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2012 Modularization of Korea's Development Experience:

Korean National Immunization Program for Children

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MINISTRY OF HEALTH & WELFARE

CHUNGNAM NATIONAL UNIVERSITY

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Preface

The study of Korea's economic and social transformation offers a unique opportunity to better understand the factors that drive development. Within one generation, Korea has transformed itself from a poor agrarian society to a modern industrial nation, a feat never seen before. What makes Korea's experience so 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 and 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 2010 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 with the hope that Korea's past can offer lessons for developing countries in search of sustainable and broad-based development. This is a continuation of a multi-year undertaking to study and document Korea's development experience, and it builds on the 40 case studies completed in 2011. Here, we present 41 new studies that explore various development-oriented themes such as industrialization, energy, human resource development, government administration, Information and Communication Technology (ICT), agricultural development, land development, and environment.

In presenting these new studies, I would like to take this opportunity to express my gratitude to all those involved in this great undertaking. It was through 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 the 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, keen insights and expertise in preparation of the case studies.

Indeed, the successful completion of the case studies was made possible by the dedication 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 Professor Joon-Kyung Kim and Professor Dong-Young Kim for his 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.

May 2013

Joohoon Kim

Acting President

KDI School of Public Policy and Management

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Chapter 1

Summary

In this report, the development of the immunization program in the Republic of (South) Korea, hereafter "Korea," is examined from the 1950s up to present. This report also examined policies that were enacted to provide immunization services in a situation where there was a low level of awareness and participation by the general public. It is also our intention that this report can be used as a reference for countries that do not have sufficient resources to treat communicable diseases or for countries that have only recently introduced immunization policies. In addition, by detailing the prevention of perinatal hepatitis B transmission, the eradication of measles, and the experiences of fighting H1N1 influenza, we also want to share Korea's experiences in coping effectively with new infectious diseases as they are discovered. Every individual's life is precious. Therefore, ineffective public health programs or policies should never be implemented, even when a country has a low socio-economic status or the interest of the general public wanes. The latter half of this report focused on major immunization policies in detail that have been introduced and implemented in Korea in order to help ensure the development of quality immunization programs.

The content of this report is, briefly, as follows: In Chapter 1, important changes and problems in the development of Korea's immunization program from past to present are described. In Chapter 2, current immunization organizations and committees are introduced. Chapter 3 covers the types and characteristics of immunization providers with a focus on the participation of private medical institutions through the immunization reimbursement system. Chapter 4 focuses on the vaccine provider system and shows the differences between the vaccine provider system in Korea and those of other countries. Chapter 5 specifies the important strategy for eradicating infectious diseases by verifying preschool children's immunization status through a centralized Immunization Registry

Information System. Chapter 6 introduces Korea's internationally well-regarded hepatitis B immunization program, which has maintained the prevalence rate of hepatitis B around 3% and has dramatically reduced perinatal hepatitis B transmission. This chapter also covers the measles eradication program and the successful management of the frightening H1N1 influenza epidemic. Chapter 7 explores the recent strategies employed to raise citizen participation in the national immunization programs. In Chapter 8, Korea's unique immunization coverage survey is covered in detail. Lastly, a list of government publications, a summary of immunization programs, and immunization methods conducted by the government are included in the Appendix.

We hope that this report will help immunization professionals, lead to more development in immunization programs, and inspire a national effort to take on new challenges.

Chapter 1

Background

1. History of Korean Immunization Program
2. Institutional and Legal Transitions
3. Changes in Organizations Dedicated to Immunization

Background

1. History of Korean Immunization Program

Immunizations not only stop infectious diseases from spreading but also help infected patients avoid sequelae. Immunizations also protect herd immunity by controlling the propagation of infectious diseases. Therefore, in practice, a 100% vaccination rate is not required.

The history of the Korean vaccination program began during the Joseon dynasty with immunizations against smallpox. The program was mainly the result of efforts of various scholars and traditional doctors. In 1882, Ji, SeokYeong founded the first institution for smallpox immunizations by opening an immunization clinic in the Jeonju Fortress. Ji, SeokYeong learned Japanese inoculation methods in Busan and introduced them to Korea. Notably, the immunization regulations of 1895 and the local immunization regulations of 1898 set out a legal basis for the immunization program in Korea [Box 1-1].

Box 1-1 | Smallpox and Ji, SeokYeong

Ji was born on May 15th, 1855 to a noble yet financially strapped family. Studying oriental medicine at early age, he was supported by his father. His father was quite knowledgeable in medicine although his aristocratic lineage stopped him from running a medical clinic. Very friendly with middle-class doctors of the time, Ji's father sent his smart and inquisitive son to study Chinese medicine under the respected physician Park, Young Sun. But in the 19th century, western studies were just coming into the country and Ji was soon introduced to western medicine.

Ji's mentor, Park learned of the smallpox vaccination method from a Japanese doctor when he visited Japan as part of the government delegation in 1876. He brought back a book on smallpox inoculation and taught his students the new and effective treatment for smallpox. The innovative treatment had helped Ji broaden the world of medicine and offered him a way to eradicate one of the most fatal diseases.

But learning from a book has limitations, and Ji wanted more. He found out that a Japanese naval clinic in Busan was administering smallpox shots to Japanese residents. So he walked 20 days down to the port city to ask the clinic to teach him about the vaccination. Impressed by Ji's commitment and passion, the Japanese naval doctor trained him for two months.

In 1879, Ji became the first Korean physician to vaccinate against smallpox, when he administered his first smallpox shot to a two-year-old brother-in-law. It was a great success, but the problem was the shortage of vaccines. He could not learn how to manufacture the vaccine. So he traveled to Japan in 1880 with diplomatic envoys and learned how to manufacture the smallpox vaccine. Upon his return to Joseon, he set up a vaccine production base in Seoul and launched a nationwide vaccination program.

Source: http://world.kbs.co.kr/english/program/program_koreanstory_detail.htm??lang=e&current_page=9&No=25970

Until 1945, the management of infectious diseases was under the oversight of the Japanese occupation forces. After the liberation in 1945 until the end of 1950 when the Korean War ended, the UN Allied Forces were responsible for overseeing the war. Yet, due to the situation, there was a sudden increase in patients with hepatitis, epidemic hemorrhagic fever, typhus, smallpox, and diphtheria. The UN forces managed infectious disease through group immunizations and quarantining infected patients. Their oversight extended not only over the soldiers, but over the general population as well <Table 1-1>.

Table 1-1 | History of the Korean Immunization Program

Year	Diseases targeted	Important background information
1882	Smallpox	Establishment of clinic in the Jeonju Fortress
1895	Smallpox	Enactment of inoculation regulations (Ordinance for the Empire, section 8)
1945	Cholera	Production of vaccination and implementation of an immunization program (Joseon Epidemic Prevention Institute)
1949	Diphtheria, tetanus, 8 other diseases	Production of vaccination and implementation of an immunization program (Joseon Epidemic Prevention Institute)
1952	Tuberculosis	Production of BCG vaccination and implementation of an immunization program
1954	Smallpox, diphtheria, whooping cough, typhoid fever, typhus, paratyphoid fever, tuberculosis	Epidemic prevention measures instituted (designated as routine immunization)
1958	Polio	Inactivated vaccine used for immunization of some populations (Live diluted vaccine introduced in '61)
1965	Measles	Implementation of an immunization program
1976	Cholera, tetanus	Routine immunizations introduced
1978	Smallpox	WHO declared eradication of smallpox in 1979; suspension of smallpox immunizations
1980	Measles, mumps, rubella (MMR)	MMR vaccine introduced
1983	Measles, polio	Introduction of routine immunizations
1990	Cholera	Suspension of vaccination
1995	Hepatitis B	Changed the '85 temporary immunization to routine immunization
2000	Mumps, rubella	Introduction of routine immunizations
2001	Measles	Implementation of an ambitious 5 year catch-up plan to eradicate measles
2004	Diphtheria, tetanus	Introduction of Td immunizations
2005	Varicella (Chicken pox)	Introduction of routine immunizations

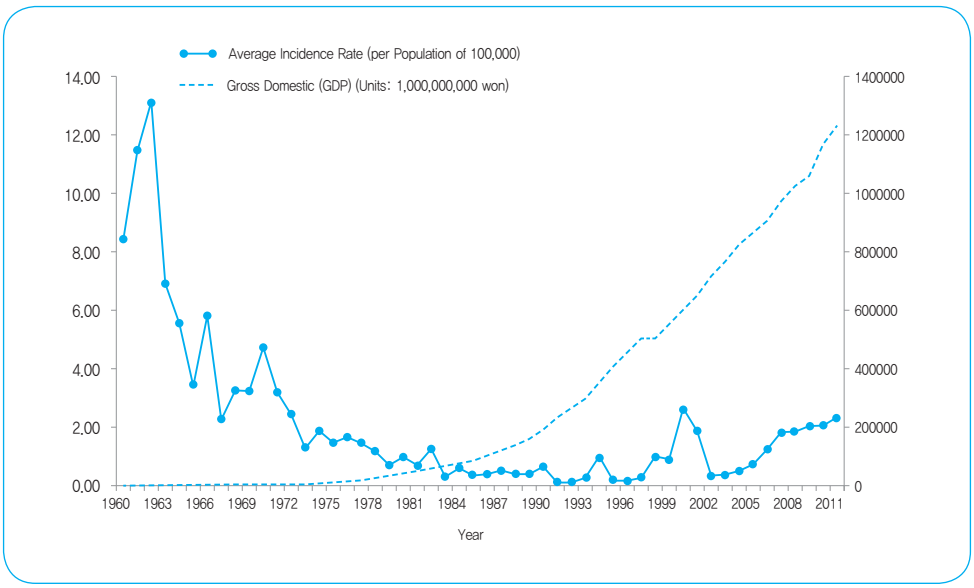
Year	Diseases targeted	Important background information
2006	Measles	Measles declared eradicated; measles vaccinations suspended
2008	Hepatitis B	WHO certified management of hepatitis B
2009	H1N1 Influenza	Private medical institutions began to participate in the routine immunization program
2011	Diphtheria, tetanus, pertussis, polio	Introduction of DTaP-IPV immunization
2012	Diphtheria, tetanus, pertussis	Introduction of Tdap immunization

BCG: Mycobacterium bovis bacillus Calmette-Guérin; WHO: World Health Organization; MMR: measles, mumps, and rubella; Td: tetanus, diphtheria; DTaP-IPV: diphtheria, tetanus, acellular pertussis and inactivated poliomyelitis virus vaccine

Source: Administrative reports of Korea Centers for Disease Control and Prevention

The UN Allied Forces' oversight of infectious diseases led to a marked reduction of sudden epidemics. [Figure 1-1] shows that infectious diseases greatly increased after the Korean War in the early 1950s. When the economic situation started to improve in the 1970s, there was a decrease in infectious diseases. It is clear from [Figure 1-1] that infectious diseases could be managed through an aggressive emphasis on a hygienic environment and a collective approach despite weak infrastructure. As a result, when the economic situation improved and medical system was revamped, there was a sharp decrease in infectious diseases. In other words, there is an inverse relationship between the annual rate of economic development and the incidence of infectious diseases [Figure 1-1].

Figure 1-1 | Relationship between Annual Economic Level and Incidence of Infectious Diseases per 100,000 People



Source: Administrative reports of Korea Centers for Disease Control and Prevention

One of the problems in offering vaccination service during the mid-1950s was that in 1951, due to the Korean War, foreign troops who were stationed in Korea conducted group vaccinations that resulted in a temporary decrease of infectious diseases. However, the demand of the general public could not be met because there were no regular immunization services available for them. To solve these problems, immunization centers were set up in every town, sub-county, and neighborhood so that immunizations could be given regularly. The government also appointed one certified professional to each center (Gyeonggi Province archives, 1953). Specifically, doctors, oriental medicine doctors, dentists, pharmacists, nurses, and other experienced health professionals were chosen and given short-term training by the local health director so they could be hired as staff in locations where no medical staff had worked previously. In order to provide convenient accessibility, certified professionals were also appointed to offer immunization services at regional immunization clinics and other regional health institutions. The cost was borne by state and local governments, and the immunizations were free. When an allowance was designated for a specific, health center, health clinic, or medical institution, the medical personnel who worked in locations, which lacked stationed doctors, were paid only. When an epidemic occurred, these measures and basic medical resources acted as a very effective means of improving the accessibility of immunization in neighborhoods where there

weren't enough medical staff. However, because of its coercive nature, there was a lack of active participation among medical institutions.

The government put considerable effort to appoint physicians to each town and sub-county.[1] In the 1960s and 70s after the Korean War ended, one of the main concerns was to prepare measures for areas where there were no doctors. The first policy attempted to commission a practitioner in private practice as the community doctor and the director of the community health clinic. From the 1960s to the 80s, the head of the county[2] commissioned certain physicians in private practice to be public doctors, including many geographically restricted doctors.[3] Effort was also made to alleviate the conditions in rural areas where there were no doctors. This was done in two ways. One was a six-month specialized residency training program that was implemented in health institutions in rural areas (in 1972). The other was a program in 1976 to give medical licenses to medical students who had failed the state medical examinations under the condition that they should work in a rural area where there were no medical personnel for two years.

Table 1-2 | Social Health Indicators in Korea 1960-1980

Indicators	1960	1966	1970	1975	1980
Population growth rate (per thousand)	3.01	2.57 ('65)	2.21	1.70	1.57
Natural population growth (per thousand)	30.0	25.1	23.2	17.1	15.4
Crude birth rate (per thousand)	42.1	34.6	31.2	24.8	22.6
Crude death rate (per thousand)	12.1	9.5	8.0	7.7	7.3
Average lifespan (years)	52.4 (M:51.1 F: 53.7)	M:54.92 F:60.99	61.93 (M:58.67 F:65.57)	63.82 (M:60.19 F:67.91)	65.69 (M:61.78 F:70.04)
Infant mortality rate (per 1,000 births)	58.2	46.2	53.0	38.0	17.3
Maternal mortality rate (per 100,000 births)	-	-	8.3	5.6	4.2

1. Town (*eup*) and sub-county (*myeon*): These two government administrative districts, towns and sub-counties, are smaller divisions of counties (*gun*).
2. County (*gun*): This government administrative district encompasses multiple towns (*eup*) and sub-counties (*myeon*), and generally denotes less densely populated areas than the city.
3. Geographically restricted doctor: Under the current medical law, physicians who were educated during the Japanese colonial period (before 1945) or who were educated in North Korea hold a license that restricts their medical practice to certain geographical areas.

Indicators	1960	1966	1970	1975	1980
Gross national income (GNI) per capita (in dollars)	79	125	255	607	1,660
Prevalence of tuberculosis (per 100 people)	-	-	4.2	3.3	2.5
Cholera morbidity rate[1)]	-	-	0.6	-	0.4
Dysentery morbidity rate[1)]	0.2	0.4	-	-	-
Typhoid fever morbidity rate[1)]	11.2	11.8	13.1	1.5	0.5
Paratyphoid fever morbidity rate[1)]	0.3	0.1	0.1	0.0	0.0
Smallpox morbidity rate[1)]	0.3	0.0	-	-	-
Epidemic typhus morbidity rate[1)]	0.1	-	-	0.0	0.0
Relapsing fever morbidity rate[1)]	3.3	4.4	1.8	1.0	0.1
Diphtheria morbidity rate[1)]	0.1	0.1	-	-	-
Epidemic meningitis morbidity rate[1)]	5.0	-	-	-	-
Bacterial dysentery morbidity rate[1)]	-	-	0.5	0.1	0.0
Polio morbidity rate[1)]	-	-	11.8	3.4	4.1
Pertussis morbidity rate[1)]	-	-	11.2	14.1	13.1
Measles morbidity rate[1)]	-	-	2.5	5.2	2.3
Mumps morbidity rate[1)]	-	-	49.4	0.9	-
Malaria morbidity rate[1)]	0.1	0.1	0.1	0.0	0.0
Meningococcal meningitis disease morbidity rate[1)]	-	-	-	-	0.1
Hemorrhagic fever morbidity rate[1)]	5.0	12.2	0.1	0.3	0.3
Japanese B encephalitis morbidity rate[1)]	5.0	12.2	0.1	0.3	0.3

*Data from each metropolitan city and provincial report.

1) rate=No. of incidence×100,000/No. of average population

Source: 1. Ministry of Health and Social Affairs (1961, 1962, 1974, 1979, 1981), "Yearbook of Health and Social Statistics," *Ministry of Health and Social Affairs* (in Korean)

2. National Bureau of Statistics of the Economic Planning Board (1966), *Korea Statistical Yearbook*, Economic Planning Board (in Korean)

3. Korean Statistical Information Service (http://www.kosis.kr), Economic Statistics System of the Bank of Korea (http://ecos.bok.or.kr/) (in Korean)

4. Park, NY (1970), "Analysis of International Health Statistics and Data," *Korea National Institute of Health* (in Korean)

In addition, in 1961, regulations pertaining to scholarships for health care personnel were enacted (State Council Law, Section 249). Graduate students studying medicine and public health could receive a scholarship if they worked in a specified area for 2-5 years after graduation. In 1976, the Act on Special Cases for Health Care Scholarships was enacted, which also provided scholarships for medical students. After graduation, the students were appointed to a community health center and branch. Later, nursing students were included in this program, and the government could recruit nurses in the same way. Similar ordinances were enacted at the provincial and local levels. In this manner, a medical workforce was secured. In 1980, the Act on Special Measures for Rural Health Care was enacted, and until present, it has reliably supplied public health doctors[4] (such as physicians, dentists, and oriental medicine doctors) to health care centers and their branch offices. Likewise, a variety of laws and institutional strategies were developed in order to address the rural areas and areas where no doctors were stationed. As a result, after 1983, all areas now have doctors. Due to such efforts, physicians working in health centers are providing preliminary checkups and adequate health counseling for those who receive immunizations <Table 1-3>.

