and evaluate prevention activities and modify them as needed	•Participate in disaster or emergency preparedness and managment committees •Participate in Rapid Response training •Conduct risk mapping of potental hazards •Conduct training of community •Participate in simulation exercises
District, State, Province	•Collect surveillance data from reporting sites including designated points of entry on time and review the quality •Ensure reliable supply of data collection and reporting tools are available at reporting sites •Collect and transport specimens for laboratory confirmation •Use local laboratory capacity to confirm cases if possible	•Make sure health facilities know and use standard case definitions for reporting priority diseases and conditions •Make sure health facility staff know when and how to report priority diseases and conditions. •Report data on time to the next level •Report laboratory results to next level •Periodically conduct risk assessment for priority diseases, events, conditions or hazards	•Define denominators and ensure their accuracy •Aggregate data from health facility reports •Analyze data by time, place and person •Periodically update graphs, tables, and charts to describe reported diseases, events and conditions •Calculate rates and thresholds •Compare current data with previous periods •Make conclusions about trends, thresholds and analysis results •Describe risk factors for priority diseases or conditions	•Arrange and lead investigation of reported diseases or outbreaks •Assist health facility in safe collection, packaging, storage and transport of laboratory specimens for confirmatory testing •Receive and interpret laboratory results •Decide if the reported outbreak is confirmed •Report the confirmed outbreak to the next level •Distribute specimen collection kits for special surveillance activities	•Select and implement appropriate public health response (for example, depending on the disease, plan to strengthen case management, conduct immunization activity, improve control and prevention activities) •Convene epidemic response committee and plan response •Conduct training for emergency activities •Plan timely community information and education activities •Alert nearby areas and districts about the confirmed outbreak	•Alert nearby areas and districts about outbreaks •Give health facilities regular, periodic feedback about routine control and prevention activities •Give feedback on surveillance and data quality findings	•Monitor and evaluate programme targets and indicators for measuring quality of the surveillance system •Conduct regular supervisory visits	•Participate in disaster or emergency preparedness and managment committees •Conduct training and simulation exercises for staff •Conduct risk mapping of potental hazards •Support and conduct health facility-based surveillance •Develop and manage contigency plans •Organize and support Rapid Response Team •Document response activities
National	•Define, update and ensure compliance with national policy and guidelines •Set policies and procedures for the national laboratory networks including quality assurance systems •Use national laboratories for confirmatory and specialized testing if necessary •Collect and transport specimens for additional analysis at WHO Collaborating Centres as necessary	•Report the immediately notifiable diseases and events to the appropriate authorities on time •Report other priority diseases and events on time •Include all relevant laboratories in the reporting network •Use IHR Decision Instrument (Annex 2) to determine risks for priority diseases, events, conditions or hazards •Inform WHO as indicated by IHR (2005)	•Set policies and procedures for analyzing and interpreting data •Analyze and interpret data from a national perspective •Regularly convene a meeting of the technical coordinating committee to review the analyzed and interpreted data before wider dissemination •Carry out special analyse to forecast magnitude and trends of priority disease events	•Ensure guidelines and standard operating procedures for outbreak investigations are available at all sites •Coordinate and collaborate with international authorities as needed during investigations •Alert and support laboratory participation •Provide logistic support: supplies, equipment, reagents, specimen transport media, health promotion budget •Share information with regional and international networks about confirmed outbreak •Use the decision instrument to decide whether the outbreak is a potental PHEIC •Process specimens from investigation and send timely results as required to each level •Request additional specimens as needed •Take part in epidemic response team	•Set policies and procedures for responding to cases and outbreaks of priority diseases and conditions •Support epidemic response and preparedness activities including deployment of rapid response teams •Report and disseminate results of outbreak response in bulletins, media, press releases and briefings	•Develop and periodically distribute regional bulletin for epidemiology and public health •Give districts regular, periodic feedback about routine control and prevention activities •Release information quickly in a transparent manner and listen to the affected community •Document provision of appropriate and timely feedback	•Monitor IDSR and laboratory core indicators regularly •Conduct outbreak investigation after action review •Support annual monitoring of IHR core capacities •Conduct IDSR regular review meetings •Conduct regular supervisory visits	•Set policies, procedures and training strategies for reporting priority diseases, conditions and events at each level. •Adapt and distribute risk mapping guidelines •Adapt and distribute guidelines for disaster or emergency preparedness plans •Develop messages for community education •Develop and manage contingency plans •Organize and support national Rapid Response Teams •Develop and organize simulation exercises •Establish and maintain a national public health emergency command and operations center
National WHO Representative, WHO Regional Office	•Develop and disseminate generic guidelines for surveillance •Document and share IDSR best practices •Provide technical support to the national level for detection and confirmation of priority diseases, conditions and events •Inform countries about problems that may cross borders •Coordinate international reference laboratory network support including centres of excellence	•Collect and compile reports of outbreaks and international notifiable diseases and events •Produce annual regional profiles or situation reports by priority diseases, conditions and events	•Develop and disseminate standard guidelines for analysis of data for each priority disease •Provide technical support to national level to improve capacity for analysis	•Provide support to countries for investigation or assessment upon request •Provide support for the coordination of laboratory participation during investigations •Provide support for risk assessment using IHR decision instrument	•Coordinate and support response activities (Strategic Health Operations Centre, technical experts, virtual rapid response teams, guidelines, SOPs, etc.) •Mobilise resources and facilitate partnerships	•Provide feedback to collaboration with national and regional levels •Disseminate risk communication guidelines •Share information with partners and stakeholders	•Use reports from countries to assess IDSR systems and advocate for improvements •Develop, update or revise guidelines and tools for IDSR/IHR monitoring and evaluation •Promote, guide and support operational research	•Mobilize resources for training, logistics and supervision •Develop, update or revise guidelines for disaster or risk management •Maintain and update a roster of experts for rapid response teams •Develop, update or revise training for IDSR and IHR implementation •Maintain a public health emergency command and operations center