Table 1-3 | The Percentages of Rural Areas with Medical Personnel

(Unit: people, %)

Year	Rural population[5]	Percentage of population in rural areas	Percentage of the rural population with no physician stationed in their area	Percentage of the rural population with no dentist stationed in their area	Percentage of the rural population with no oriental medical doctor stationed in their area	Percentage of rural population without any medical personnel
1952	16,070,667	81.2	48.3	70.1	53.6	35.3
1955	16,243,982	75.5	30.8	61.7	41.5	21.5
1960	17,995,264	72.0	29.5	61.8	43.1	18.5
1965	19,380,347	67.6	26.2	55.9	35.9	20.7
1970	18,507,899	58.8	20.2	48.3	33.9	16.7
1974	18,262,204	54.9	17.0	44.0	36.1	14.9

*Population ratio (%): Comparison of a percentage of the national population

Source: Ministry of Health and Social Affairs (1955-1957, 1964, 1974), "Yearbook of Health and Social Statistics," *Ministry of Health and Social Affairs* (in Korean), pp.9-12 in 1955-1957, pp.36-39in 1964, pp. 162-165 in 1974

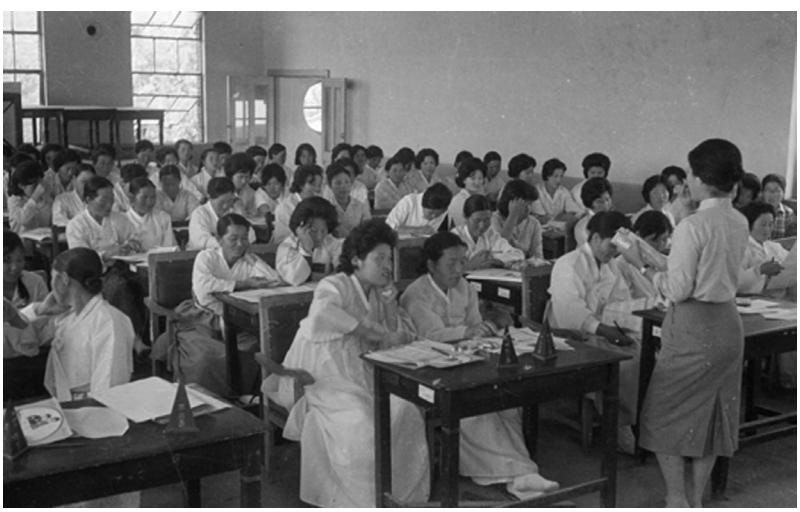
4. Doctors, dentists, and oriental medicine doctors (public health doctors) were asked to carry out public health work instead of military service.

5. More specifically, population of towns (*eup*) and sub-counties (*myeon*).

Apart from the doctors and dentists provided by the above strategies, the state gradually started to deploy other health care personnel. At each health care center, three staffers were deployed: one responsible for family planning, another responsible for maternal and child infant health, and a third responsible for tuberculosis management. Immunizations were included in child infant health.

In terms of immunization programs, only smallpox immunizations were offered without charge before 1960. Afterwards this free program was extended to immunizations for typhoid fever, cholera, DPT, TB, and others. However, despite high incidence rates and death rates, there were cases that were not covered by the state like measles. For such diseases, immunizations had to be administered at a private health institution and the cost borne by the individual. Nevertheless, even in this inconvenient situation, the central government set regional immunization goals. As family planning (such as birth control) was advocated by World Health Organization advisers as a major challenge to address, family planning personnel were placed in every town and sub-county. Along with these family planning services, health education about immunizations and immunization services were also offered. The benefits of immunizations were seen in rural areas [Figure 1-2]. In addition, the efforts of international organizations played a major role in raising the general public's awareness of health issues by emphasizing the importance of hygienic environment such as kitchens, bathrooms, and clean wells. These all helped reducing infectious diseases.

Figure 1-2 | Family Planning and Immunization Classes (1960s)



Source: National Archives of Korea

During the months when infectious diseases spread (e.g., cholera and typhoid in summer), immunizations were carried out at a large scale: at bus terminals, trains, markets, and other places with a large transient population. This was a good opportunity to provide immunizations to the general public. In particular, this strategy was important for providing immunization access to those members of the public who were not proactive in visiting a health care center. Immunizations for infectious respiratory diseases in children were usually given by the family planning staff as they toured the village. Simultaneously, they gave health instructions [Figure 1-3, 4, 5].

Figure 1-3 | Group Immunizations Administered in a Rural Village (1960s)

Source: National Archives of Korea

Figure 1-4 | Cholera Immunizations Administered for Train Passengers at the Daegu Station (1970s)

Source: National Archives of Korea

Figure 1-5 | Immunizations inside a Train Car

Source: National Archives of Korea

It was very important to improve the residents' awareness and knowledge of immunization programs as well as immunization coverage through quantitative expansion and group immunization programs. Emphasis on environmental sanitation to prevent infectious diseases was very important given the low education level of the general public. Therefore, there was particular interest at the national government level about instructions and public awareness. Common instructions at that time were about sexually transmitted diseases, tuberculosis, immunizations for infectious diseases, and food hygiene. Government agencies developed educational materials, and such information was broadcast through a variety of media including newspapers, leaflets, and broadcasts through street public address systems. Due to the low level of formal education and the harsh economic environment, it was difficult to access health care and immunizations. Furthermore, people barely knew about the importance of immunizations. As a result, health education was very important as it could reap significant benefits. When the socio-economic level of the nation began to improve in the 1970s, the foundational education of the 60s provided an opportunity to drastically improve the immunization program. There were also World Health Organization advisors consisting of doctors, health officers, and a nursing supervisor at the health center in Gongju, South Chungcheong Province (*ChungcheongNamDo*) who played an important role in training health care workers and local residents about cleanliness, immunizations, and family planning [Box 1-2].

Box 1-2 | Example of Public Relations for Child Vaccination through the Newspaper


東亞日報 1984年2月28日 土曜日

「어린이豫防接種」百科

時期놓쳐도 指針에 따른 回數맞추면 같은 效果

生後 2개월부터 두달간격 3回 DPT

갓태어난아기 백신 꼭 맞히도록

Source: http://newslibrary.naver.com/viewer/view.nhn?editNo=2&printCount=&publishDate=1984-02-02&officeId=00020&pageNo=11&printNo=19179&publishType=00020&articleId=&serviceStartYear=1920&serviceEndYear=1999

The public sector, specifically the community health center's active promotion of the immunization program and the existence of maternal and infant health care centers, should not be overlooked. Originally, workers identified pregnant women and registered them at the community health center. This was part of their work related to maternal and infant care. Four weeks after birth, the infant also was registered. Accordingly, their growth and development were checked, and immunizations were given. From 1981 to 1984, additional maternal and infant health care centers were built in approximately 91 places on county bases. This was to serve residents of rural areas and to provide birth control, population growth control, and health care for pregnant women and infants. When there were major installations, the cost was borne by the foreign loan (International Bank for Reconstruction and Development; IBRD) and the operating costs were borne by the national and county governments.

The public health center consisted of a convalescing room, delivery room, a newborn nursery, and a day care center. The mayor and the head of the county took charge of the center, provided strong administrative support, and appointed the health center director. One out of three of the existing nursing staff was recruited from the rural maternal and infant care centers to work in the city-or province-owned hospitals. The doctors were also recruited to be public health physicians. Eventually, the maternal and infant health centers were absorbed into the community health centers, and by the early 1990s, their functions had gradually disappeared.

According to evaluation reports of the early days of the maternal and infant health care centers, 0.2 people per day delivered infants, 3 infant per day were vaccinated, and 2 people per day came for infant examinations and counseling (Ministry of the Interior, 1983). On the whole, these operating results were much lower than those that were originally planned. One reason for this was because of insufficient manpower and equipment to support infant delivery. Lack of ability to cope with high risk deliveries and local residents' preferences were other reasons. During this time, the economy was rapidly developing and simultaneously, private medical institutions were also developing. Hence, accessibility to private obstetrics and gynecology institutions significantly improved, but this led to poor performance in the public sector. Nonetheless, it is important that health care facilities for maternal and infant health care were built in areas of poor conditions. In particular, when there was very little political or social interest in health care, the Ministry of the Interior's directly managing the program at the front lines was quite noteworthy. However, the maternal and infant health centers failed to follow the rapid expansion of medical resources and could not fulfill their intended goal. It is unfortunate that the maternal and infant health care centers were not established earlier. It is also regretful that they did not have the resources to be quality centers that could compete with the private sector. If they had, they might have had a greater effect on the health environment in Korea.

2. Institutional and Legal Transitions

In Korea, the law for the prevention of infectious diseases was first enacted in 1954. This law has been the foundation for the basic framework of the law on infectious disease management in Korea. Revised in 2011, the most recent law is the Law on the Prevention and Management of Infectious Diseases. The statute includes the following sections: Article 1, General Provisions (Types of Infectious Diseases); Article 2, Basic Planning and Program (Appointment of a Secretary of Health and Welfare every five years); Article 3, Notification and Reporting; Article 4, Monitoring and Epidemiological Investigation; Article 5, High Risk Pathogens; Article 6, Immunizations; Article 7, Measures for Blocking the Propagation of Infections; Article 8, Preventive Measures; Article 9, Epidemic Prevention, Quarantine Commissioner and Epidemic Prevention Committee; and Article 10, Expenses.

The first law mentioned above was put in force from 1954 until 1999. Under this, it was the responsibility of the guardian whose child was under 14 to have the child immunized. Mental patients or those deemed incompetent were to be immunized following the same policy. If the inoculations were not given, heavy fines were imposed. Through the heavy fines, the government would attempt to increase the rate of inoculation coverage. From 1999, regulations forcing caregivers to access immunizations were abolished because the immunization coverage rate goal had been reached. This was also because of the increased awareness of human rights to preserve citizens' freedom of choice. By granting responsibility to the heads of the local governments for routine immunizations, a variety of programs depending on local conditions could be developed and implemented to improve immunization coverage.

The central and local government had to bear the burden of the cost specified by the law. Thus, the expenses of the immunization program were clearly specified. The national government was responsible for over 1/2 of the provincial share of the cost, and the provincial government was responsible for 2/3 of the proportion that the county government covered. Currently 50% of the cost is normally borne by the national government, 15% (or 25%) borne by the provincial government, and 35% (or 25%) borne by the county government <Table 1-4>.

Up to the present, from the legislative or organizational perspective, the immunization program in Korea has been considered legally part of the prevention and management of infectious diseases program, and there were no separate immunization laws. That is, the overall legal basis for immunization has been considered in terms of the management of infectious diseases by the Law on the Prevention and Management of Infectious Diseases. So there was no law for immunization only. Consequently, unique and independent immunization goals and strategies could not fully be performed.

Two types of immunization programs operate at the national level: the National Required Immunization Program and the Complementary Immunization Program. Core immunizations are based on professional review and the relevant national law. In case of a sudden influx of an epidemic from overseas or a rapid increase of an infectious disease in Korea, complementary immunizations are administered. As complementary immunizations are meant to raise the immunity of a population to a certain disease in a short period of time, the immunization programs are temporary. Prime examples are the immunizations administered due to the rapid increase of measles in 2000 and the immunization because of the swine influenza pandemic in 2010.

For a certain immunization to be included in the list of required immunizations, several factors are taken into account. The most important factors are the incidence rate and the fatality rate. When the law was first enacted, seven diseases -- smallpox, diphtheria, pertussis, typhoid fever, typhus, paratyphoid, and tuberculosis -- were covered, but currently eleven diseases-- hepatitis B, diphtheria, polio, pertussis, measles, tetanus, tuberculosis, mumps, rubella, varicella, and Japanese encephalitis-- are targeted. Whether to include hepatitis A, rotavirus, type b Haemophilus influenzae, and Streptococcus pneumoniais is under consideration. In other words, there is continuous effort to include any disease that significantly affects the population in the required immunization list.

The public health centers set up by local governments for required immunizations had limitations that made it inconvenient for the public to use their immunization services. However, after 2009, a change in the law allowed people to get required immunizations at private medical institutions that were appointed. This was a plan to improve the quality and quantity of immunization coverage that stemmed from the government's strong commitment to fight against preventable infectious diseases. Currently, in 2012, immunizations in public health centers are completely free. In addition to the immunizations offered by the state, one can also receive immunizations at a private health institution, but in this case, the cost must be borne by the individual, which is up to 5,000 won (approximately US $5.00) per inoculation.

Table 1-4 | Contents of Major Laws related to Immunizations and Types of National Immunizations

Year	Guardian's duties and regulations regarding required immunizations	Types of required immunizations	Burden of cost			Temporary immunizations
			National	Provincial	County	
1954	• Obligation of guardian whose child is 14 years & under to have the child immunized • Obligation of citizens to receive immunizations	• Person responsible for the immunizations: leader of municipality, mayor Types of immunization(7): smallpox, diphtheria, whooping cough, typhoid fever, typhus, paratyphoid, tuberculosis	Over half of the provincial share	2/3 of county costs	Remaining cost except national and provincial subsidies	Ministers, mayors, leader of municipality
1976	Same	• Person responsible for immunizations: Leader of municipality, mayor, county magistrate • Types of immunization (7): smallpox, diphtheria, whooping cough, typhoid fever, cholera, tetanus, TB (excluding typhus, paratyphoid)	Same	Same	Same	Minister, leader of municipality, mayor, county magistrate

Year	Guardian's duties and regulations regarding required immunizations	Types of required immunizations	Burden of cost			Temporary immunizations
			National	Provincial	County	
1983	Same	• Person responsible for immunizations: Same • Types of immunization (6): diphtheria, pertussis, tetanus, tuberculosis, polio, measles (excluding smallpox, typhoid, cholera)	Same	Same	Same	Same
1995	Same	• Person responsible for immunizations: mayor, county magistrate, ward (district) head • Types of immunization(7): added hepatitis B	Same	Same	Same	Minister, mayor, county magistrate, ward head
1999	• Delete provisions pertaining to immunization obligations	• Person responsible for immunizations: Same • Types of immunization (7): Same	Same	Same	Same	Same
2000	Same	• Person responsible for immunizations: Same • Types of immunization (9): mumps, rubella added	Same	Same	Same	Same

Year	Guardian's duties and regulations regarding required immunizations	Types of required immunizations	Burden of cost			Temporary immunizations
			National	Provincial	County	
2005	Same	• Person responsible for immunizations: Same • Types of immunization (10): varicella added	Same	Same	Same	Same
2006	Same	• Person responsible for immunizations: Same • Place of national immunization: Public health center (can commit to private medical institution) • Types of immunization (10): Same	Same	Same	Same	Same
2009	Same	• Person responsible for immunizations: Same • Place of national immunization: Same • Types of immunization (11): Japanese encephalitis added	Same	Same	Same	Same

Source: Administrative reports of Korea Centers for Disease Control and Prevention

3. Changes in Organizations Dedicated to Immunization

3.1. Before the Establishment of the Department (up to 2002)

Child immunization was traditionally performed as part of maternal and infant care, and the separate organization overseeing immunizations was eliminated from the central and local governments. Even in the 1960s and 70s when various infectious diseases were rampant, there was no separate system for child immunizations. What is worse, due to the low level of hygiene, waterborne diseases spread rapidly during the summer. Furthermore, only cholera and typhoid were immunized as these diseases led to death.

In 1948, after the Republic of Korea was founded, experts from the World Health Organization were sent to improve Korea's low level of hygiene and to tackle the high birth rate. In the field of environmental sanitation, the conventional kitchen and bathroom built with clay was improved, and the improvement of wells was also a key focus. With respect to the high birth rate, there was a focus on dispelling widely held preferences for boys and providing contraception. These kinds of health education campaigns, along with the success of economic development started in 1962, and the improvement in the level of education among the general public contributed to the success even more in improving the sanitation level.

In the same way, immunizations were offered as part of family planning or maternal and infant health care. Due to health education on immunization services and the prevention of infectious diseases, the general public's level of awareness gradually increased. This was also a time of rapid socioeconomic development. Another notable point of this period was that immunizations for children were considered to be part of maternal and infant care, while immunizations for adults were considered to be projects for the prevention of waterborne diseases (part of the Ministry of Health and Social Affairs quarantine division). In other words, the immunization programs did not exist separately, but were considered to be part of other programs. Consequently, there was only quantitative development and no qualitative development of the immunization programs.

In 1999, the Division of Quarantine, the organization dedicated to fighting infectious diseases, which had belonged to the Ministry of Health and Social Affairs (currently the Ministry of Health and Welfare) was transferred to the National Institutes of Health (currently the Korea Centers for Disease Control and Prevention). Gradually, there was emphasis on expertise and technology in the management of a growing epidemic rather than administrative solutions. In 2000, the sudden outbreak of measles created another opportunity for a gradual change in the government's recognition of immunization. The government began to recognize the limitations of existing quantitative supply-driven

immunization programs. Accordingly, interests in immunizations increased, and a variety of research and programs began.

3.2. After the Establishment of the Department (from 2003)

In 2002, the Ministry of Health and Welfare was reorganized again. In the reorganization, the children's immunization program, which had been part of maternal and infant healthcare, was transferred to the National Institutes of Health. As a result, the task of immunizing children of the Ministry of Health and Welfare was merged with the task of adult immunizations administered by the National Institutes of Health, Quarantine Division. This unification at the level of the central government had an impact on the regional community health centers, and consequently, a unified immunization system began to take form (but, at the present time this change has been very limited to only a few health centers).

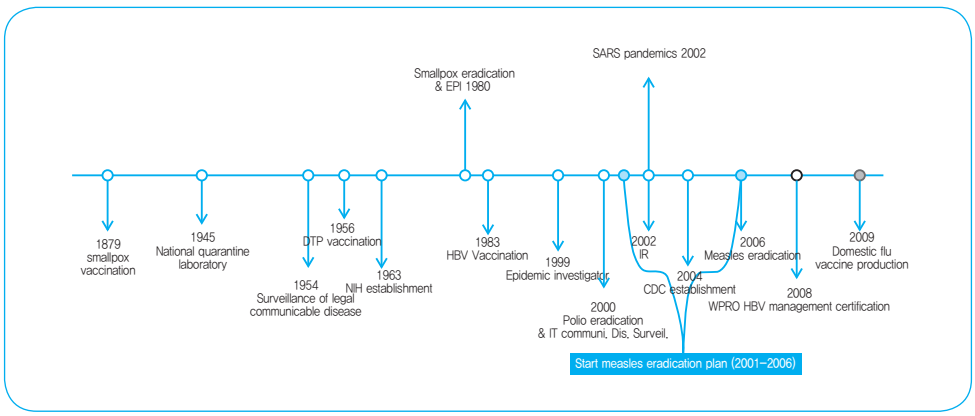
In 2003, the Korea Centers for Disease Control and Prevention was established, as an expansion of the duties previously covered by the National Institutes of Health. In addition, Korea's first separate immunization organization, the Immunization Management Division (currently Division of Vaccine Preventable Disease Control and National Immunization Program) was set up. After the department was formed, there were efforts to assemble various professionals related to immunizations and immunizations, which had been seen as part of the management of infectious diseases, was seen as a separate and independent task. To improve the quality of the immunization program, a variety of efforts were employed. A vision and goals for the immunization program were established, an individual immunization records management system was put in place (the National Immunization Registry Information System), and systematic training of the workforce in public health centers and private medical institutions began. Private medical institutions started to participate actively in the National Immunization Program in order to improve the qualified immunization coverage rate, and the reminder/recall service was introduced. Furthermore, the administration of immunizations for disadvantaged groups, the measurement of national immunization coverage, and other such various policies were also revived.

Among all these policies, the introduction of the National Immunization Registry Information System (IRIS) in 2002 was a significant landmark in Korean public health history. In 2002 the basis of Korean immunization policy changed from quantity management through group immunizations to quality management through personalized immunizations.