Source: http://www.cdc.gov/globalhealth/dphswd/idsr/pdf/idsr-matrix_28x18_english.pdf.

The goal of the IDSR is to strengthen the overall national system for the surveillance of diseases particularly at the district level and aims to ensure a continuous and timely provision and use of information for public health decision making. Thus, the IDSR is a system with the potential to ensure a reliable supply of information to the national level in order to fulfill the below IHR 2005 requirements.

- Infrastructure and resources for surveillance, investigation, confirmation, reporting and response of diseases
- Experienced human resources
- Defined implementation process (sensitization, assessment, plan of action, implementation, monitoring and evaluation)
- Generic guides for assessment; plan of action development; technical guidelines; training materials; tools and Standard Operating Procedures that incorporate IHR components.

1.3. Key Attributes of Surveillance Systems in Developing Countries

Key attributes of good surveillance systems suggested by the U.S. CDC are simplicity, flexibility, data quality, acceptability, sensitivity, predictive value positive, representativeness, timeliness, and stability.[46] Of these attributes, sensitivity, timeliness, and stability will be most critical to the success of the IHR 2005 surveillance system. Simplicity, acceptability, and flexibility will affect the establishment and sustainability of the surveillance system. Data quality, positive predictive value, and representativeness are central to accurately characterizing health-related events under surveillance (Baker, Michael G., 1508).

Table 6-2 | Definitions of the Attributes of Public Surveillance Systems, U.S. CDC.

Attribute	Definition
Simplicity	Simplicity refers to both its structure and ease of operation. Surveillance systems should be as simple as possible while still meeting their objectives.
Flexibility	A public health surveillance system can adapt to changing information needs or operating conditions with little additional time, personnel, or allocated funds.
Data Quality	Completeness and validity of the surveillance data.
Acceptability	Willingness of persons and organizations to participate in the surveillance system.
Sensitivity	1. Proportion of cases of a disease detected by the surveillance system. 2. Ability to detect outbreaks, including the ability to monitor changes in the number of cases over time.
Predictive Value Positive	Proportion of reported cases that actually have the health-related event under surveillance.
Representativeness	Representative surveillance system describes accurately the occurrence of a health-related event over time and its distribution in the population by place and person.
Timeliness	Speed between steps in a public health surveillance system.
Stability	Stability refers to the reliability (i.e., the ability to collect, manage, and provide data properly without failure) and availability (the ability to be operational when it is needed) of the public health surveillance system.