The development of various immunization-related institutions can be summarized as follows: in 1945, the Joseon Epidemic Prevention Institute, which was responsible for the prevention and control of infectious diseases, immunizations, production of vaccines, research, etc., was established. In 1963, the National Institutes of Health, responsible

for the management of infectious diseases, research, and the education of health care professionals, was established. Smallpox was declared to be eradicated in 1979, And the National Institutes of Health assigned physicians in the cities and provinces to be trained as epidemiology investigators in 1999. In the first decade of the 21st century, Korea celebrated its rapid progress of its immunization programs. Polio was declared eradicated in Korea in 2000, and in the following year, the National Immunization Registry Information System was established. In 2004, the Korean National Institutes of Health was reorganized and the Korea Centers for Disease Control and Prevention was founded. In 2006, Measles was declared eradicated in Korea and two years later, Korea received a certification for maintaining those positive for hepatitis B surface antigen below 0.2% of the population aged 15 or under [Figure 1-6].

Figure 1-6 | The Historical Development of Immunization-related Organizations



Source: Administrative reports of Korea Centers for Disease Control and Prevention

2012 Modularization of Korea's Development Experience
Korean National Immunization Program for Children

Chapter 2

National Immunization Program

1. Organizations Managing Immunizations
2. Expert Committees
3. Recommended Immunization Schedules

National Immunization Program

1. Organizations Managing Immunizations

Korea's immunization-related organizations can generally be divided into the central government level, the provincial and metropolitan city government level, and finally the city, county, and district government level. At the central government level, there is the Ministry of Health and Welfare and the Korea Centers for Disease Control and Prevention. Other related organizations are the Food and Drug Administration that covers the testing of imported and domestic vaccines in the country and the Public Procurement Service that is responsible for purchasing and supplying vaccines used in community health centers. The Department of Disease Policy under the Ministry of Health and Welfare, which is the central organization, is responsible for drawing up and coordinating policies on infectious diseases and illnesses. For setting up prevention plans and managing immunizations targeting infectious diseases, the Division of Vaccine Preventable Disease (VPD) Control and the National Immunization Program (NIP) of the Korea Centers for Disease Control are in charge. Furthermore, they monitor adverse effects, operate the national compensation scheme, supply the vaccines, and manage information. In terms of the development and operation of concrete and practical strategies for the immunization program, various professional committees are in authority <Table 2-1>.

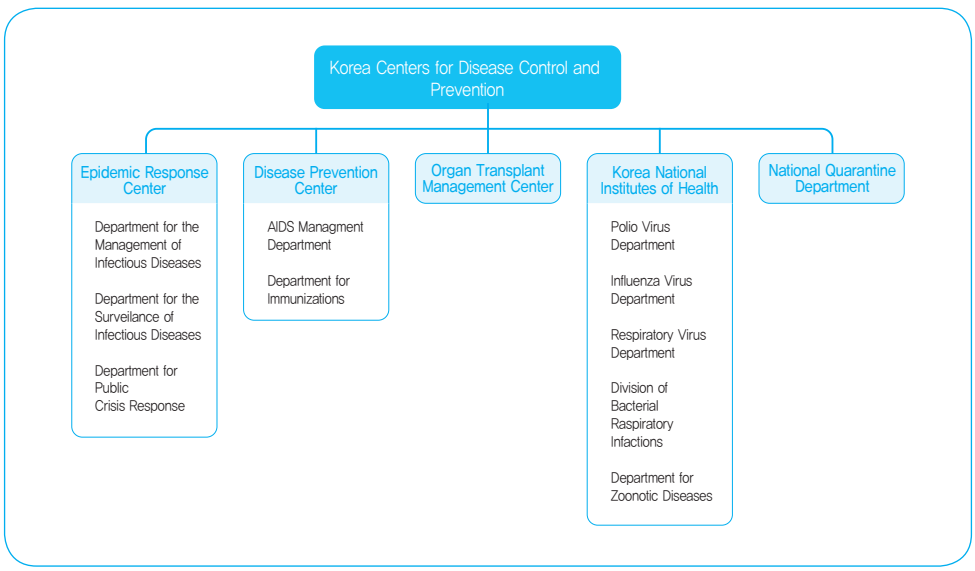
Table 2-1 | Tasks of the National Agencies related to Immunization

Department in charge	Major immunization-related tasks
Department of Health and Welfare (Disease Policies Division)	• Put all the policies on infectious diseases together and coordinate them • Particulars regarding laws concerning infectious diseases • Particulars relating to measures preventing infections in medical institutions • Support the National Tuberculosis Hospital and National Hospital for Hansen's Disease • Support the Korea Centers for Disease Control and Prevention • Support organizations and partnerships regarding tuberculosis, Hansen's disease, AIDS, and other infectious diseases
Korea Centers for Disease Control and Prevention (VPD Control & NIP Division)	• Target infectious diseases, immunizations, and manage and operate plans • Monitor adverse reactions after immunizations and epidemiological investigations • Manage vaccination damage, national compensation surveys • Vaccination: standards of conduct and management methods • Coordinate and plan the supply and demand of vaccines, support vaccine development • Carry out tasks regarding the registry of immunizations • Oversee the Immunization Expert Committee and the Immunization Victims Compensation Committee • Educate and train diseases through public relations
Food and Drug Administration	• Manufacture, import and grant permission to imported items and manufacture biological diagnostic medicine and biological products • Assess the effectiveness, safety and quality of biological diagnostic medicine and biological products • Assess the clinical examination plan for biological diagnostic medicine and biological products • Preliminary review of biological diagnostic medicine and biological products • Manage and set the standard for biological products
Public Procurement Service (Materials and Equipment Division)	• Analyze and evaluate purchases • Conduct surveys of procurement costs and particulars of the system associated with expected pricing • Assess and adjust domestic supply and demand plans

Source: Administrative reports of Korea Centers for Disease Control and Prevention

After its launch in 2003, all tasks are addressed under the Korea Centers for Disease Control and Prevention. In terms of work content and quality, the program started to gradually take on a professional image. In particular, the Ministry of Health and Welfare Diseases Policy Division largely sets the immunization policy and the Korea Centers for Disease Control VPD Control and NIP Divisions are in charge of technical judgments about immunizations and the actual operation of immunization programs [Figure 2-1].

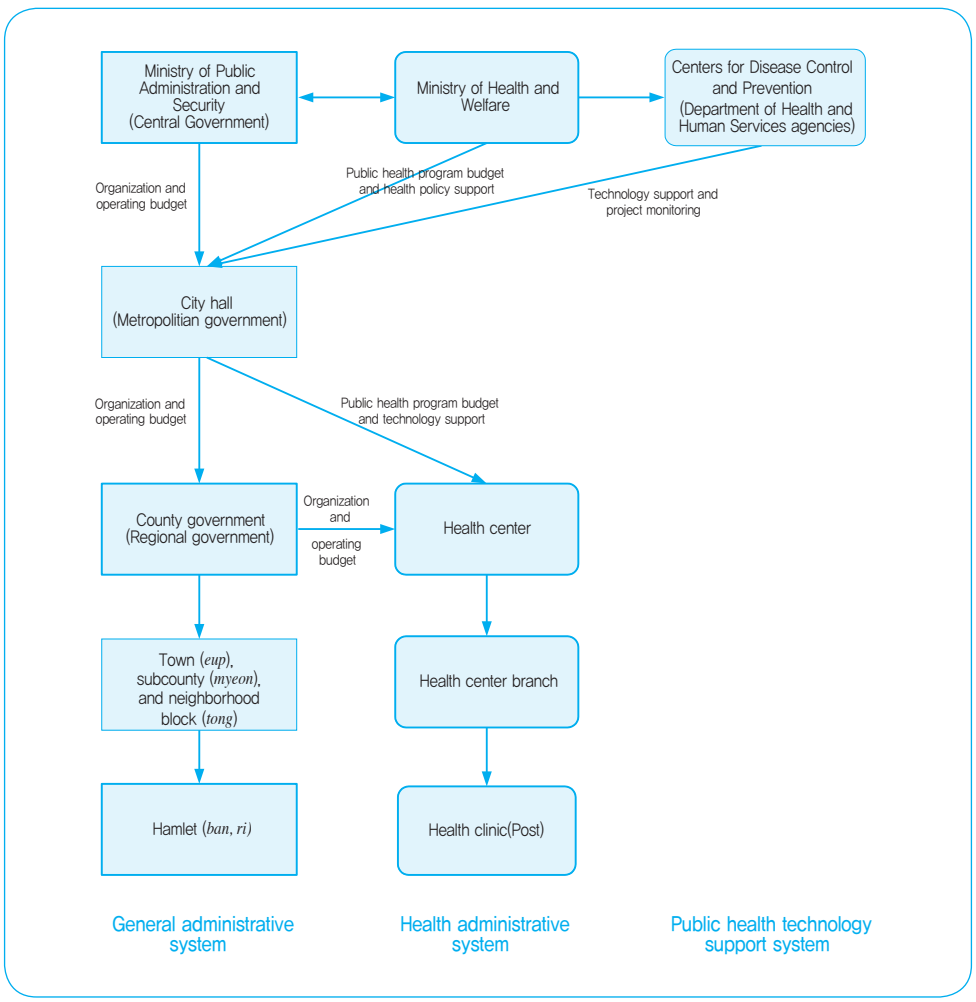
Figure 2-1 | Immunization-related Organizations in the Korea Centers for Disease Control and Prevention



As for local organizations, the provincial government fiscally supports the city, county, and district health centers so that they can offer an immunization program. In particular, the provincial government has the responsibility to check and report the performance of county government's immunization programs to the national government. The county governments set up public health centers and operate the facilities and personnel. For implementing the immunization program, the public health center is in charge. A public health center offering immunizations has the responsibility to oversee the practice of immunizations in the medical institutions in the area under its jurisdiction. It also directly offers immunization services. However, as community health centers are providing immunizations for free, it is difficult for a public health center to work with private health institutions in offering immunizations. Yet, even at private medical institutions, an individual can report adverse reactions after an immunization. Guidance and supervision managing the quality of the immunizations are also held at private medical institutions.

Under the public health center, there are public health center branches and health posts. Normally the public health center branch employs one public health doctor, one dentist, and two health staffers. Towns (*eup*) and sub-counties (*myeon*) under the jurisdiction of each health facility carry out immunizations under the health center's guidance. For a small or spread out population whose accessibility to the medical institution is difficult, a health clinic (health post) is established in villages. One health staffer who holds a nurse's certificate works there and carries out immunizations for the citizens of that hamlet (*ri*) under the health center's guidance [Figure 2-2].

Figure 2-2 | Relationship of the General Administrative System and the Health Administrative System



Source: Administrative reports of Korea Centers for Disease Control and Prevention

2. Expert Committees

Immunizations at the national level are under the jurisdiction of the Infectious Disease Management Committee. This committee deliberates methods and standards of conducting immunizations, and the pre-purchase, production, and stockpiling of medicine and equipment.

Specifically, members of the committees include the Infectious Disease Management Committee, the Immunization Expert Committee, the Expert Committee on Compensation for Immunization Victims, the AIDS Committee, the Tuberculosis Committee, the Committee for Epidemiological Investigations, and the Committee for Zoonotic Infections. Of these committees, only two that are directly related to immunization will be introduced below.

2.1. Immunization Expert Committee

Immunization Expert Committee is the most important committee with respect to immunizations. It deals with the designation of diseases that should be targeted through immunizations, immunization criteria and methods, policies on tackling infectious diseases with immunizations, and the control (or eradication) of diseases.

The Immunization Expert Committee is composed of approximately 15 people. The committee includes vaccine safety management personnel, immunization management personnel, health care professionals, a person from civic groups, preventive medicine or public health scholars, experts in the field of immunology, experts in the field of microbiology, experts in the field of adverse reactions to immunizations, and experts in the field of health economics. In addition, under the Immunization Expert Committee, there were twelve subcommittees. Specifically, these are as follows: 1. Tuberculosis subcommittee, 2. Hepatitis type A/B subcommittee, 3. Diphtheria-tetanus-pertusis (DTaP) polio subcommittee, 4. Measles-mumps-rubella (MMR) subcommittee, 5. Japanese B encephalitis/hydrophobia subcommittee, 6. Influenza subcommittee, 7. Varicella subcommittee, 8. Hemorrhagic fever/typhoid subcommittee, 9. Haemophilus influenzae Type B (Hib)/pneumococcal/meningococcal subcommittee, 10. Human papilloma virus subcommittee, 11. Rotavirus subcommittee, 12. Adult subcommittee, and 13. Policy coordination subcommittee. The role of the subcommittees is to research field-related important issues and develop guidelines or advice. Each subcommittee is composed of less than 20 members. Also, there is a commission for the eradication of infectious diseases and eradication certification (the National Certification Commission on Measles and the National Certification Commission of Polio Eradication) with approximately 10 members. This certification committee performs surveillance and conducts research on infectious diseases. Afterwards, they assess

the alleviation and eradication of the diseases. They also write an annual report, submit the report, plan the control and eradication of infectious diseases, and coordinate international cooperation.

2.2. Expert Committee on Compensation for Immunization Victims

The Expert Committee on Compensation for Immunization Victims holds hearings on injuries or other related situations that arise from immunization. Some of the important points deliberated upon include 1. whether the damage was caused by immunization and what the requisite compensation is, 2. the standards and methods of compensation for damages caused by immunization, 3. the particulars of additional condolence money the head of the Infectious Disease Management Committee offers, and 4. whether there was something wrong with the medicine used or a mistake made by the medical personnel giving the immunization, and if so if it was willful or unintentional negligence by the person administering the medicine used in immunizations or treatment or if it was by a third party.

The Expert Committee on Compensation for Immunization Victims has one chair, one vice-chair, and 15 members. The members are 1. the managing director responsible for vaccine safety in the Food and Drug Administration, 2. the managing director responsible for immunizations in the Korea Centers for Disease Control and Prevention, 3. related professionals (A. a clinical doctor with extensive experience in performing immunizations, (Department of Pediatrics, Internal Medicine, etc.), B. a professional recommended by immunization-related civic organizations, C. a lawyer recommended by the Korean bar association, D. forensic scientists, E. medicine experts, F. experts in the field of diseases targeted by immunizations, G. experts in the field of immunology associated with immunizations, H. experts in the field of microbiology associated with immunizations, and I. either members of the board of infectious disease management and related societies and organizations or those who have received recommendations from committee members. These professionals receive their appointment and commission from the chair of the Infectious Disease Management Committee.

In addition, the Expert Committee on Compensation for Immunization Victims forms the damage investigation team. Primary tasks are to determine whether death or other severe adverse reactions occurred after the immunization, to perform initial epidemiological investigations, and to decide whether to use the vaccine according to the provisional conclusions and deliberations about the results of the autopsy and the epidemiological investigations. The damage investigation team is composed of pediatrics specialists, forensic experts, medicine experts, and, if required, immunization safety administrators from the Food and Drug Administration.

3. Recommended Immunization Schedules

The standard immunization schedule (CDC, 2011) is based on the comprehensive opinion of the specialized committees and sub-committees. Below is a detailed table of national immunizations for children – the types, the frequency, the intervals, and the ages <Table 2-2>, [Figure 2-3].

Under the question, "Which should be vaccinated?" the benefit of the immunization, the disease, and the dangers are reviewed before a decision is made. Furthermore, the decision is influenced by the incidence rate, the severity, the cost and benefit, the general public's acceptance, and a variety of other factors. Therefore, this is a continual process.

In Korea at present, there are 11 required immunizations that are offered. The World Health Organization (WHO) recommends including Haemophilus influenzae type b (Hib), Streptococcus pneumonia, hepatitis A, and rotavirus also, but immunizations for those diseases are not included yet.

Table 2-2 | Ages and Intervals for National Standard Pediatric Immunizations

Disease	Vaccination	Recommended time for the immunization	Minimum age	Next immunization interval	Minimum immunization interval
Tuberculosis	BCG (intradermal)	from birth to 1 month	-	-	-
Hepatitis B	Hepatitis B (1st)	at birth	at birth	1 - 4 months	4 weeks
	Hepatitis B (2nd)	1 - 2 months after birth	4 weeks after birth	2 - 17 months	8 weeks
	Hepatitis B (3rd)	6 - 18 months after birth	24 weeks after birth	-	-
Diphtheria Tetanus Pertussis	DTaP (1st)	2 months after birth	6 weeks after birth	2 months	4 weeks
	DTaP (2nd)	4 months after birth	10 weeks after birth	2 months	4 weeks
	DTaP (3rd)	6 months after birth	14 weeks after birth	6 - 12 months	6 months
	DTaP (4th)	15 - 18 months after birth	12 months after birth	3 years	6 months
	DTaP (5th)	4-6 years	4 years	-	-

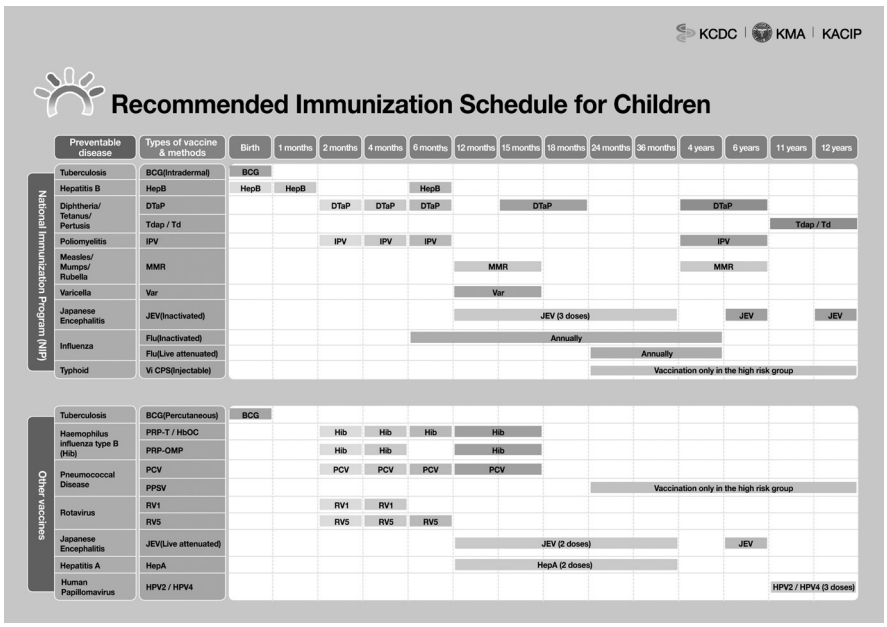
Disease	Vaccination	Recommended time for the immunization	Minimum age	Next immunization interval	Minimum immunization interval
Polio	Inactivated vaccine (IPV, 1st)	2 months after birth	6 weeks after birth	2 months	4 weeks
	Inactivated vaccine (IPV, 2nd)	4 months after birth	10 weeks after birth	2 - 14 months	4 weeks
	Inactivated vaccine (IPV, 3rd)	6 - 18 months after birth	14 weeks after birth	3 - 5 years	6 months
	Inactivated vaccine (IPV, 4th)	4-6 years	4 years	-	-
Measles Mumps Rubella	MMR (1st)	12 - 15 months after birth	12 months after birth	3 - 5 years	4 weeks
	MMR (2nd)	4 - 6 years	13 months after birth	-	-
Japanese encephalitis	Inactivated vaccine (1st)	12 - 23 months	12 months	7 - 30 days	7 days
	Inactivated vaccine (2nd)	12 - 23 months	12 months	12 months	6 months
	Inactivated vaccine (3rd)	24 - 35 months	18 months	3 - 4 years	2 years
	Inactivated vaccine (4th)	6 years	5 years	6 years	5 years
	Inactivated vaccine (5th)	12 years	11 years	-	-
	Live attenuated vaccine (1st)	12 - 23 months	12 months	12 months	12 months
	Live attenuated vaccine (2nd)	24 - 35 months	24 months	3 - 4 years	2 years

Disease	Vaccination	Recommended time for the immunization	Minimum age	Next immunization interval	Minimum immunization interval
Influenza	Inactivated vaccine	at least 6 months after birth	6 months	1 month	4 weeks
	Live attenuated vaccine	at least 24 months after birth - 49 years of age	24 months	1 month	4 weeks
Varicella (Chicken pox)	Varicella	12 - 15 months after birth	12 months after birth	4 weeks	4 weeks
Adult diphtheria and tetanus	Td	11 - 12 years	7 years	10 years	5 years
Adult diphtheria, tetanus, and pertussis	Tdap	at least 11 years	11 years	-	-

1. The third dose of hepatitis B vaccine should be at least 8 weeks after the second dose and 16 weeks after the first dose. The third dose should also not be prior to 24 weeks of age
2. The recommended interval between the third and fourth doses of DTaP is at least 6 months. However, if the fourth dose was administered at least 4 months after the third dose, there is no need to administer the fourth dose again
3. If there is a measles outbreak, infants between 6 and 12 months of age can be immunized. However, providing measles immunizations for those under 12 months of age is not part of the standard immunization schedule
4. For children of 6 months to 9 years of age who have had only one dose or none, two doses of inactivated influenza vaccine are recommended at a 4 week interval. Children in the same age range who have been immunized for influenza can simply be vaccinated once a year
5. For children of 12 months to 13 years of age, one dose of varicella vaccine is enough. For those above age 13, two doses are recommended at an interval of 4 weeks or more

Source: Administrative reports of Korea Centers for Disease Control and Prevention

Figure 2-3 | National Standard Immunization Schedule for Children



Source: Epidemiology & management of vaccine preventable disease

2012 Modularization of Korea's Development Experience
Korean National Immunization Program for Children

Chapter 3

Immunization Service Providers

1. Public and Private Providers
2. Reimbursement System

Immunization Service Providers

1. Public and Private Providers

1.1. Public Sector

Public health centers are established as a basic administrative structure in every city (*si*), county (*gun*), and district (*gu*), which are the larger or more urban administrative districts of Korea. Public health center branches affiliated with a public health center are established in every town (*eup*) and sub-county (*myeon*), which are the administrative districts of more rural areas. Health posts are established in a specific vulnerable hamlet (*ri*), which is the smallest administrative unit in rural areas.

1.1.1. Public Health Centers

The healthcare administrative system was established in Korea in 1945 after liberation from Japan. The next few years comprised of a politically turbulent period, which was only after the Korean War (1951 - 1953) that the system gradually began to be improved. In 1956, a law to establish public health centers (currently the Community Health Act) was first enacted. At first, public health centers were only established at the metropolitan and provincial levels. It was not until 1963 that public health centers were established as front-line administrative units focused mainly on the city, county, and district level.

The public health centers have, up until now, been the facilities that offer the most immunization services and are the organizations directly responsible for the national immunization program. Although initially, the quantity of medical personnel was insufficient for these public health centers, doctors, nurses, nurse assistants, and those with experience working in medical institutions were put through a short period of training and were then

able to work as immunization staffers. Normally, the doctor is to determine whether it is possible to inoculate and to note if there are symptoms or any physical problems. The actual immunizations are given by the immunization staff. Currently, immunizations are usually given by a public health staffer who holds a nurse's certificate. Preliminary checkups are always done by a physician. Although it differs depending on the location, in general, the public health center's immunization workforce consists of a diagnostic doctor and two nurses.

Even though private medical institutions have been extensively developed, the general public considers the public health centers' immunizations to be trustworthy, and because of the low cost they are widely accessed. The required national immunizations are free at public health care centers. For other immunizations in some public health centers, the individual should pay for the cost of the vaccine only. Until 2008, the required national immunizations were offered for free at the public health facilities, and this encouraged the general public to visit public health centers for immunizations. On the other hand, at private medical institutions, the individual had to cover all the expenses. From 2009 onwards, immunizations were offered at private medical institutions, but even the costs of those on the list of national required immunizations were only partially covered by the government. Beginning in 2012, the cost for the individual was only 10,000 won (about US $10.00) and some qualify for a co-payment of less than 5,000 won (about US $5.00) per inoculation. Consequently, the general public could receive immunizations at private medical institutions at a minimal cost.

In the past, the greatest concern was herd immunity in Korea, so the strategy for this was mass immunizations. Rather than the general public visiting a public health facility and receiving personal immunizations, health care staffers traversed the villages and schools and administered mass immunizations to those at each school or village on a week-by-week basis [Figure 3-1]. In a situation where the economic level was so low that even medical treatment could not be properly accessed, it was rare for citizens to go all the way to a public health facility or medical facility to receive immunizations on their own initiative. Consequently, health care staffers visited places where people lived, congregated people, and implemented mass immunizations. This made a significant quantitative contribution to immunization coverage.

Figure 3-1 | Mass Immunizations at a School (1971)

Source: National Archives of Korea

As required immunizations were offered for free at the public health center, it was the most important institution for immunizations for children despite the development of transportation, the increase in privately owned vehicles, the increase in private medical institutions, and the improvement in the quality of life. However, in addition to the 254 public health centers, 7,000 other medical institutions now offer immunizations with the cost directly or indirectly covered. Of all of the immunizations offered, around 30% are now offered at public health centers.

1.1.2. Public Health Center Branches

Public health center branches have been established not in cities but in the smaller administrative districts of towns (*eup*) and sub-counties (*myeon*), which tend to be in less densely populated areas. They were introduced in 1960 to solve problems of areas without medical personnel. A public health center branch employs one doctor and three health care

staffers. One of the health care staffers is responsible for maternal and infant health care, another for tuberculosis management, and the other for family planning. However, in many branches of certain areas, it has been difficult to recruit doctors or public health staff.

Beginning around 1964 when the health center branches were first established, the health care staff was selected by region and appointed to a public health center branch. Because insufficient management of these branches was a problem, they were put under the management of the town and sub-county heads in the end of the 1960s. These workers were not full-time regular civil servants but were recruited as temporary contract workers. Beginning around 1980, many of the public health care staffers lacked the required qualifications for full-time work. Consequently, a qualifying exam was scheduled for staffers, which was to be taken after training at the National Institutes of Health. If they passed the exam, they could become full-time workers. In addition, in 1993 these staffers of public health center branches were under the direct management of the public health center director from a town or sub-county. The family planning tasks and the immunization tasks were performed concurrently, which greatly contributed to solving the problem of accessibility to immunization services in rural districts. Currently, there is one doctor and one or two public health staffers at every health care branch.

As previously explained in the first chapter, in addition to public health staffers, much effort had been put in up to this time to appoint doctors to those locations. One way to induce doctors to serve at a public health center branch was a system of part-time community doctors (commissioned doctors).[6] In neighborhoods where there was no part-time community doctor, a practitioner in private practice in that area was commissioned as the health center branch director as well as the branch doctor. Similarly, physicians were recruited to public health center branches by a number of incentives, namely ① a residence at or near the public health center branch, ② a (fixed) monthly salary approximately the same as that of a general public official at a public health center, ③ income derived from patient care at the health branch was retained by the doctor as personal income, and ④other incentives such the attainment of social status in the town or sub-county.

The health center branch's temporary doctor was under the management of the public health center director, but health personnel as civil servants in that neighborhood were under the administration of the head of the town or sub-county. In this redundant system, the health personnel received health and medically related technology supervision from the branch director (doctor). In the 1990s, the personnel management was consolidated into the

6. If the Health Branch Office of a rural area was not able to recruit a doctor to serve its community, a doctor practicing in a nearby urban area was forced to serve at the Health Branch Office (mobilization by Article 21 of the National Medical Act [1951]). In the 1970s, a doctor who was not able to pass the national medical examination could be licensed to practice after working provisionally for two years in a rural area.

public health center, and in the 1980s, doctors could fulfill their national military service requirement by working as doctors in areas without doctors. This policy played the greatest role in helping to eradicate the problem of lack of doctors in rural areas <Table 3-1>.

Table 3-1 | Legal Systems to Secure Doctors for Underserved Areas

Division	Statutory basis	Role	Year implemented	Duration of doctor's service
Public health physician	Act on special measures for rural healthcare (Section 3335 Amended , '80.12.31)	Doctors and dentists who did not complete their military service and were incorporated in the reserve officer corps. After working in an area designated by the Minister of Social and Health Affairs, they could be exempt from the military service duty.	1979	3 years
Public health scholarship physicians	Act on special cases concerning public health scholarships (Section 2911 Amended '76.12.22)	Medical students who received scholarships from the government would have their loans paid depending on the number of years engaged in public health work.	1977	2 - 5 years
Specialized duty assigned physician	Medical law article 11, regulations pertaining to a doctor's conditional license (Section 519 Amended '76.4.24)	Physicians who failed the national medical examinations could work in a public health center of particular rural region for two years, and then be licensed.	1976	2 years
Appointed (General and geographically restricted doctors)	Medical law, article 57	In the case when there was no doctor directing a public health center or branch, a private medical practitioner was appointed.	1962	No limits

Source: Ministry of Health and Social Affairs (1983), "White Paper on Health and Society," *Ministry of Health and Social Affairs* (in Korean), p.153

At this time, immunization health workers went out to administer immunizations at a school, at a village hall, or in a vacant lot and regularly performed mass vaccinations. It was the guardians' responsibility to care for children under 14 for whom they were responsible. Since infectious diseases were common, the general public's reaction towards immunizations was very positive. Moreover, the magistrate of a county or heads of a town or sub-county had responsibility for public health administration. Consequently, both the administrative support and the business management for immunization were simpler.

The medicines used in the vaccines were supplied by the public health center, and a regular refrigerator was installed in each health center branch to store the medicines. However, if a large quantity of medicines was in need or if the electric power situation was not optimal, the medicines were supplied directly from the public health center. During mass immunizations, the medicines could be put in an icebox and moved conveniently. At this time, the populace in rural areas did not have a proactive attitude towards immunizations and did not usually come to a public health center branch for immunizations.

Recently there has been a reduced role for the public health center branches in administering immunizations. The young population has left rural districts for the cities, and there has consequently been a marked reduction in the population who would be targeted by immunizations. With the increase in private medical institutions and the increase in private car ownership, the use of city-based health care has also increased. The immunizations at the public health center were administered after a preliminary checkup by a doctor (the public health physician) and then the immunizations were given by the health staffers. The national required immunizations were completely free. For all other immunizations, the only cost was the price of the vaccine.

1.1.3. Health Posts

Health posts were established in hamlets as frontline health agencies. Regions that were targeted for health posts had a resident population of more than 500 and were located where it took over 30 minutes by public transportation from a medical institution. In September 1981, health posts were established firstly in 257 villages. Currently, there are 1,909 of them. Health posts were proposed in the late 1970s as a strategy to solve a developing country's health problems. The reason for health post establishment was that in the majority of rural districts, access to private medical institutions was very difficult.

In health posts, there is only one health staffer. The health staffer's living space and the clinic (treatment center) are sometimes in one building and sometimes in separate buildings. Health staffers need a nurse's license and should acquire a public health practitioner's qualification after receiving six months of training. Their main tasks include maternal and infant care, family planning, treatment for minor illnesses, and chronic disease management.

However, with a drastic decrease in the young population, there are almost no young people left who need immunizations. Hence, the significance or supply of immunizations are not as much, compared to those of the past. Regardless, immunizations are still available at health posts, and the national routine immunization can be obtained at no cost.

1.2. Private Sector

In the 60s and 70s, there were an insufficient number of private medical institutions. Given the lack of service providers for those suffering from acute diseases, there was no reason to exert particular effort regarding immunization services in private institutions. Therefore, private medical institutions took only a small role in immunization service. However, they are now growing in numbers.

Currently, it is estimated that approximately 7,000 private medical institutions offer immunizations. Traditionally, the quantity of immunizations offered at private institutions was small compared to those offered at public health centers (Until 2009, the immunizations at private institutions accounted for 40% of the national immunizations for children). Normally, one doctor, one nurse (or nurse's assistant) and other health care staffers work at each primary health care medical facility. Until 2000, immunization service was not covered in the national health insurance, and national resources did not provide immunization facilities at private medical institutions. Therefore, individuals who received immunizations had to bear the whole immunization cost themselves.

In the past, only public health centers provided national routine immunizations. However, private medical institutions argued that this was unfair and refused to cooperate with the national immunization program. Accordingly from 2009, the system was improved so that private medical institutions could be permitted to participate in the national immunization program. As a result, the use of private medical institutions for immunizations is expected to gradually rise.

2. Reimbursement System

2.1. Background

Starting in March 2009, a reimbursement system for private medical institutions was introduced in national routine immunization. In this state-supported program, the state bears the cost of mandatory immunizations for private institutions. This was an important feature that distinguished it from previous immunization programs in Korea. In the 50s and 60s, the poor socioeconomic level and specifically the low level of sanitation, caused

large scale epidemics and deaths. The lack of health care personnel and their low level of training made the situation even more difficult. Therefore, the immunization policy at that time was focused on giving immunizations to as much of the general public as possible. Instead preparing in advance, immunizations were given at places such as train stations or bus terminals during the spread of an epidemic. Under such circumstances, the formation of a more robust policy for the purpose of improving the quality of the immunizations and controlling/eradicating infectious diseases was remote.

As the general public's education level and their socio-economic level gradually increased, the supply of medical staff became sufficient. Due to this improvement, the overall quality of the immunization systems started to gain more focus. This focus brought about the reimbursement system (a state-supported project to bear the costs of mandatory immunizations). The program's goal was to improve the coverage of immunizations until a disease had been successfully eradicated and to reduce and ultimately eradicate infectious diseases that could be prevented. To further this goal, the main focus was to raise immunization coverage to over 95% by enhancing the quality of immunization services, improving the accessibility of immunization facilities for community citizens, and reducing the cost burden of immunizations for guardians. At the societal level, the goal of this program was to alleviate the burden of child care and decrease the health bills and medical expenses of the general public through the reduction of infectious diseases.

For effective immunizations, the patient must be inoculated at a proper time and in an appropriate manner, and have as many booster shots as required. In Korea, basic immunization coverage is over 95%, but additional immunization coverage is only 90-94%. In 2008, 59.5% of children from 0 to 6 years of age had full coverage (all immunizations, namely 1 BCG, 3 HepB, 4 DTaP, 3 polio, and 1 MMR) (Pack, et al., 2009). In 2011, only 56.3% of children at age 3 had full immunization coverage (all immunizations, namely 1 BCG, 3 HepB, 4 DTaP, 3 polio, 1 MMR, 1 varicella, 3 (or 2) JEV) (Lee, et al., 2011). In addition, approximately 7,000 medical facilities offered immunizations nationwide; however, free immunizations were only given at the 254 public health centers. So those who needed immunizations could get free immunizations only by going to the public health center. Private medical institutions were easily accessible, but as the full cost had to be borne by the individual (Ko, 2007; 50 (8): 600-601), the cost of the immunization was a substantial burden. In the case of immunizations at a private medical institution, the cost of the national required immunizations was approximately 490,000 won (450 US$) per infant. This was an extra burden in childcare. Therefore, the purpose of the reimbursement system (the National Immunization Reimbursement System) was to facilitate access to the national required immunizations at the nearest medical institution through state support.

With the reimbursement system, the cost-benefit ratio of immunizations was approximately 4 to 30 times (for hepatitis B, 4 times; for polio, 9 times; for MMR, 24 times; and for DTaP, 32 times) (CDC, 2001). Therefore, this also greatly contributed to limiting national health expenditures. The launch of the reimbursement system in Korea's immunization program was a very important starting point. The change of focus from public health care center immunization programs to the participation of private medical institutions was highly significant. Particularly when immunizations at public health centers were free and those in private medical institutions were not, there was a struggle between the private and public sectors. However, after this was solved, private medical institutions could actively involve in the national immunization program.

2.2. Program Evolution

2006: Basic legislation enacted (Participation of private medical institutions in the national immunization program)

2009: Implementation of the medical facility reimbursement program (National program for reimbursing the cost of required immunizations)

Contents supported: The cost of required immunizations at hospitals and clinics for children ages 0 - 12

Vaccines supported: hepatitis B, tuberculosis (BCG, intradermal), diphtheria/tetanus/pertussis (DTaP), polio (IPV), measles, mumps, rubella (MMR), Japanese encephalitis (inactivated vaccine), varicella, tetanus/diphtheria (Td) (8 types)

Costs supported: 30% of the immunization; an individual had to pay approximately 15,000 to 16,000 won (US $15.00-16.00).

2012: Expansion of the private medical facility reimbursement system (national program to reimburse the cost of required immunizations)

Contents supported: The cost of required immunizations at hospitals or clinics for children ages 0 - 12

Vaccines supported: BCG (intradermal), hepatitis B, diphtheria/tetanus/pertussis (DTaP), polio (IPV), varicella, measles/mumps/rubella (MMR), Japanese encephalitis (inactivated vaccine), tetanus/diphtheria (Td), diphtheria/tetanus/pertussis/polio (DTaP-IPV), tetanus/diphtheria/pertussis (Tdap) (a total of 11 types of diseases, 10 types of vaccines)

Costs supported: 10,000 won (about US $10.00) cost of the vaccine and cost of the inoculation (individual is responsible for less than 5,000 won– about US $5.00)

2.3. Major Strategies

2.3.1. State-supported National Essential Immunizations

- Expansion of national support to cover the cost for national essential immunizations at private medical institutions for children aged 12 and under
- Expansion of the range of medical institutions giving immunizations (improvement of accessibility for providers)

2.3.2. Improvement of Immunization Coverage in the Community

- Immunization information guidance services (immunization schedules and missing immunizations)
- Management of immunizations for disadvantaged groups
- Public relations regarding immunizations

2.3.3. Improvement in the Quality of Immunization Services

- Immunization education for medical personnel
- Stabilization of vaccine supply
- Strengthening of the vaccine safety management system
- Operation of the immunization registry

2.4. Program Performance

In 2011, the number of medical institutions participating in the reimbursement system was 6,769 and the average number of applications for reimbursement per month was 272,486 <Table 3-2>. In June 2012, the number of medical institutions participating in the medical institution reimbursement system (the national program for reimbursing the cost of essential immunizations) was 7,149. The average number of applications for reimbursement per month was 548,850.