46. German, Robert R., et al. "Updated guidelines for evaluating public health surveillance systems." MMWR 50 (2001): 1~35.

These attributes according to the U.S. CDC provide important concepts and standards for effective, sustainable, accurate surveillance systems to all countries, including low-income countries. However, surveillance systems in developing countries suffer from a number of common constraints, as noted above, including a lack of human and material resources, weak infrastructure, poor coordination, uncertain linkages between surveillance and response and other factors.[47] Therefore, there is a need to consider the context of the developing countries for the standard.

The attributes or criteria of surveillance systems mentioned can be applied to all countries including both developing and developed countries. These attributes represent what systems are to be established, which can be the objectives of the surveillance system, rather than how to accomplish the surveillance system. In developing countries, however, it is difficult to accomplish the goal because of the common constraints mentioned above, including a lack of human and material resources, weak infrastructure, poor coordination, uncertain linkages between surveillance and response, and other factors. It is therefore necessary to present the "how" properties to account for the attributes of surveillance system in developing countries.

The IDSR, explained above, well represents those attributes or criteria needed to establish a surveillance system in developing countries. The attributes of developing countries suggested by the IDSR can be summarized as follows: 1) attributes should be on a district basis, 2) integrated, and 3) coordinated.

The district level is important in the context of developing countries because it is the first line of the health system with staff dedicated to all aspects of public health such as monitoring health events in the community, mobilizing community action, encouraging national assistance and accessing regional resources to protect the district's health.

For example, community-based surveillance programs that employ volunteers may lessen the burden on health workers. Increased use of automated reporting may decrease the burden on health care and public health workers and allow for more complete reporting of potential cases of public health importance.[48]

Integration and coordination in surveillance systems is also important for rational use of resources and streamlining common surveillance activities as the IDSR suggest. Donor-driven priorities or international concerns in a developing country often result in

47. U.S. Government Accountability Office. "Challenge in improving infectious disease surveillance system." 2001.

48. Nsubuga, Peter., et al. "Public Health Surveillance: A Tool for Targeting and Monitoring Interventions." Disease control priorities in developing countries. Measham, Anthony R., et al. Washington, DC: World Bank and Oxford University Press, 2006.

multiple, vertical, disease-specific surveillance programs that use separate information systems, personnel, vehicles, and office space at every administrative level of the country.[49] Surveillance activities for different diseases involve similar functions (detection, reporting, analysis and interpretation, feedback, action) and often use the same structures, processes and personnel (Centers for Disease Control and Prevention, 6). Thus, integration of similar surveillance functions across multiple diseases can lead to greater efficiencies.[50] Coordination of several stakeholders and programs also increase efficiency through information sharing, joint planning, monitoring, evaluation and etc.

Integration also refers to harmonizing different surveillance methods, software, data collection forms, standards and case definitions in order to prevent inconsistent information and maximize efforts among all disease prevention and control programs and stakeholders. For example, while syndromic surveillance is augmenting traditional surveillance in the developed world, it also has the potential to improve timely detection of infectious disease outbreaks in developing countries, most of which lack access to a strong public health infrastructure and specialized laboratories.[51]

2. Implications of Korea's Development Experiences

2.1. Challenges of Infectious Disease Surveillance Systems in Developing Countries

Infectious disease is a very important problem in developing countries. According to the World Health Organization, deaths of children under five years old account for more than 6.6 million every year, and infectious diseases account for 58% of the death toll.[52] Moreover, deaths occur mostly in developing countries. Six of ten major causes of death in low income countries are infectious diseases.[53] Most developing countries still face unsolved challenges with the infectious diseases.

49. World Bank. "Pakistan's Public Health Surveillance System: A call to action." Working paper: World Bank. August 15, 2005.
50. Stansfield, Sally. "Structuring information and incentives to improve health." Bulletin of the World Health Organization 83.8 (2005): 562~562.
51. World Health Organization. "Communicable disease surveillance and response system: Guide to monitoring and evaluating." World Health Organization. 2006.
52. World Health Organization. "Global health observatory-child health" n.d. Web. 10. Jan. 2014.
53. World Health Organization. "Fact sheet: The top ten causes of death." World Health Organization. 2011.