Table 3-2 | Performance of the Medical Institution Reimbursement System

Category	2009	2010	2011	Growth relative to previous year (%)
Number of participating medical institutions	3,949	4,937	6,769	5.6
Number of participating pediatric clinics	364	1,011	2,302	1.9
Average number of claims for reimbursement per month	87,666	119,648	272,486	101.4

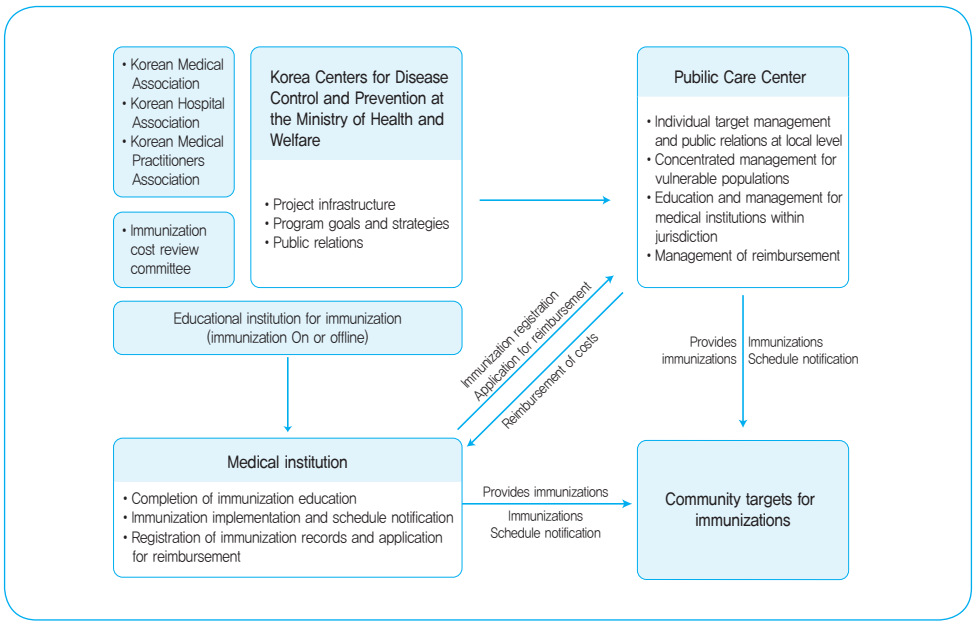
Source: Administrative reports of Korea Centers for Disease Control and Prevention

2.5. Program Implementation System

The mayor, county magistrate, and sub-county head (or public health center director) have entrusted immunization services to the private medical institutions under their jurisdictions. The medical institutions use the computerized Immunization Registry Information System (IRIS) to type in individual immunization records. If an immunization is registered, a claim for immunization reimbursement is automatically sent. When giving the immunization, the medical institution should check the prior immunization record from the immunization management information system before administering an immunization so that the appropriate immunization could be administered [Figure 3-2].

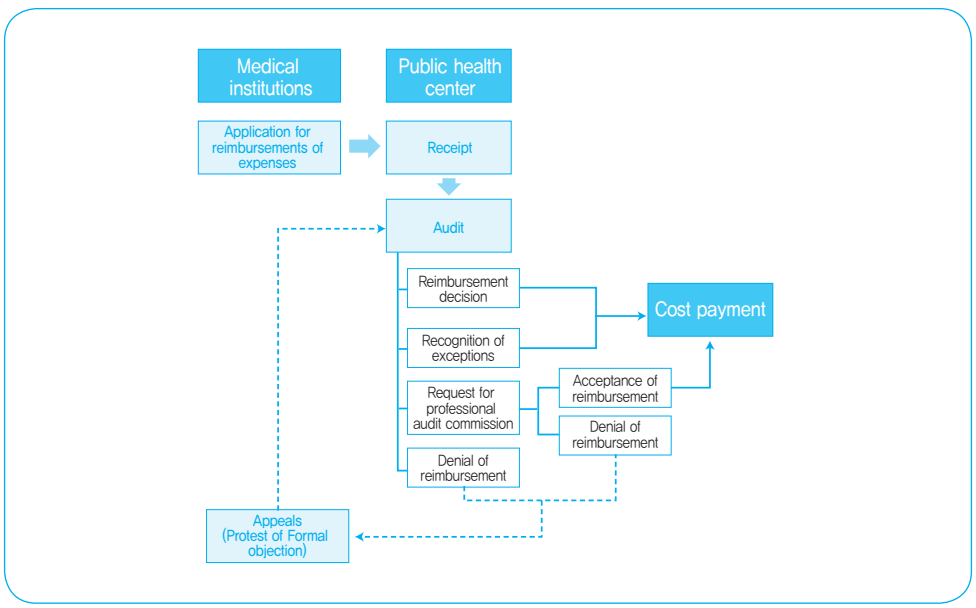
Once the immunization is registered in the computerized Immunization Registry Information System at the medical institution, the public health center will reimburse the cost if it is covered by the reimbursement system [Figure 3-3].

Figure 3-2 | Reimbursement System for Medical Institutions



Source: Administrative reports of Korea Centers for Disease Control and Prevention

Figure 3-3 | Reimbursement System for Immunization Expenses



Source: Administrative reports of Korea Centers for Disease Control and Prevention

2.6. Implications

The socioeconomic level and the level of education of the general public have improved, whereas the birth rate has decreased. Consequently, parents' interest in their children has been markedly increasing, and the rate of immunization coverage has also dramatically increased. Correspondingly, there is continuous demand for a more sophisticated policy with regard to the quality of scheduled and complementary immunizations. Furthermore, as a result of the measles epidemic in 2000 and the H1N1 influenza epidemic in 2009, there is a national consensus that the state should have a more sophisticated immunization program.

To solve some basic problems with quality of immunization, the government established a computerized Immunization Registry Information System in 2002. The purpose of this program was to promote the participation of private medical institutions in the National Immunization Program and to increase access to institutions that offered children immunizations. Through this initiative, free national immunizations that were available only at the public health centers were expanded to private medical institutions. As a result, not only at public health centers but also at private medical institutions, information of personal immunizations could be saved in the Immunization Registry Information System. Thanks to this system, immunization registries could be checked before immunizations were given, the correct immunizations could be administered, and guardians could check their children's registry at any time.

Through such measures, the focus was changed from group vaccinations to individual vaccinations. As the medical personnel could check the immunization status of every individual, they could administer the required immunizations in a timely manner. This boosted the effort to eradicate infectious diseases.

2012 Modularization of Korea's Development Experience
Korean National Immunization Program for Children

Chapter 4

Vaccine Supply Systems

1. Vaccine Production and Sales
2. Vaccine Supply
3. Vaccine Supply Monitoring System
4. Implications

Vaccine Supply Systems

1. Vaccine Production and Sales

Vaccines are different from general medicine because the uses of vaccines are very limited and few. As a result, the proportion of vaccines in the whole market is small. Hence, as the production and distribution of vaccines is difficult and costly, the state of the national vaccine supply is worth consideration. Due to low product prices, profit margins are low. Furthermore, the vaccine market has a small number of providers because existing vaccine producers are in a dominant position in the market, multinational vaccine companies cause market distortion, and the potential for market expansion is limited. This is markedly different from other sectors of the pharmaceutical market. For these reasons, experts recommend various policies to improve the market. That is, to supply vaccines more stably and to further develop technologies.

In 2011, 14 companies in Korea were involved in the production and supply of vaccines, including 7 domestic firms, 5 multinational firms, and 2 importers. The domestic companies are normally involved in domestic manufacturing with either domestic or imported raw materials. On the other hand, most multinational companies and importers are involved in importing finished products.

In 2011, among the 30 immunization vaccines that are in circulation for the national immunization of infants, only 8 (26.7%) were domestically manufactured, 16 (53.3%) were imported as finished products, and 6 (20%) were manufactured domestically using imported raw materials. Examining the manufacture of vaccines by type shows that 100% of BCG, MMR, DTaP-IPV, and Tdap vaccines were finished imports. Hepatitis B and Japanese encephalitis vaccines were 100% domestically manufactured, while DTap, polio, and Td vaccines were either manufactured domestically with imported raw materials or

were imported as finished products. Varicella vaccines were either produced at domestic production facilities or supplied through imports of the finished products <Table 4-1>.

Domestic firms produced their own vaccines for hepatitis B, Japanese encephalitis, and varicella. BCG is scheduled to be produced domestically in the near future. DTaP, MMR, polio, and other important vaccines were either produced overseas and then imported or needed imported raw materials for production. Thus, shortages in domestic vaccine supply could occur depending on changes in the international environment.

Table 4-1 | Manufacturing of Vaccines for National Required Immunizations of Infants in 2011

(Unit: dose)

Type of vaccine	Domestically manufactured	Domestically manufactured with imported raw materials	Imported finished products	Total
BCG (blood content)	0 (0.0%)	0 (0.0%)	37,110 (100.0%)	37,110 (100.0%)
Hepatitis B	3,997,903 (100.0%)	0 (0.0%)	0 (0.0%)	3,997,903 (100.0%)
DTaP	0 (0.0%)	2,287,459 (92.9%)	175,890 (7.1%)	2,463,349 (100.0%)
DTaP-IPV	0 (0.0%)	0 (0.0%)	331,864 (100.0%)	331,864 (100.0%)
Td	0 (0.0%)	220,973 (41.3%)	314,582 (58.7%)	535,555 (100.0%)
Tdap	0 (0.0%)	0 (0.0%)	150,691 (100.0%)	150,691 (100.0%)
Polio	0 (0.0%)	578,189 (38.0%)	942,522 (62.0%)	1,520,711 (100.0%)
MMR	0 (0.0%)	0 (0.0%)	1,204,710 (100.0%)	1,204,710 (100.0%)
Japanese encephalitis (inactivated vaccine)	1,631,616 (100.0%)	0 (0.0%)	0 (0.0%)	1,631,616 (100.0%)
Varicella	1,619,933 (86.6%)	0 (0.0%)	250,140 (13.4%)	1,870,073 (100.0%)

Source: National Institute of Food and Drug Safety Evaluation

2. Vaccine Supply

The immunization providers in Korea are classified into the public health centers (those functioning in the public sector) and medical institutions (functioning in the private sector). Thus, the supply of vaccines for public health centers and private medical institutions

are also different. The private medical institutions deal directly with the manufacturing company/sales company or acquire their supply through a wholesaler. On the other hand, public health centers currently acquire their supply of vaccines through a wholesaler that is contracted with the public procurement service. This is different from the past when they acquired their supplies directly from a manufacturing company or a wholesaler. However, when there is an insufficient supply of vaccines in a public health center, the center may purchase vaccines through its own regional wholesale company.

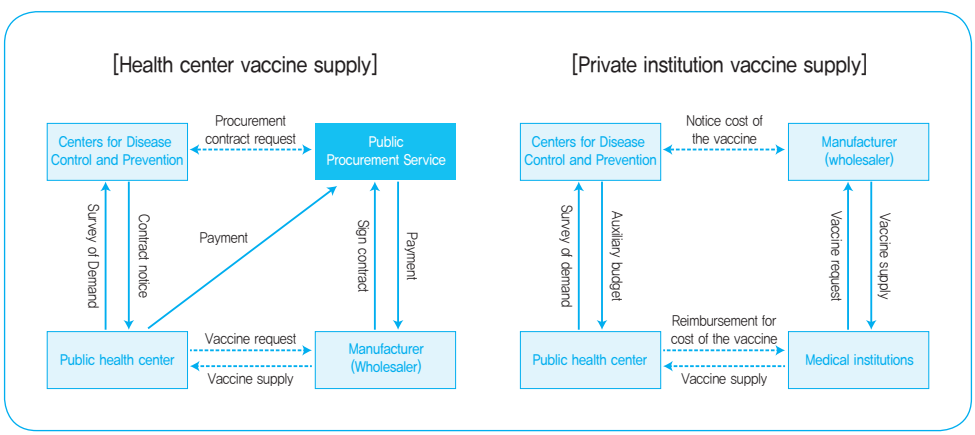
Although the vaccine budget was completely publicly funded in the past, after 1998 the national government only bore 50% of the cost. Since 2005, the cost of the vaccination has been completely supported by the health promotion fund.

2.1. Public Procurement Service

Vaccines used in public health centers are supplied through a wholesaler by means of a vaccine supply contract. Normally, the national essential immunizations are issued every year in January or February by the public procurement service to meet the demands of each public health center. The vaccine contract determines the unit price and quantity.

The public procurement service does not cover the quantity purchased but the price itself with the wholesalers. Each public health center requests purchases of specific vaccines through the public procurement system. Then contractors (such as the wholesalers) deliver the vaccine to the public health center. That is, the wholesaler is notified through the public procurement site that it should supply vaccine to the public health center [Figure 4-1].

Figure 4-1 | Procedure for Domestic Vaccine Supply



Source: Administrative reports of Korea Centers for Disease Control and Prevention

2.2. Wholesalers

The wholesaler supplies vaccines to the private medical institutions through a separate contract. When the private medical institutions request a vaccine, they deliver the vaccines directly to a hospital or clinic. Also in the case of medical institutions in remote areas, the wholesaler or distributer firms that are located in adjacent regions deliver vaccines instead of the original contracted wholesaler.

If there is waste at the hospital or clinic, it is turned over to the wholesaler who supplied it. It is then delivered to the respective manufacturing company and wholesaler and is discarded.

2.3. Manufacturers

Manufacturers can be broadly divided into multinational pharmaceutical companies and domestic pharmaceutical companies. Multinational pharmaceutical companies perform most of their distribution through domestic vendors. Along with domestic vendors, vaccines are also supplied through wholesalers.

The domestic manufacturing companies supply their vaccines directly from the company or through a wholesaler. Yet, the pharmaceuticals do not directly deliver the vaccines to public health centers. Instead, after procurement contracts are signed with the government, the wholesaler acts on behalf of the pharmaceutical companies. As they handle the delivery, the vaccines are completely supplied through a third party bidding. In response to the requests from each public health center, the vaccine supplier purchases the various vaccines from the manufacturer and delivers the vaccines to public health centers nationwide. The manufacturing company will pay the vendor's prescribed margins and distribution costs.

3. Vaccine Supply Monitoring System

Since 2012, a system to monitor vaccine supplies has been developed on the internet. The Korea Centers for Disease Control and Prevention Vaccine Supply Monitoring System tracks the status of vaccine supplies at health centers in real time. It also makes immediate response to vaccine shortages and is connected to the Immunization Registry Information System (IRIS). The Vaccine Supply Monitoring System can be accessed through IRIS (http://is.cdc.go.kr) and important information such as vaccine supply status, lot-specific receipt/factory registry details, vaccine status statistics, and the status of optimum/minimum reserves are offered on the website. However, only public health centers can use the vaccine monitoring system. As private medical institutions purchase the vaccines directly, they do not need to use the system [Figure 4-2].

On the basis of preset immunization plans, public health centers are assigned to optimum and minimum holdings of vaccines. By entering the amount of vaccine warehousing, the government can automatically see the status of the vaccine supply through the computer system at the national, city, and public health care center levels.

Figure 4-2 | Screenshot of the Vaccine Monitoring System

4. Implications

There are a limited number of vaccine manufacturing companies, unlike manufacturing companies for general pharmaceuticals. The targets of immunizations do not exceed a limited number while extensive time and resources are spent to develop the medicine used for vaccines. Therefore, special management is required. Korea has a very low level of self-sufficiency with respect to vaccines. As a result, there are difficult structural limitations to respond flexibly to the needs of epidemics or other large-scale demands. Furthermore, except for the vaccine supply for the public health centers, the supply for private medical institutions is furnished on the private market. Still, there are limitations to identifying the exact scale of the supply or managing the national supply of vaccines. Fortunately however, the country is relatively small and densely populated, so there is little difficulty in the distribution and management of vaccines.

Recently, a variety of alternative plans for the vaccine supply have been suggested. In the long term, the national government will have to manage the supply of vaccines for children. For this, the national government will have to purchase all required vaccines. The prevailing opinion is that the government would then need to distribute the vaccines on the private market. Fortunately, the computerized immunization system that begun in 2009 will allow relatively accurate analysis of the immunization supply in Korea in the near future. Based on these results, it will be possible to identify the exact demand for vaccines and set up plans to meet such demands. In this way, an effective system for managing the vaccine supply can be devised. In addition, private medical institutions and public health centers can improve their dual supply systems. It is also important to establish an organization at the national level that is in charge of supplying vaccines.

Originally, the cost for childhood immunizations was completely borne by the national government. However in 1998, the national government's share was reduced to 50%. Beginning in 2005, the cost of vaccines was not covered by general appropriations but from the Health Promotion Fund. In light of the important responsibilities of the state with regard to childhood immunizations, it would be quite natural to cover the immunizations costs from national general taxes. However, immunizations are currently funded by the Health Promotion Fund, which is not directly related to tax collection. It would be much better if the immunization budget were shared between the national and local governments and supported through taxation.

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Chapter 5

Immunization Reporting Systems

1. Immunization Registry Information System
2. Immunization Certification for School Entry
3. Adverse Reaction Monitoring System
4. Infectious Disease Surveillance System

Immunization Reporting Systems

1. Immunization Registry Information System

1.1. Introduction

The most important factors in immunization are as follows: that a greater than optimum ratio of total population receive vaccinations, and that they receive vaccinations while maintaining proper immunization intervals for the appropriate age brackets so that every individual can have optimum immunity. In order to determine and maintain precise immunization rates and the timeliness of immunization, every individual's immunization record should be registered and accessible in real time. Computerization is essential for managing these records because through an online system, information can be exchanged and same records can be effectively shared in real time. In fact, the lack of individual immunization information makes optimal management difficult. This can become an obstacle in preventing infectious diseases, making complete immunization unachievable. For this reason, as a preparatory step towards the management of target groups and elimination of infectious disease through precise immunization information, the Korea Centers for Disease Control and Prevention has developed a program to computerize and manage all immunization records and has been promoting the National Immunization Registry Information System (IRIS) since 2002. In the initial stage, IRIS was promoted in all public health centers nationwide, and from 2004, it was expanded quantitatively and qualitatively to include private medical institutions.

Despite its efforts to develop and spread the registry program, their participation is still not satisfactory. This is mainly because of insufficient participation by private medical

institutions, which provided about 40% of routine immunizations nationwide until 2009. The government body in charge of this project recognized the importance of enhancing the quality of immunizations by collecting immunization records through IRIS. In order to motivate private medical institutions to participate in the National Immunization Registry, the government has begun to pay the vaccination fees of private hospital and clinic users. 2009 was a seminal year for Korea's national immunization program, with the introduction of the 'reimbursement system for medical institutions.' An opportunity to address many of the weaknesses that had been observed over the years, this policy could solve problems stemming from low level of participation by private medical institutions.