The high burden of infectious diseases in developing countries is related to social situations such as socio-economic inequality and poverty. But an inadequate surveillance system is also one of the major causes of the problem of infectious diseases. As already mentioned, a nation needs to have appropriate surveillance systems to control and prevent diseases (Phalkey RK. et al., 2013). Many developing countries have several challenges, and the scope of the challenges range from proper capabilities for a surveillance system in the country to a lack of or deficient competencies for the system. Such weaknesses in developing countries thus reveal limitations of a global capacity to understand, detect, and respond to infectious disease threats (U.S. Government Accountability Office, 16).

Many unresolved issues in the surveillance system are in low- and middle-income countries and include weak health infrastructures; use of obsolete methods and concepts to operate surveillance systems; lack of human capacity, technical and financial resources; uncoordinated policies at different levels of the systems; and uncertain linkages between surveillance and response.[54]

These challenges can be categorized as follows, from public health systems to the surveillance system function perspective:

1. Challenges of surveillance system structures.
    1) Governance challenges (legislation, organization, financing system, etc.)
    2) Resource challenges (facilities, equipments, technologies, human, etc.)
2. Challenges of surveillance system functions (notification-reporting-analysis-feedback)
    1) Inadequate standards, guidelines, and training systems
    2) Inefficiencies in reporting and feedback methods
    3) Lack of evaluation and quality control system

2.1.1. Governance

a. Legislation and Policy

The IHR (2005) provides obligations and rights for infectious disease control to State Parties. State Parties have been required to comply with and implement the IHR standards starting with their entry into force in 2007.[55] To do so, State Parties need to have an

54. Hitchcock, Penny, et al. "Challenges to global surveillance and response to infectious disease outbreaks of international importance." Biosecurity and bioterrorism: biodefense strategy, practice, and science 5.3 (2007): 206~227.

55. World Health Organization. "IHR CORE CAPACITY MONITORING FRAMEWORK: Checklist and Indicators for Monitoring Progress in the Development of IHR Core Capacities in States Parties." World Health Organization. 2011.

adequate legal framework and policy to support and enable the implementation of all of their obligations and rights.

Nevertheless, there is still a big gap between the goal and reality. The WHO reports that 69% of responding countries reported having assessed their legislation and regulations, and 55% of countries reported that they had implemented policies to facilitate the functions of NFPs (National Focal Points). Globally, countries that responded had achieved an average of 61% of the attributes required by 2012, while African countries achieved only 32% of the required attributes.[56] For example, some countries have legal issues to enforce private areas for surveillance, and some countries have the weakness of having to coordinate several surveillance data for legal and political reasons.

The challenges of legislation and policy, unlike a lack of personnel and surveillance functions, are not easily-defined problems, and many developing countries often do not share the same challenges. However, legislation and policy form the basis of infectious disease surveillance systems in a country. Especially in those countries where such regulations are not well established, separate vertical programs aided by other countries can be operated.

b. Financing System

The new IHR 2005 provides a legal framework for global surveillance to respond to human disease, but there is no funding mechanism for implementation. Many resource-limited countries do not have the appropriate financing system to establish surveillance and response systems.

Surveillance and response activities can only be performed if the required and appropriate financial resources are in place. This means the financial resources needed to implement the various surveillance activities at each level of the system should be identified during the planning stage. Also, mobilized financial resources should be managed and used efficiently.

For the IHR 2005, there is no strategic plan to raise the financial resources required for implementing the revised IHR at the country level. Without a relevant financing system to acquire the needed technical resources, plans for implementing the IHR at the country level are unlikely and unrealistic.

56. World Health Organization. "Summary of 2011 States Parties report on IHR core capacity implementation." World Health Organization. 2012.

2.1.2. Limited Surveillance Function

a. Standards and Guideline

Standards, norms and guidelines are necessary for implementing, monitoring and evaluating surveillance and response systems (Hitchcock 206~227). A comprehensive surveillance guideline should define the priority diseases for surveillance, standards, updated case definitions and action thresholds, and include reporting and data management tools, a description of roles and responsibilities, and the expected actions by level. Other important guidelines include those for outbreak investigations, for case management and infection control, and laboratory standard operating procedures.

Inadequate surveillance of priority conditions and inadequate standardization and interoperability of surveillance systems are common challenges for developing countries.[57] Surveillance systems often are set up without due diligence for the information system and surveillance architecture in which they need to operate. The idiosyncratic experience of one international consultant might result in a recommendation of a surveillance approach, data definitions and formats, laboratory methods recommended, or software used that is mismatched to what would be optimal for the country.[58]

b. Uncertain Linkages Between Surveillance and Response

Surveillance is further constrained by uncertain linkages between data collection, analysis, and response. The information generated by many developing country systems often does not produce a response because it is not timely or reliable enough to be useful.

For example, during the 1990s, several sub-Saharan African countries introduced broadly targeted health management information systems to consolidate data collection and analysis on disease incidences and a variety of other health issues such as vaccination rates. While it was useful for other purposes, these information systems had often proven too broad in scope, cumbersome in details, and slow to be used as effective surveillance tools.

In fact, many national surveillance assessments indicated that, despite attempts to use these systems as a means of simplifying disease reporting, they had become yet another parallel disease reporting system. Routine reporting systems often do not provide data that can be used to make a decision for long-term disease control management, even though they were designed with this purpose in mind (U.S. Government Accountability Office, 22).

57. Louis, Michael St. "Global Health Surveillance" CDC's Vision for Public Health Surveillance in the 21st Century. Center for Disease Control and Prevention. (2012):15~19.

58. Biesma, Regien G., et al. "The effects of global health initiatives on country health systems: a review of the evidence from HIV/AIDS control." Health Policy and Planning 24.4 (2009): 239~252.

c. Poorly Coordinated Surveillance Activities

Global disease surveillance is also constrained by poor coordination of surveillance activities. Multiple reporting systems, unclear lines of authority in the event of an outbreak, poor integration of laboratories into public health systems, and nonparticipation among private health care providers have combined to further hamper surveillance efforts. While these problems exist in industrialized countries, they are particularly severe in the developing world.

Unclear lines of authority make it difficult to know whom to contact and who is responsible for which tasks in the event of an outbreak. Many of the assessments of African surveillance systems that we reviewed cited weakness in this area as an important problem, as did the World Bank and WHO officials.

Disease surveillance systems in developing countries do not take full advantage of, nor do they coordinate the contributions that laboratories can make to surveillance. Few developing countries have public health laboratories, and thus testing to confirm outbreaks must compete with testing to support individual patient-care decisions. Laboratories and epidemiologists often report to separate sections of a nation's health ministry, resulting in poor communication between those who test disease specimens to confirm diagnoses and those who analyze disease outbreaks and trends.

It is necessary to ensure effective coordination between the implementers and stakeholders for effective and efficient implementation of surveillance and response systems. Through M & E, the needs for improvements in coordination can be identified, and effective coordination mechanisms and strategies implemented (World Health Organization (2006), 6).

2.1.3. Resources

a. Poor Healthcare Infrastructure

Healthcare facilities provide the primary opportunity for detecting cases of unusual diseases or unusual clusters of disease, but healthcare facilities are absent or inadequate in resource-limited countries in Africa, Asia, and other parts of the world. Consequently, these countries do not have adequate domestic disease detection or response capabilities (Nsubuga, Peter., et al. 997~1015).

The absence of health infrastructure in resource-limited countries creates gaps in coverage in regional surveillance systems. Many people in developing countries live in remote areas without access to health care facilities. Weaknesses in transportation and communication infrastructure in developing countries also worsen the surveillance

function in these countries.[59] The result is a porous patchwork of surveillance systems that is exacerbated by differences in focus, approach, intended audience, and resource base, and by inadequate integration and poor coordination between surveillance systems. Moreover, in terms of surveillance systems, laboratory facility and equipment is not enough to confirm microbiologic pathogens in many hospitals of developing countries. These are major barriers to operate efficient and timely surveillance system.