1.2. Project Promotion Progress

2000 - 2001 (only public health centers were registered)

- Since June of 2000, IRIS programs were installed in public health centers nationwide and the computerization of individual immunization records began

2002 - 2005 (1st period)

- The Immunization Registry Information System(IRIS) was created
- Immunization Record Standardization Project: Standardized modules were supplied to public health centers/private medical institutions and information was used collectively

2006 - 2009 (2nd period)

- Database was constructed, expanded and improved
- Realization of the Infectious Disease Outbreak Prediction & Management System: Provision of rudimentary data for R&D about virtual scenario analysis on disease spreading, health policy establishment, vaccine development and effectiveness assessment, etc., and realization of a geographic information system for vaccine preventable disease (GIS VPD) prediction
- Reminder/recall service was expanded to cover all children
- Computer network was linked among related subdivisions of the Korea Centers for Disease Control and Prevention

2012: The Korea Centers for Disease Control and Prevention system is linked with other government department systems

- Resident registry information from the Ministry of Public Administration and Security is linked

- Immunization records are shared through a linkage with the Ministry of Education, Science and Technology.

1.3. Project Promotion Strategies

The United States'(Orenstein, et al., 1999) National Immunization Registry is operating in order to carry out six main functions: ① monitoring individual immunization levels, ② monitoring immunization levels in a given population group, ③ reminding recipients and their guardians of necessary vaccinations, ④ recalling recipients for necessary vaccinations, ⑤ reminding medical staff if vaccinations are needed when patients visit medical institutions, and ⑥ identifying recipients of newly introduced vaccines.

Likewise, in South Korea, IRIS systematically collects and manages immunization-related data such as vaccines' demographic characteristics, inoculation periods, and types of vaccinations with the aims of qualitative enhancement of, record keeping for, supervision of, assessment of, and research on immunization services. There are three main strategies for ongoing advancement.

The first strategy is to help the quantitative and qualitative enhancement of immunization rates.

The second strategy is to help improve the timeliness of immunization rates through IRIS. In other words, IRIS distinguishes the vaccinated and non-vaccinated, makes a list of recipients needing vaccinations, and utilizes it to trace and vaccinate them. With IRIS established, the immunization rate increases as non-vaccinated individuals feel a psychological burden from not being immunized and the reminder/recall function automatically notifies them about their children's immunization schedule.

The third strategy is to provide database for vaccine effectiveness assessments and the immunization policy. In other words, with the linking of the National Immunization Registry Information System (IRIS) and the Infectious Disease Outbreak Monitoring System, we can determine the difference in the rates of infectious diseases between vaccinated and non-vaccinated groups. This offers crucial information for examining the effect of any given vaccine as well as the necessity of certain policies. Moreover, this can be an important tool for securing the reliability and quality of vaccines by collecting and analyzing adverse reactions in a timely manner.

1.4. Project Promotion Accomplishments

In 2002, the first year in effect of the National Immunization Program's computerized registry, 2,962,153 cases were registered. In fact, the number of cases increased every year. In 2009, there were 2,962,153 cases, 8,030,961 cases in 2010, and 9,445,326 cases in 2011 <Table 5-1>.

Table 5-1 | Results of the National Immunization Program's Computerized Registry

(Unit: number of cases)

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
BCG	55,540	74,946	94,416	92,136	94,809	102,240	101,892	104,800	112,232	125,539
Hepatitis B	288,131	333,181	428,934	529,301	587,797	730,341	840,388	1,103,779	1,232,577	1,426,739
DTaP	679,619	766,474	935,769	1,050,164	1,174,488	1,388,640	1,602,539	1,817,990	1,861,739	2,282,780
Td	2,515	2,273	3,280	65,307	235,231	290,569	348,906	443,153	454,828	473,657
Polio	513,351	610,885	743,387	789,047	984,047	1,171,901	1,333,997	1,474,329	1,505,133	1,879,636
MMR	643,259	719,465	842,163	901,888	816,285	888,304	916,117	849,330	836,105	962,631
Japanese encephalitis	772,854	701,767	1,007,195	1,101,852	1,079,059	1,260,541	1,337,230	1,552,243	1,630,185	1,808,056
Varicella	6,884	13,525	23,314	110,737	202,031	250,572	332,893	374,121	398,162	486,288
Total	2,962,153	3,222,516	4,078,458	4,640,432	5,173,747	6,083,108	6,813,962	7,719,745	8,030,961	9,445,326
The rate of increase compared to the previous year	-	8.8	26.6	13.8	11.5	17.6	12.0	13.3	4.0	17.6

Source: Administrative reports of Korea Centers for Disease Control and Prevention

1.5. Project Promotion System

Private medical institutions can register immunization records in the computer database in two ways. The first way is to login to the immunization registry of KCDC's web-based Portal System (http://is.cdc.go.kr). The second method involves linkage of the Electronic Medical Records System (EMR) used by private medical institutions to the standardized module. After logging in to KCDC's Portal System (http://is.cdc.go.kr), whenever additional immunization-related information is registered, such records are simultaneously saved in the computer database, and this information can be accessed by medical institutions. Since the Portal System of the KCDC can only be used by medical institutions that have authorized access, institutions must apply for online registration. After the public health center approves its registry, the institution has the authority to use the system. When this

process is finished, institutions can use the system by logging in with their ID/password and officially recognized authentication certificate [Figure 5-1, 2, 3].

The data collected in the National Immunization Registry consists of three sets: the vaccinee's information, the guardian's information, and immunization history. The vaccinee's information includes the vaccinee's name, personal identification number,[7] zip code, address, home phone number, and cell phone number. The guardian's information, including name and resident registration number, is temporarily used in order to distinguish newborns before their resident registration numbers are issued. Immunization history data is used to verify whether all the core vaccinations were given, if any other shots are needed, and which vaccines caused adverse reactions. This data includes the vaccine name, date of vaccination, vaccinated body part, method of vaccination, dosage, order of vaccination in the vaccine series, and vaccine's lot number <Table 5-2>.

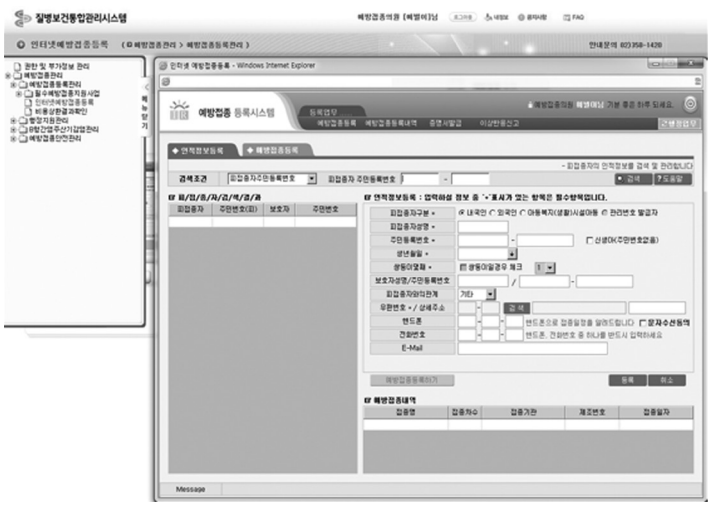
Table 5-2 | Types of Information Gathered in the Immunization Registry Information System

Type of information	Data
Vaccinee information	Name, personal identification number, zip code, address, home phone number, cell phone number, e-mail
Guardian information	Name, personal identification number
Vaccination information	Vaccine name, date of vaccination, vaccinated body site, method of vaccination, dosage, order of vaccination in the vaccine series, vaccine's lot number

Source: Administrative reports of Korea Centers for Disease Control and Prevention

7. This number is similar to the social security number used in some other countries.

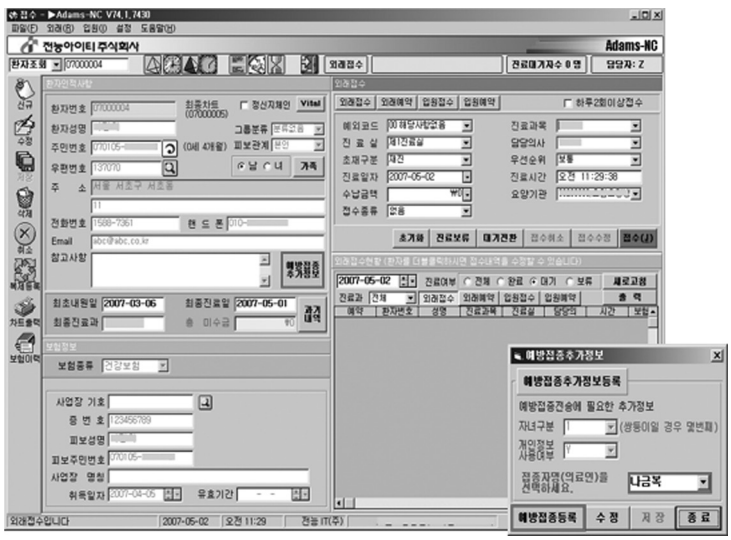
Figure 5-1 | Screenshot of the Portal System of the KCDC's Immunization Registry Information System



Source: Administrative reports of Korea Centers for Disease Control and Prevention

Figure 5-2 | Screenshot of an Immunization Record Registry accessed through the Immunization Registry Information System

Figure 5-3 | Screenshot of an Immunization Record Registry accessed through a Private Medical Institution's Electronic Medical Recording System (EMR)



1.6. Legal Reporting Responsibility

Responsibility of legal reporting (i.e. filing and reporting vaccination records) is stipulated in Article 28 of the Prevention and Management of Infectious Diseases Act. Mayors, heads of counties, and heads of districts are responsible for drawing up and filing immunization records when required immunizations and recommended optional immunizations are carried out or when they are reported from other medical institutions. The documents are to be reported to the mayor, provincial governor, and the Minister of Health and Welfare.

When an individual (i.e. private doctors, medical officers) other than the mayor, head of the county, or head of the district administers vaccinations, such cases must be reported to the mayor, county head, or district head on a monthly basis. Immunization records can be registered online via KCDC's Portal System's (http://is.cdc.go.kr) mmunization registry system and they can also be reported through paper documents. The report should include personal data about the vaccinee and guardian, as well as detailed vaccine information.

1.7. Implications

At first, the Immunization Program was to focus on quantitatively enhancing the immunization rate through mass vaccination. However, now that a broader immunization rate has been secured, its focus has changed. The current goal is not only to control the qualitative immunization rate at the individual level but also to search for individuals who have not received immunizations, make them get vaccinations, and raise the prevention level of preventable infectious diseases up to elimination.

The Immunization Registry Information System has been successful for several reasons. Medical institutions had long before computerized their own medical records. Beyond being merely responsible for reporting records, private medical institutions were encouraged to participate in the National Immunization Program through the government's funding of immunization costs. This encouraged a considerable number of people who previously got vaccinated only at public health centers to now visit nearby medical institutions for their vaccinations. In 2009, when H1N1 influenza suddenly broke out and the vaccine was in short supply, the National Immunization Registry Information System was used to encourage members to reserve vaccinations beforehand and get inoculated on their reserved date. This system helped to effectively deal with short supply.

At present, nearly all newborn infants are being registered in the database, and presumably the national immunization rate will soon be calculated. Moreover, through the linkage with resident registration information, we can find children who are omitted from immunization records in real-time and therefore, can individually manage those who are missing.

2. Immunization Certification for School Entry

2.1. Introduction

In the past, parents or guardians in Korea were legally obligated to immunize their children. From 1999, however, the policy changed so that guardians could voluntarily immunize their children. Such change from mandatory to voluntary immunization was to signify the autonomous decision making of individual citizens, who greatly value personal choice regarding health matters. However, there is still a responsibility not to cause harm to others' health when entering a social group involving communal interaction, such as at school. Therefore, despite holding the citizen's right to autonomous decision making, there is a responsibility to get vaccinated in certain situations. The representative policy for this situation is the Immunization Certification for School Entry.

The Immunization Certification for School Entry is a highly effective policy to enhance and maintain immunization rates. It is very difficult, however, for children to get issued and turn in immunization certificates for all the national core vaccinations. In other words, since 100% of vaccination records have not been logged into the computer database, there is an obstacle of having to visit each immunization center one by one to get one's immunization certificate issued and submitted. Owing to these restrictions, from 2001 to 2011, the government only verified whether children had received the second dose of the measles vaccine.[8] In 2012, immunization verification expanded to include 4 types of additional vaccinations for school children aged 4 to 6.

2.2. Project Promotion System

2.2.1. Project Subjects

The targets of this project are children who are about to enter elementary school. There are 4 types of booster vaccinations for children ages 4 to 6: the fifth dose of DTaP, the fourth dose of polio, the second dose of MMR, and the fourth dose of inactivated vaccine (or third dose of live attenuated vaccine) of Japanese encephalitis.

2.2.2. Project System

a. Mayors, County Heads, or District Heads

These public officials issue notices concerning the immunization certification for school entry.

b. Parents

Before their children enter elementary school, parents should check whether their immunization records are registered in the database and have any omitted vaccinations completed.

c. Elementary School Principals

Principals use the National Education Information System (NEIS) to check whether new students have been vaccinated and supervise the vaccination of unregistered students.

d. Public Health Centers

The School Children Immunization Completion Status submitted by the school is registered on the Immunization Completion Status Management page of the School Children

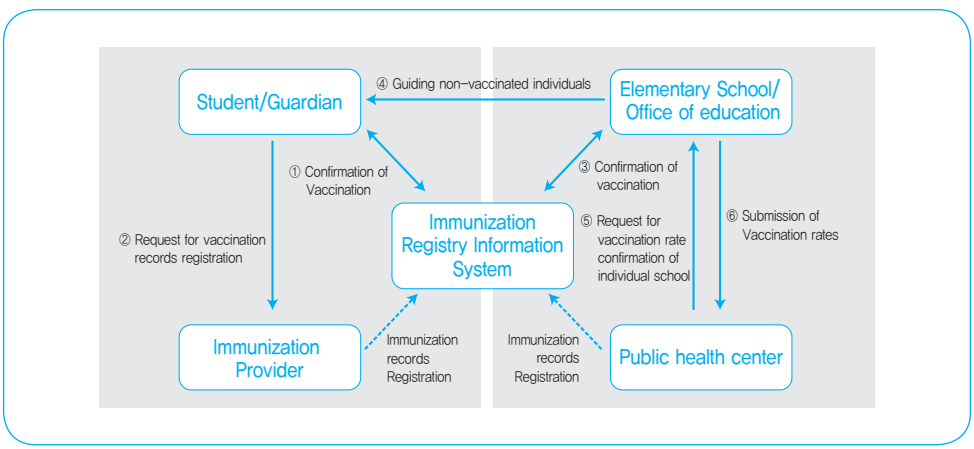
8. The measles epidemic that had just occurred in the year 2000 motivated the formation of some degree of social consensus regarding the need for immunizations.

Immunization Verification System's website (http://is.cdc.go.kr). Submitted immunization certificates are registered at the certificate management registry page of the School Children Immunization Verification System's website (http://is.cdc.go.kr).

e. Other Responsible Parties

The Korea Centers for Disease Control and Prevention is in charge of drawing up and issuing project guidelines, creating and distributing project PR materials, and linking its computerized data bases of the Ministry of Education, Science and Technology. The Ministry of Education, Science and Technology and the Office of Education are responsible for establishing systems so that elementary schools can verify immunization records sent from the Korea Centers for Disease Control and Prevention using the National Education Information System (NEIS). They are also responsible for advertising in local communities as well as monitoring the immunization status of each school. The Ministry of Public Administration and Security is in charge of distributing the School Children Immunization Notice to the respective town (*eup*), sub-county (*myeon*), and village (*dong*) who, in turn, issue the notices. The ministry also encourages PR through newsletters and the local media.

Figure 5-4 | Project System for Immunization Certification for School Entry



Source: Administrative reports of Korea Centers for Disease Control and Prevention

2.2.3. Legal Basis

The Prevention and Management of Infectious Diseases Act and the School Health Act stipulates that mayors, county heads, and district heads may request elementary and middle school principals to submit medical records concerning the completion of immunization. Institutions such as kindergartens and daycare centers may also ask parents to submit immunization record verification. Moreover, any preschoolers or students who have not completed their vaccinations should be immunized.

2.3. Implications

The Immunization Certification for School Entry project can be seen as a policy that has two sides: the perspective of protecting the population from infectious diseases and the perspective of securing citizens' rights to personal liberty. Even though immunization is socially necessary, it cannot be forcibly carried out while ignoring one's personal liberty. However, if all immunization-related decisions were solely made by the individual, the social losses due to infectious diseases could be enormous. Accordingly, when immunization-related decisions come down to individual free will, this policy ensures that individuals fulfill the minimum level of social duty when entering social institutions such as schools.

Korea introduced the Immunization Certification for School Entry system due to sufficient – quantitative and qualitative - civil awareness of immunization. Other important reasons for introducing this project are as following: it helps finding omitted immunization information, it helps completing uncompleted vaccinations, and it helps encouraging people to complete their vaccinations on an individual basis.

3. Adverse Reaction Monitoring System

3.1. Introduction

Immunization is known as the most cost-efficient health project for preventing many infectious diseases (World Development Report, 1993). When the immunization rate in a local community is maintained above 95 percent, vaccination can decrease the rate of preventable infectious diseases' outbreak. Moreover, immunization can be regarded as one of the most important health policies from the economic perspective, since the benefits of immunization are about 4-30 times greater than the cost (CDC, 2001). After immunization, however, adverse reactions occur inevitably and unfavorable results happen unexpectedly.

Adverse reactions to vaccinations are difficult to predict and, even when they occur, a direct connection with the vaccine is difficult to establish. Infants under six months,

the main recipients of vaccinations, are particularly vulnerable to diseases due to their fragile immune system. Hence, it is difficult to establish a direct causal relationship with the vaccination if an infant contracts a disease after being inoculated. However, if citizens avoid immunization because of excessive anxiety over such adverse reactions, a decrease in the immunized population can lead to the spread of infectious diseases. As this could threaten the health of the entire country, measures for post-immunization problems are being prepared and implemented at the national level.

In the United States, the increase in adverse reactions caused by the whole-cell Bordetella pertussis component in the DPT vaccine in the 1970s led to the first public discussion over injury compensation policies. Pharmaceutical companies abandoned vaccine manufacturing due to the increase in lawsuits, which led to problems with the vaccine supply. In 1986, the National Childhood Vaccine Injury Act (NCVIA) was passed, and based on this Act, the National Vaccine Injury Compensation Program (VCIP) was introduced.