b. Inadequate Human Resource System

The human resources necessary to perform surveillance activities are at a premium in developing countries. Poor salaries and working conditions drive many qualified public health workers abroad in search of work. Key positions in developing countries, including laboratory technicians and health care workers, are often filled by people who do not possess the necessary qualifications. Shortage of trained health care workers at the district level contributed to inadequate reporting, analysis and feedback for decision making. For example, incomplete and untimely reports to upper levels, and a lack of laboratory confirmation or accurately validated diagnoses make for inappropriate responses. WHO officials stated that laboratory personnel in developing countries often cannot competently test blood samples for malaria because they are not properly trained (Louis, Michael St, 15~19)

Developing countries need to build and sustain the human capacity for field epidemiology. A stronger field epidemiological capacity can serve a country in the following specific areas (Nsubuga, Peter., et al. 997~1015):

- providing a response to acute problems
- providing the scientific basis for program and policy decisions
- implementing disease surveillance systems
- supporting national health planning
- making resource allocation decisions and
- allocating the human capacity base for national health priorities.

59. Knobler, Stacey, et al., eds. The impact of globalization on infectious disease emergence and control: exploring the consequences and opportunities, workshop summary-forum on microbial threats. National Academies Press, 2006.

c. Lacking Information Technology Support

A good information system is the "brain" of the surveillance system.[60] Speed of communication is most critical to contain or stamp out an outbreak, save lives, and prevent misery. Mobile networks, which are now widespread in the developing world, are the best and most immediate way to get vital data to the public. However, information technology and networks are inadequate to support infectious disease surveillance systems in developing countries. Also, there is still a big gap in phone and internet system capabilities in the least developed countries, and this gap weakens surveillance, reporting, outbreak investigations, and response.[61] Even where information systems for health surveillance are established, the system is not used well by healthcare workers because of the lack of IT personnel to provide the necessary information technology support.

Another ICT issue is coordination of ICT systems. Development of several vertical IT systems usually makes a country's surveillance system fragmented. In developing countries, it is a common phenomenon that both sender and receiver use IT systems, but transmit information through printed paper because of differences in the data standards. Moreover, the lack of shared standards for data collection means that the same data are often collected and reported many times through different structures, while at the same time there are gaps where important data do not get reported.[62] Standardization and linking surveillance data are also very important between independent surveillance systems.

2.2. Implications for Developing Countries: 4 Types of Problems

When considering all of the problems, the issues can be divided into four different types: 1) legislation, organization, and financing systems, 2) limited surveillance function, 3) inadequate surveillance infrastructure and human resources, and 4) inadequate information technology support. Insufficient healthcare facility infrastructure is excluded among those because the issues are related with not only surveillance systems, but also entire health systems.

2.2.1. Type 1: Legislation, Organization, and Financing Systems

In many developing countries, infectious diseases in the private sector are often not reported, and legislation for enforcement is inadequate. In some countries, overall regulations or policies regarding investigation and surveillance are not organized. Thus,

60. Kant, Lalit, and Sampath Krishnan. "Information and communication technology in disease surveillance, India: a case study." BMC public health 10.Suppl 1 (2010): S11.

61. "Mobiles 'to help track diseases.'"BBC News 17 Oct. 2006. Web. 10. Jan. 2014.

62. Braa, Jørn, et al. "Developing health information systems in developing countries: the flexible standards strategy." Mis Quarterly (2007): 381~402.

problems like which department should be assigned or what authority should coordinate and link the investigation and surveillance activities are unclear. Also, most developing countries do not have adequate financial resources to carry out investigations and operate surveillance systems.

Establishing legislation, organizing responsibilities, and raising funds to maintain the system are basic requirements for investigation and surveillance of infectious diseases. Through IHR 2005, the international community requires each member state to fulfill these requirements.

In 1954, the Korean government proclaimed "the Communicable Diseases Prevention Act," and combined several related organizations to launch the Korea National Institute of Health in 1963. The KNIH was expanded and reorganized in 2003 into the Korea Centers for Disease Control and Prevention, responsible for infectious diseases, non-infectious diseases and injury. As for the budget, the National Health Promotion Fund and Emergency Medical Fund as well as general accounts are utilized to operate disease response programs.

Particularly in Korea, the code of notification duty mandates doctors including private practitioners to fill out notification forms as well as record diagnoses when the disease is the subject of the surveillance system. These notifications are connected to reimbursements by the national health insurance system.

Korea's success in establishing and organizing overall legislation is the result of compliance with international requirements rather than the country's unique experience. Developing countries also need to establish and operate organizations responsible for the surveillance of and response to infectious diseases according to international regulations. Through such organization, the system must be modified in ways that support communities' primary health care centers. The fact that the KCDC is responsible for the detection and investigation of and response to every disease has major implications.

Ways to induce the participation of the private sector in the regulation, incentives, and public notification aspects of a surveillance system can be different in countries. Korea's example of the National Health Insurance and connecting notification to the private sector with insurance reimbursement, with the support of IT infrastructure, can be taken into consideration.

2.2.2. Type 2: Limited Functions of Surveillance and Investigation

The main challenges of surveillance and investigation in developing countries are that various data sources and systems require strong cooperation and coordination. Although a variety of diseases under investigation and surveillance can be difficult to investigate in the same manner, the absence of cooperation and coordination leads to separate operation of programs and decreased overall efficiency. Unclear linkages between surveillance

and response are another problem. Also, standards or guidelines for investigation and surveillance functions are unclear, resulting in difficulties in evaluation for many developing countries. These challenges constitute major obstacles to the basic function of investigation and surveillance: notification (investigation) – report – analysis – feedback.

In Korea, the KCDC coordinates and connects every surveillance and investigation activity including statutory infectious disease survey, epidemiological investigations, whole surveillance systems, sentinel surveillance systems for legal infectious diseases, laboratory surveillance systems, and surveys of high risk groups of zoonoses (communicable diseases between men and animals), through a monitoring network for disease information. These various data sources with disease characteristics and priorities are useful means for establishing an effective and efficient investigation system. Especially, the KCDC takes responsibility for establishing the standards and guidelines for disease surveillance of public health centers across the country and the metropolitan health headquarters, providing technical support such as personnel training, and maintaining quality. The KCDC actively gives feedback on investigations and surveillance data through various means, including statistical annual reports, weekly reports, weekly newsletters, and web statistical systems.

Developing countries are trying to establish integrated investigations and surveillance systems that can be coordinated and connected with various other investigation and surveillance systems such as the IDSR. Although the level of operational systems can vary with the socioeconomic status of the country, the KCDC's method for choosing and operating disease surveys, community based surveillance systems, whole surveillance, sentinel surveillance and laboratory surveillance, and the methods for combining these activities to support personnel training for primary health facilities, maintaining quality, and providing feedback – can be reviewed as a best practice and good reference point.

2.2.3. Type 3: Inadequate Investigation and Surveillance Infrastructures and Human Resources

Limited facilities, equipment, and human resources necessary for investigation and surveillance, and an inadequate personnel training system are common to developing countries. Building the basic facility and equipment, as well as personnel with adequate capabilities, is closely related to the quality and stability of the surveillance system.

In Korea, field management training programs (FMTP) are being operated to train personnel primarily responsible for investigation, surveillance and response. Also, epidemiologist training programs cultivate and maintain the capacity of professionals with advanced knowledge and sustain active epidemiological investigation. Moreover, activities including task-related education for epidemiologists and responsible public officials promote efficient investigation, surveillance and response activities.

Systematic training and cultivating of human resources are clearly an important contribution to Korea's success in investigation and surveillance, but retraining professionals such as cultivating epidemiologists (EIS officers) was a difficult assignment because of the little interest among medical doctors. Nowadays, doctors serving in the military are utilized as epidemiologists, reflecting Korea's unique environment. As for Korea's infrastructure, rapidly grown whole medical systems following the nation's economic growth and health insurance system introduction also contributed to a successful surveillance system.

Infrastructure needed for confirming pathogens such as pathology laboratories was centralized in Korea's early economic growth period. As the size and quality of private hospitals rose, the private sector took some responsibility except for cases of rare diseases and inspections for specific purposes. However, in the early growth period, supporting infectious disease diagnosis through centralized laboratories such as Korea's Tuberculosis Research Center was a major success factor in disease surveillance and response in Korea.