Korea confronted with adverse reactions issues after the Japanese encephalitis vaccination in 1994. Accordingly, to lay the legal groundwork for infectious disease prevention measures, Korea set up the national compensation program for vaccine injury in August of that year.

3.2. Project Promotion Process

1994: Legal basis for a National Compensation Policy is established and the Post-immunization Adverse Reaction Monitoring System is introduced.

2000: The Electronic Document Interchange (EDI) reporting methods for post-immunization adverse reaction is introduced.

2001: The Vaccine Injury Compensation Inquiry Committee is established and begins operation. Medical reporting of post-immunization adverse reactions becomes mandatory.

2003: The Vaccine Injury Investigation Unit is established.

2005: A web-based reporting method for the post-immunization adverse reaction reporting system is introduced.

2010: Name changed to Vaccine Injury Compensation Expert Committee

3.3. Project Promotion System

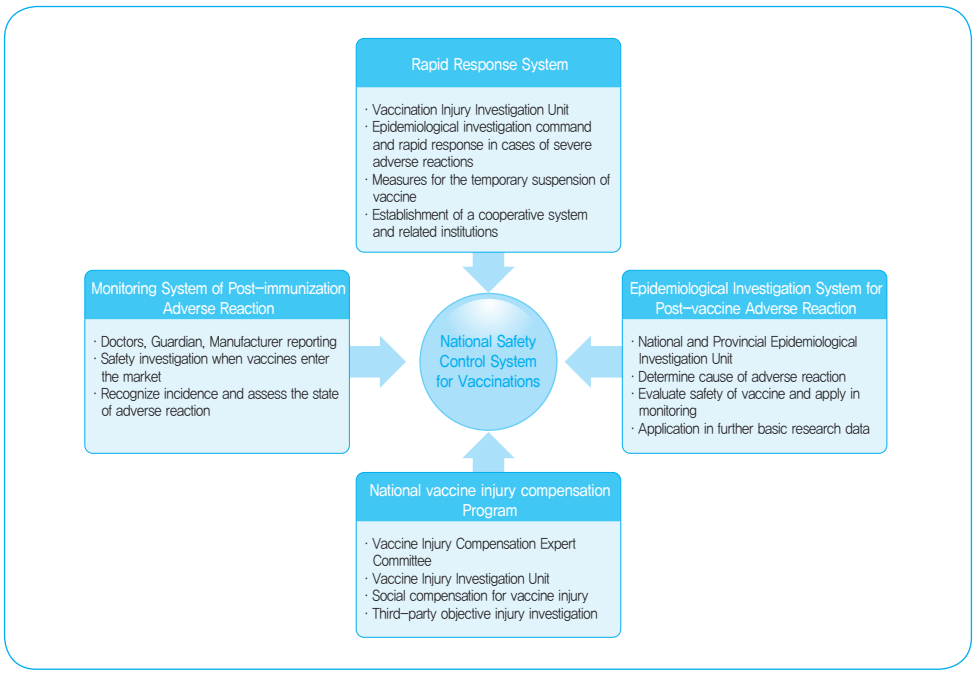
3.3.1. Adverse Reaction Monitoring System

The post-immunization adverse reaction monitoring system can be mainly divided into two parts: the passive monitoring system and the active monitoring system. Due to its lower cost, the passive monitoring system has been used as the basic apparatus for the adverse reaction monitoring system. In the past, the system was run by vaccine manufacturers, but nowadays, it is operated at the national level. In the US, the Centers for Disease Control and Prevention (CDC) and the Food and Drug Administration (FDA) have jointly operated the Vaccine Adverse Event Reporting System (VAERS) since 1990 and have also run the Vaccine Safety Datalink (VSD) as part of the active monitoring system. Since 2005, with the linkage of the health insurance system and the introduction of Rapid Cycle Analysis (RCA), adverse reactions have been quickly monitored.

In 2000, Korea consolidated a national safety control system for immunization consisting of rapid countermeasures for post-immunization adverse reactions, early-period monitoring, scientific epidemiological research, and injury compensation. For a prompt countermeasure system, the Post-immunization Injury Investigation Unit (Formerly Post-Immunization Adverse Reaction Council) was established to make decisions about a vaccine's scope and whether to temporarily suspend the use of a vaccine when the vaccine causes serious adverse reactions such as death [Figure 5-5].

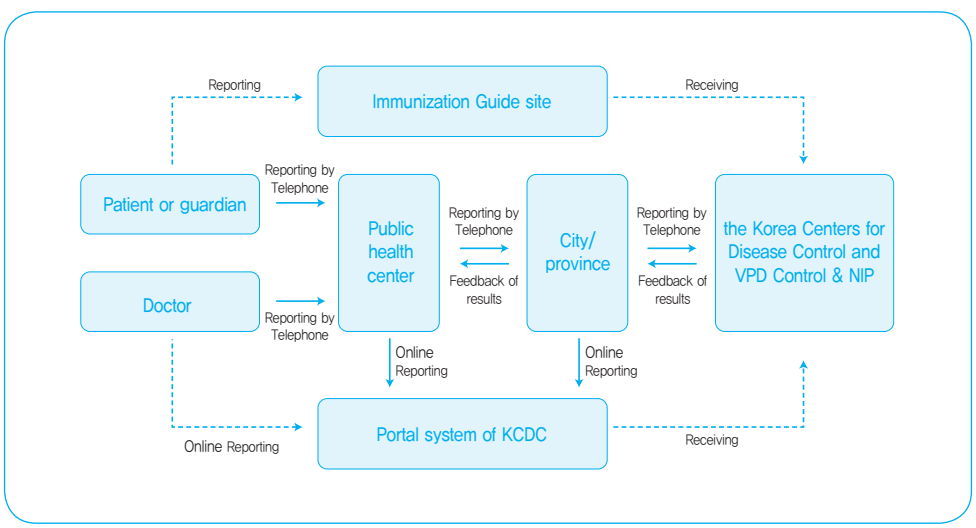
Currently in Korea, post-immunization adverse reaction monitoring is carried out through the diagnosis and reporting of doctors (http://is.cdc.go.kr) or through the monitoring by guardians (http://nip.cdc.go.kr). When doctors diagnose or examine a post-immunization adverse reaction, they must immediately report it to a public health center via phone, fax, mail, or online (http://is.cdc.go.kr). Personal data, the date of vaccination, the medical institution that provided the vaccination, relevant information about the vaccine, immunization record (immunizations administered within the past 4 weeks), unusual details before immunization, the date of the adverse reaction occurrence, the type of adverse reaction, and the progress of the adverse reaction should be included in the report. Guardians who suspect an adverse reaction may report it online or to a public health center [Figure 5-6]. Thereafter, reported data is collected and analyzed through the post-immunization adverse reaction integrated monitoring system and shortly after, the warning system is activated.

Figure 5-5 | National Safety Management System for Adverse Reactions



Source: Administrative reports of Korea Centers for Disease Control and Prevention

Figure 5-6 | Adverse Reaction Reporting System



Source: Administrative reports of Korea Centers for Disease Control and Prevention

3.3.2. Epidemiological Research on Adverse Reactions

Since there are a variety of causes and types of adverse reactions that occur after immunization, an adverse reaction can be classified by its frequency of occurrence, range, severity, precipitating factors, etc. A vaccine not only contains antigens, but also other materials such as suspension, antibiotics to prevent bacterial contamination during the manufacturing process, stabilizers, preservatives, and immune boosters. These ingredients are essential for the manufacturing of vaccines, but they can also cause adverse reactions. Post-vaccination adverse reactions are generally caused by antigens with egg or egg-related substances (in MMR and influenza vaccine), mercury-based medicine (in Hepatitis B, DTaP, Japanese encephalitis, and influenza vaccine), stabilizers (in MMR vaccine), antibiotics (in MMR vaccine), certain components of vaccine pathogens or some still unknown components of vaccines. While adverse reactions can be caused by direct pharmacological effects of these substances, hypersensitivity to the substances is a common cause.

Post-immunization adverse reactions can also be classified by the type of cause. (WHO WPRO, 1999) The first type is a vaccine reaction, when the original substance in the vaccine itself is the cause or trigger of the adverse reaction. Vaccine reactions are defined as signs or symptoms caused or triggered by inherent properties of the vaccine, despite the inoculation being properly performed. There are two types of vaccine reactions: minor vaccine reactions, which are common, and serious vaccine reactions, which are rare. The second type of post-immunization adverse reaction is procedural error, in which an adverse reaction arises due to a procedural mistake, an error in the storage, preparation, or handling of the vaccine. The following can be classified as procedural errors: ① inoculation of a contaminated vaccine, ② improper preparation of a vaccine such as using the wrong diluent, ③ inoculation of the improper body part, ④ improper distribution or storage, and ⑤ administration of a contraindicated vaccine. The third type of post-immunization adverse reaction is a coincidental event, when a reaction arises. This happens coincidentally, and is unrelated to the vaccine itself. The fourth type is an injection reaction, when pain or anxiety occurs because of the inoculation procedure itself. The final type of adverse reactions is when cause cannot be determined.

Therefore, epidemiological research is being conducted under the premise that there is a need to establish the causes of adverse reactions by a trustworthy standard.

3.3.3. National Compensation for Immunization Injury

When one suspects that he or she has been injured from a vaccination, the vaccinee or guardian can request compensation from the city, county or district administrations. The Ministry of Health and Welfare (Korea Centers for Disease Control and Prevention)

will complete a compensation review through the Vaccine Injury Compensation Expert Committee within 120 days of receiving the compensation request. The period during which one can submit a petition is within 5 years after the injured party became aware of the post-immunization adverse reaction.

- Investigation process
  - Primary investigation of injury: The mayor or provincial governor conducts an investigation of the vaccination injury submitted by the claimant. Afterwards, the results and comments of the primary investigation are sent to the Korea Centers for Disease Control and Prevention.
  - Detailed investigation of injury: The Vaccine Injury Investigation Unit examines and evaluates the results of the primary investigation and carries out additional investigation if necessary.
- Indemnity coverage: medical bills, fixed nursing fee, temporary indemnity for the disabled, temporary indemnity for the deceased, funeral service costs

3.4. Project Promotion Accomplishments

In 2009, there were 2,380 reports of adverse reactions, 741 in 2010, and 238 in 2011. In terms of injury compensation requests, there were 16 in 2009, 276 in 2010, and 71 in 2011 under the national compensation policy. Among the requests, 5 cases received compensation in 2009, 113 cases in 2010, and 46 cases in 2011 <Table 5-3>.

Table 5-3 | Management Status for the National Compensation Policy for Adverse Reactions

(Unit: number of cases)

Year	Number of reports of adverse reactions	Number of injury compensation requests		
		Number of cases of compensation rewarded	Number of rejections	Subtotal
2002	22	13	2	15
2003	25	3	4	7
2004	45	6	1	7
2005	364	13	5	18
2006	635	15	9	24
2007	515	13	8	21

Year	Number of reports of adverse reactions	Number of injury compensation requests		
		Number of cases of compensation rewarded	Number of rejections	Subtotal
2008	407	7	9	16
2009	2,380	5	11	16
2010	741	113	163	276
2011	238	46	25	71
Total	5,372	234	237	471

Source: Administrative reports of Korea Centers for Disease Control and Prevention

3.5. Implications

Compared to the history of the introduction of vaccinations, the injury compensation policy for immunization-caused adverse reactions (the term "side-effects" was used in the past) was late in becoming institutionalized. Because of this, however, Korea could analyze and learn from the experiences and errors of other countries that had already implemented such policies. Also, by developing and introducing a policy that fit domestic circumstances, Korea could institutionalize it in a short period of time.

4. Infectious Disease Surveillance System

4.1. Introduction

Since the mid-1970s, the rate of acute infectious diseases has rapidly decreased as living standards and levels of hygiene in Korea have improved. Since the beginning of the 90's, however, global warming has brought a sudden increase in new and reoccurring infectious diseases (Gayer, et al., 2007). Infectious disease has moved beyond a simple epidemiological level and has risen as an important national economic and international health issue. Recently, rather than being limited to particular locations or temporary outbreaks, the spread of infectious diseases are frequently occurring over various regions. Through an increase in traveling and the advancement of transportation systems, the possibility of an influx of infectious diseases into the country from abroad is greatly increasing, making the enhancement of the infectious disease management system even more important.

The World Health Organization (WHO) defines "disease surveillance" as "systematically collecting and using epidemiological data for planning, executing, and assessing disease

control." Through the infectious disease surveillance system, infectious disease incidence information can be used for disease management and prevention by continuously and systematically collecting, analyzing, and circulating it. Ultimately, the surveillance system holds great importance as the system for infectious disease outbreak countermeasures.

4.2. Project Promotion Process

1954 (passage of the Infectious Disease Prevention Act): The Infectious Disease Surveillance System is introduced.

2000 (the Act is renewed): classification standards and types of nationally notifiable communicable diseases

standardization of reporting

introduction of a sample surveillance system

the surveillance system is strengthened by the establishment of the Infectious Disease Surveillance Information System(EDI program)

2007: Online Infectious Disease Surveillance Information System and Online Statistical System are established.

2009: The Medical Institution Reporting System is established via the Online Information System.

4.3. Project Promotion System

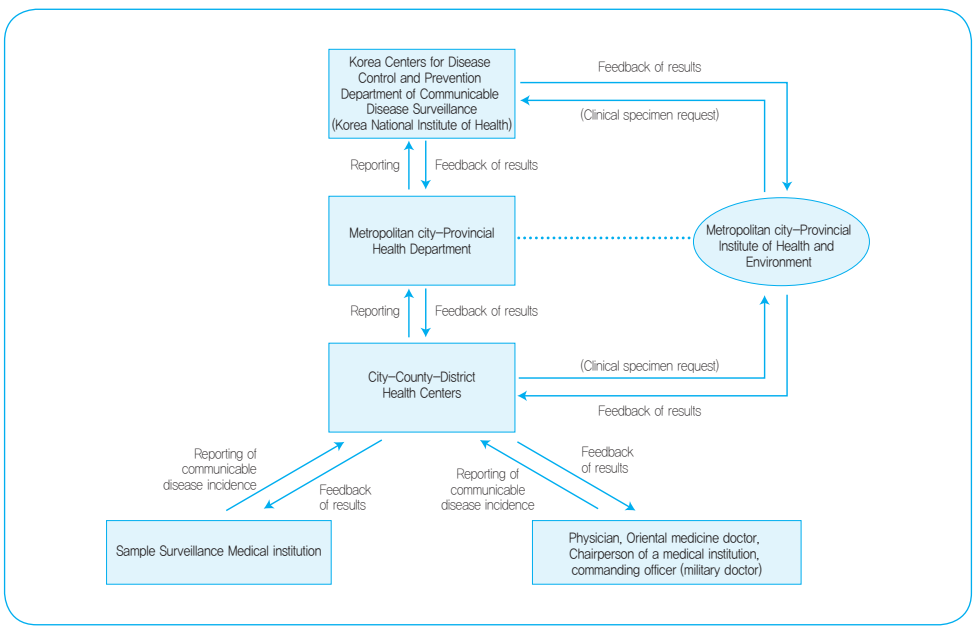
4.3.1. Infectious Disease Surveillance System

"Surveillance" is the total process of systematically and consistently collecting, analyzing, and interpreting data related to the outbreak of infectious disease and its vector, and distributing the results to the people who need it at the proper time so that it can be used to prevent and manage infectious diseases. The objectives of infectious disease surveillance are 1) to predict the magnitude of the problem caused by any given disease, 2) to observe the progress of the disease incidence, 3) to confirm the outbreak and spread of a disease within a population, and 4) to pinpoint new problems and apply this information for prevention and management purposes.

The occurrence of Category I, II, III (except influenza), and IV nationally notifiable communicable diseases requires immediate reporting. Category III and V influenza and specified communicable diseases are notified on a weekly basis [Figure 5-7].

Moreover, the infectious disease statistics website (http://stat.cdc.go.kr) is a public website that provides statistics on infectious disease cases. Whoever has internet access can get precise and rapid information on the number of cases regarding the occurrence of infectious diseases. The information on the website covers Category I, II, III, and IV nationally notifiable communicable diseases and specified communicable diseases. It is updated every day, giving users information in real-time.

Figure 5-7 | Reporting System for Nationally Notifiable Communicable Diseases



4.3.2. Sample Surveillance System for Infectious Disease

Sample surveillance of infectious disease is being carried out in order to observe the outbreak progress and predict the spread of infectious diseases. The infectious diseases covered by sample surveillance are Hepatitis C, hand-foot-and-mouth disease with complications, sexually transmitted diseases, infectious diseases from foreign parasites, influenza, parasitic infectious diseases, medical treatment-related infectious diseases, internal infectious diseases, acute respiratory infectious diseases, and enteroviral infectious diseases. Within 7 days of its occurrence, the infectious disease should be notified, and reported once a week. The reporting system is as follows: the sample surveillance institution reports to public health centers via a website (http://is.cdc.go.kr) or fax, the public health centers report to the metropolitan city or province via the web, then the city or province reports to the Korea Centers for Disease Control and Prevention via the web.

a. Influenza Sample Surveillance System

The objectives of the Influenza Sample Surveillance System are to monitor the trends in influenza outbreak cases, analyze demographic features and detect an outbreak at the early stage through actively surveilling diseases, monitoring the emergence of new viruses by isolating the prevalent influenza virus, and predicting the effects of current vaccines and outbreak patterns in order to establish a national influenza management organization.

b. Infant Sample Surveillance System

Run by primary care physicians and pediatricians in local communities, the Infant Sample Surveillance System has the aim to observe outbreaks and predict the spread of infant diseases. This sample surveillance covers meningitis, classified in the "other infectious diseases category," as well as Category II national notifiable communicable diseases - measles, mumps, rubella, and varicella.

c. Ophthalmological Sample Surveillance System

The Ophthalmological Sample Surveillance System is managed by primary care ophthalmologists in the local community for observing the incidence and predicting the spread of ophthalmological diseases.

d. Sample Surveillance System for Infectious Diseases at Schools

To predict and observe disease occurrence, the Sample Surveillance System for Infectious Diseases at Schools is managed by school nurses/health teachers in charge of school health. The number of students absent due to the cold/influenza, varicella, cerebromeningitis, conjunctivitis, mumps, pneumonia, and measles, and those who visit the nurse's office due to cold symptoms are reported.

4.3.3. Other Surveillance Systems

Monitoring of other infectious pathogenic organisms, laboratory monitoring of acute diarrhea, and systems monitoring infectious diseases from abroad are also being performed.

4.4. Project Promotion Accomplishments

4.4.1. Incidence Rate of Acute Infectious Diseases

The highest disease incidence rate was in 1962 with 222.9 cases per 100,000 individuals. It steadily decreased until the mid-1990s. However after the late-1990s, the incidence rate increased again and in 2000, it reached 93.9. This seems to be due to the spread of measles, bacillary dysentery, and the reoccurrence of malaria. In 2003, the incidence rate decreased to 13.2 but began to rise again in 2004. This could have resulted from the increase in autumn

pyrogenic diseases (mostly scrub typhus) and zoonosis (mostly brucellosis). The fact that malaria, which had been decreasing, rebounded somewhat in 2005, and that varicella, newly added to the nationally notifiable communicable diseases in July of 2005, likely have contributed to such increase.