Thus, continuous training of primary healthcare workers and operation of centralized pathology laboratories in the early period have huge implications for developing countries.

2.2.4. Type 4: Inadequate Information Technology Systems

Inadequate information technology systems are a common factor in the lowest- and lower-middle income countries as well as higher middle income countries. Considering how the ICT system with timeliness and stability influences the outcomes of surveys and surveillance systems, even developing countries should pay more attention to the ICT system. Furthermore, various public health programs using mobile networks may stand out as alternatives to overcome limited human and material resources in those countries.

Korea has been operating a program for establishing infectious disease surveillance systems since 1995. This effort developed into an integrated computer network for infectious diseases and a web-based infectious disease surveillance system, further enhanced by computerization earlier than other countries. Such a system has dramatically improved the speed and quality of the notification, report, analysis and feedback process.

Mobile technology, actively utilized by community health workers in recent years, forms the basis of innovative report processes for infectious diseases. However, unless the report system of health facilities and report/feedback systems are utilized integrally, the status and cause of infectious disease outbreaks can be difficult to identify accurately. Early establishment of an integrated ICT system should be reviewed especially in many developing countries where various vertical surveillance systems are separately operated, and where linkages between data sources and the quality of analyzed data are significantly challenged.

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Report Sheet of Infectious Diseases

Patients or Deceased	Name			Social Security Number	
	(under 19: Guardian Name)				
	Phone number		Occupation	Gender	male
					female
	Address				
		Postal code			
	[ ]Residence unknown [ ] Unidentified				
Infectious diseases	Group 1	[ ] Cholera	[ ] Typhoid fever	[ ] Paratyphoid fever	
		[ ] Shigellosis	[ ] EHEC	[ ] Vaal hepatitis A	
	Group 2	[ ] Diphtheria	[ ] Pertussis	[ ] Tetanus	
		[ ] Measles	[ ] Mumps	[ ] Rubella	
		[ ] Poliomyelitis	[ ] Japanese encephalitis	[ ] Chicken pox	
		[ ] Viral hepatitis B [ ] Acute [ ]HBsAg positive maternity [ ] Perinatal)		[ ] Haemophilus influenzae type B	
	Group 3	[ ] Malaria	[ ] Hansen's disease	[ ] Scarlet fever	
		[ ] Meningococcal meningitis	[ ] Legionellosis	[ ] *Vibrio vulnificus* (sepsis)	
		[ ] Epidemic typhus	[ ] Murine typhus	[ ] Scrub typhus	
		[ ] Leptospirosis	[ ] Brucellosis	[ ] Anthrax	
		[ ] Rabies	[ ] SFTS (Severe fever with thrombocy topenia syndrome)	[ ] Syphilis ([ ] 1phase, [ ] 2 phase, [ ] congenital)	
		[ ] CJD, vCJD			
	Group 4	[ ] The plague	[ ] Yellow fever	[ ] Dengue fever	
		[ ] Small pox	[ ] Botulism	[ ] SARS (Severe Acute Respiratory Syndrome)	
		[ ] Animal influenza infection in humans		[ ] Novel influenza	
		[ ] Tularemia	[ ] Q fever	[ ] West Nile fever	
		[ ] Lyme borreliosis	[ ] Tick-borne encephalitis	[ ] Viral hemorrhagic fever	
		[ ] Melioidosis	[ ]Chikungunya fever	[ ] SFTS	
		[ ] Emerging infectious disease syndrome			
Date of onset	(dd/mm/yy)		date of diagnose	(dd/mm/yy)	
confirmed Test results	[ ] positive [ ] negative [ ] in progress [ ] not tested				
patient status classification	[ ] patient [ ] suspected patient [ ] Pathogens holder		hospitalization Status	[ ] outpatient [ ] hospitalized [ ] others	
Suspected infection route	[ ] In contact with infected patients groups [ ] In contact with infected individual [ ] uncertain [ ] no contact		Suspected infection area	[ ] domestic [ ] international (country:) (period of stay:)	
deceased status	[ ] alive [ ] deceased, (cause of death:)				
others (If applicable)	remarks				
	medical institutions number				
	Diagnose doctor name (signature)			license number:	
Report Organization			Chief of the organization		

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