Incidences of infectious diseases soared during 2009 and 2010 as influenza A/H1N1 spread globally. Exempting influenza A/H1N1, the incidence rate of acute infectious disease was 79.0 cases per 100,000 in 2009 as well as in 2010, having trended upward since 2004. In 2011, the incidence rate increased to 117.3 cases, as hepatitis A and B and syphilis were transferred from sample surveillance to nationally notifiable communicable disease surveillance <Table 5-4>.

Table 5-4 | Incidence Rate Trends for Acute Infectious Diseases

(Unit: per 100,000 people)

Year	'65	'75	'85	'95	'99	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11
Acute infectious disease incidence rate	65.3	29.4	8.7	3.6	21.7	93.9	67.2	13.8	13.2	18.5	27.7	48.1	71.1	72.8	1,502.6	192.4	117.3

Source: Administrative reports of Korea Centers for Disease Control and Prevention

4.4.2. Current Status of (Category II) Vaccine Preventable Diseases

The highest number of Category II infectious disease cases reported was varicella, followed by mumps and hepatitis B. Reports of varicella have notably increased after being designated as a nationally notifiable communicable disease in 2005. Thanks to ongoing education and publicity efforts since its designation, more people have reported incidences and this led to the increase in the reporting rate. For pertussis, a project for monitoring adults started and consequently, notification rates and occurrence reports increased. Likewise, mumps, which up until 2009 had showed an increase, leveled off afterwards.

After the large scale measles outbreak in 2001, a mass immunization project kept incidence rates at eradication levels. However, the number of cases rose to 194 in April 2007 after an outbreak that began in a hospital spread to the local community. In 2008, its incidence rate was near eradication levels, but a 2010 outbreak at a school saw it rise again to 114. An influx from abroad in 2011 led to a small outbreak that centered around Changwon, South Kyungsang Province (*KyungsangNamDo*).

The incidence of Japanese encephalitis had stayed below 10 individuals per year until 2010, when 26 cases were reported. This was the highest incidence rate since 2000, yet in 2011 it decreased again to a mere 4 cases <Table 5-5>.

Table 5-5 | Incidence of (Category II) Vaccine Preventable Diseases

(Unit: number of reports)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Pertussis	9	21	5	6	11	17	14	9	66	27	97
Tetanus	8	4	8	11	11	10	8	16	17	14	19
Measles	23,060	62	33	11	7	28	194	2	17	114	42
Mumps	1,668	764	1,518	1,744	1,863	2,089	4,557	4,542	6,399	6,094	6,241
Rubella	128	24	8	15	12	18	35	30	36	43	54
Hepatitis B	2,944	4,998	9,214	9,731	7,998	8,214	8,574	7,202	5,566	5,085	1,781
Japanese encephalitis	1	6	1	0	6	0	7	6	6	26	4
Varicella	-	-	-	-	1,934	11,027	20,284	22,849	25,197	24,400	36,356

Source: Administrative reports of Korea Centers for Disease Control and Prevention

4.4.3. Status of Cases Reported through the Mandatory Surveillance of Nationally Notifiable Communicable Diseases

The total number of reported infectious disease patients in 2011 was 98,717 (195 per 100,000 individuals). This was a 26.1% decrease (34,842 individuals) compared to that of the previous year (2010) with 133,559 (266 per 100,000). The infectious disease with the highest incidence in 2011 was tuberculosis with 39,557 cases (40.1%), followed by varicella with 36,249 cases (36.7%). In 2011, after tuberculosis and varicella, mumps with 6,137 cases (6.2%), hepatitis A with 5,521 cases (5.6%), and scrub typhus with 5,151 cases (5.2%) followed. The top-five highest incidence infectious diseases comprised 93.8% (92,615 cases) of all 2011 infectious disease cases.

In terms of acute and chronic infectious diseases, 58,265 acute disease cases were reported in 2011. There was a 39.6% decrease compared to that of the previous year (2010) with 96,475 people. For chronic disease cases, 40,452 cases were reported in 2011, including tuberculosis, Hansen's disease and AIDS: a 9.1% increase compared to that of the previous year (2010) with 37,084 people <Table 5-6>.

Table 5-6 | Reporting Status of Incidences via Mandatory Surveillance of Nationally Notifiable Communicable Diseases

(Unit: number of reports)

		2005	2006	2007	2008	2009	2010	2011
Cholera		16	5	7	5	0	8	3
Typhoid		190	200	223	188	168	133	148
Paratyphoid		31	50	45	44	36	55	56
Bacillary dysentery		317	389	131	209	180	228	171
Infectious disease from enterohemorrhagic E. coli		43	37	41	58	62	56	71
Hepatitis A		-	-	-	-	-	-	5,521
Pertussis		11	17	14	9	66	27	97
Tetanus		11	10	8	16	17	14	19
Measles		7	28	194	2	17	114	42
Mumps		1,863	2,089	4,557	4,542	6,399	6,094	6,137
Rubella		12	18	35	30	36	43	53
Hepatitis B	acute	-	-	-	-	-	462	462
	maternal	-	-	-	-	-	1,183	1,183
	perinatal	-	-	-	-	-	30	30
Japanese encephalitis		6	0	7	6	6	26	3
Varicella		1,934	11,027	20,284	22,849	25,197	24,400	36,249
Malaria		1,369	2,051	2,227	1,052	1,345	1,772	838
Scarlet fever		87	108	146	151	127	106	406
Meningococcal meningitis		7	11	4	1	3	12	7
Pittsburgh pneumonia		6	20	19	21	24	30	28
Vibrio sepsis		57	88	59	49	24	73	51
Murine typhus		35	73	61	87	29	54	23
Scrub typhus		6,780	6,480	6,022	6,057	4,995	5,671	5,151
Leptospirosis		83	119	208	100	62	66	49
Brucellosis		158	215	101	58	24	31	19
Rabies		0	0	0	0	0	0	0
Korean hemorrhagic fever		421	422	450	375	334	473	370
Syphilis	Stage 1	-	-	-	-	-	-	690
	State 2	-	-	-	-	-	-	235
	Congenital	-	-	-	-	-	-	40

	2005	2006	2007	2008	2009	2010	2011
Creutzfeldt-Jakob disease (CJD)	-	-	-	-	-	-	29
Tuberculosis	35,269	35,361	34,710	34,157	35,845	36,305	39,557
Hansen's disease	38	56	12	7	5	6	7
AIDS	680	749	740	797	768	773	888
Dengue fever	34	35	97	51	59	125	72
Botulism	0	1	0	0	1	0	1
Q fever	-	6	12	19	14	13	8
H1N1	0	0	0	0	706,911	56,850	0
Lyme disease	-	-	-	-	-	-	2
Melioidosis	-	-	-	-	-	-	1
Leishmaniasis	0	0	0	0	0	1	-
Babesiosis	1	0	0	0	0	0	-
Cryptosporidiosis	1	0	0	0	0	0	-
Schistosomiasis	0	0	2	1	0	0	-
Total	49,467	59,665	70,416	70,941	782,754	133,559	98,717

1) All reporting of patients, doctor-patients, and pathogen carriers were included

2) Diseases which are not reported as incidences, such as diphtheria, polio, typhus fever, anthrax, pest, yellow fever, viral hemorrhagic fever, small pox, severe acute respiratory syndrome (SARS), avian influenza virus infectious disease, H1N1, rabbit fever, West Nile fever, tick-borne encephalitis, and Chikungunya fever, are excluded

Source: Administrative reports of Korea Centers for Disease Control and Prevention

4.4.4. Status of Reporting Deaths due to Nationally Notifiable Communicable Diseases

The number of deaths reported due to nationally notifiable communicable diseases was 7 in 2010 and 536 in 2011. In 2011, Category III tuberculosis was reported as the cause of death of 340 people (63.4%), which accounted for the greatest amount of total cases, followed by 148 cases (27.6%) of death due to AIDS and 26 cases (4.9%) of death due to Vibrio sepsis <Table 5-7>.

Table 5-7 | Reports of Deaths due to Nationally Notifiable Communicable Diseases

(Unit: number of reports)

	Name of disease	2010	2011
Group I	Cholera	0	0
	Typhoid	0	1
	Hepatitis A	0	3
Group II	Tetanus	0	2
	Rubella	0	0
	Japanese encephalitis	7	0
Group III	Malaria	0	2
	Tuberculosis	0	340
	Meningococcal meningitis	0	2
	Pittsburgh pneumonia	0	1
	Vibrio sepsis	0	26
	Scrub typhus	0	6
	Korean hemorrhagic fever	0	3
	AIDS	0	148
	Syphilis (Stage 1, Stage 2, Congenital)	0	1
	Creutzfeldt-Jakob disease	0	1
Total		7	536

Source: Administrative reports of Korea Centers for Disease Control and Prevention

4.5. Implications

In comparison to other nations, Korea set up and began to operate specialized systems for the surveillance of infectious disease occurrence quite late. However, the use of developed information systems, in particular the internet, allowed the establishment of precise surveillance systems in a relatively short period of time. Moreover, the usage of the internet by all medical institutions and the establishment of the electronic mandatory recording system made a major contribution to the establishment of a web-based infectious disease occurrence surveillance system. Thanks to this computerized surveillance system, real-time information registration and sharing is now possible, along with the provision of up-to-date information about infectious diseases.

2012 Modularization of Korea's Development Experience
Korean National Immunization Program for Children

Chapter 6

Immunization Success Stories

1. Hepatitis B
2. Measles
3. Pandemic Influenza A (H1N1)

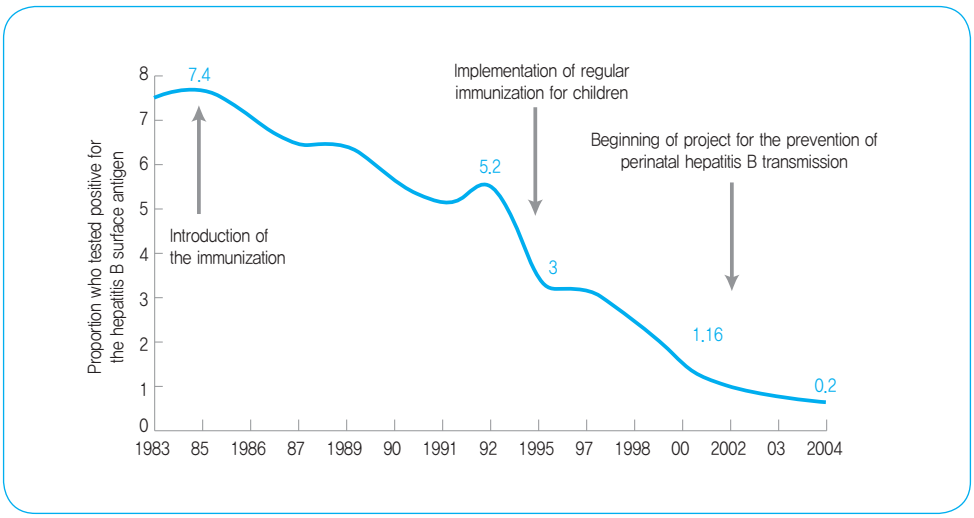
Immunization Success Stories

1. Hepatitis B

1.1. Background

Approximately 90% of adults infected with hepatitis B can fully recover without any difficulties. Conversely, the majority of infants infected with perinatal hepatitis B (from 28 weeks of gestation to 1 postnatal day) will not exhibit any symptoms. Nevertheless 90% of the infected infants will become chronic carriers, who in their 40s and 50s could contract chronic hepatitis or cirrhosis. Either disease can lead to serious illnesses. Before the dissemination of hepatitis B immunizations in Korea in the 1980s, a high percentage of the population tested positive for hepatitis B surface antigen (HBsAg), specifically, 8-9% of the men and 5-6% of the women (Ahn, 1982). As the illness is regarded as one of the major causes of liver cancer, it was designated as a third class infectious disease in 1982. Currently, it is classified as a second class infectious disease. Hepatitis B has been a target on the list of national essential immunizations since 1995 [Figure 6-1].

Figure 6-1 | Important Programs for Managing Hepatitis B in Korea and Status of Reduction of Individuals Who Tested Positive for Surface Antigen (Survey of Donors)



Source: Center for Disease Control and Prevention (2012), "Information on Immunization Programs against Perinatal Hepatitis B Infection in 2012," Center for Disease Control and Prevention (in Korean), p.5

One route of transmission of the hepatitis B virus (HBV) is from the mother to the infant through perinatal infection. The hepatitis B virus can also be transmitted by such means as blood transfusions (both blood and blood products), sexual contact, and needles. However, of all these, perinatal exposure is the primary route of infection in Korea. The rate of pregnant women tested positive for hepatitis B surface antigen (HBsAg) showed a slight decline as it was 4.1% in 1990, 3.4% in 1995, and 3.2% in 2006. Every year, 15,000 infants have been born exposed to the hepatitis virus (Chung, 2011). 65-93% of mothers of newborns who tested positive for HBsAg transmitted the virus to their children and 90% of infected children contracted a chronic infection. However, 75-80% of these cases can be prevented through hepatitis B vaccine mono-therapy, and when this vaccine is administered with immunoglobulin, 95% of the cases can be prevented. Therefore, in terms of managing hepatitis B, it is very important to prevent perinatal infection. The goals of the 2012 Korea Centers for Disease Control and Perinatal Hepatitis B Infection Prevention Project are as follows:

- Reduce the total population of those with hepatitis B surface antigen to 1% in 10 years.
- Reduce the prevalence of chronic hepatitis B to 0.1%.
- Reduce the incidence of liver cancer due to hepatitis B to 1/10th of the present rate within 20 years.

1.2. Program Progress Timeline

1983: Introduction of plasma-derived vaccine

1984: Domestic vaccine production

1985: Recommendation of the vaccine for those at high risk of contracting the disease

1987: Introduction of recombinant DNA vaccine

1987: Inclusion in the National Essential Immunizations list

2002: Introduction of a prevention program for perinatal hepatitis B

2007: Improvement of the computerized system for the prevention program for perinatal hepatitis B

2008: Certification of achievements in managing hepatitis B from the Western Pacific Regional Office (WPRO) of the World Health Organization (WHO)

2009: Production of an online manual on the hepatitis B perinatal infection prevention program

2011: Certification of selected government innovation best practices for hepatitis B management

1.3. Program Implementation Performance

According to the prevention program for perinatal hepatitis B infection, approximately 15,000 infants are infected every year. Of these children, 96.4% are registered and 14,000 have been treated <Table 6-1>.

Table 6-1 | Status of the Program for Initial Registry of Infants with Perinatal Hepatitis B

(Unit: persons, %)

Categories	2002 (7-12)	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Newborns exposed to the infection	7,857	16,678	16,074	14,791	15,237	15,783	14,909	14,235	15,045	15,084	145,693
New registrants	5,394	14,586	15,410	14,411	15,002	16,483	15,266	14,547	14,760	14,976	140,835
Enrollment coverage	68.7	87.5	95.9	97.4	98.5	104.4	102.4	102.2	98.1	99.3	96.7

Note: Estimated exposure of newborns to perinatal transmission of hepatitis B in a given year = number of births in that year x 0.032 x (births to women positive for surface antigen). Also, infants exposed in 2011 were based on the 2010 figure for number of births. Mothers positive for surface antigen: 2002-06, 3.4%; from 2007, 3.2%

Source: Administrative reports of Korea Centers for Disease Control and Prevention

Medical institutions regularly used for infant delivery showed a high participation rate in the prevention program for perinatal hepatitis B infection. Approximately 3600 private medical institutions participated. In addition, 440 public health centers/health center branches/health posts, 268 hospitals, 266 clinics, and 239 general hospitals participated in the program <Table 6-2>.

Table 6-2 | Status of Medical Institutions Participating in Preventing Perinatal Hepatitis B Infection

(Unit: institutions)

Year	General Hospital	Hospital	Clinic	Public Health Center	Total
2002	122	108	131	256	617
2003	191	205	317	418	1,131
2004	193	228	346	421	1,188
2005	199	243	329	435	1,206
2006	207	239	321	447	1,214
2007	203	247	309	496	1,255
2008	215	258	296	522	1,291
2009	210	243	271	556	1,280
2010	230	262	274	526	1,292
2011	239	268	266	440	1,213

Note: Figures refer to medical institutions in which hepatitis B perinatal transmission prevention project coupons were redeemed for immunization in a given year

Source: Administrative reports of Korea Centers for Disease Control and Prevention

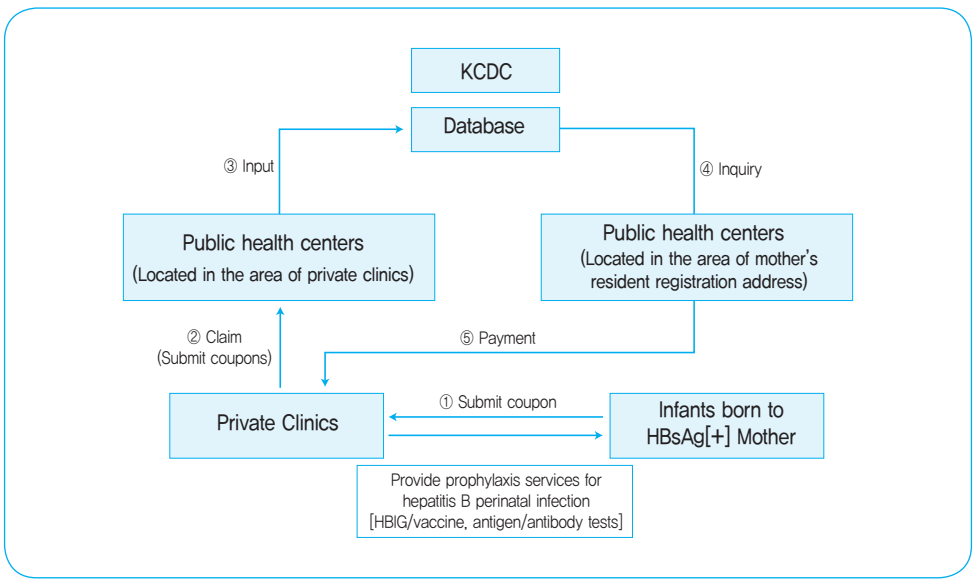
1.4. Program Implementation System

1.4.1. Childbirth Delivery Facilities

a. Check the Individual Tests Positive for Hepatitis B Surface Antigen (HBsAg)

It is preferable for all pregnant women to get tested for hepatitis B in the early stages of pregnancy. If the patient is at high-risk or concurrently exhibiting symptoms of hepatitis, they are recommended to get a retest at the end of the pregnancy. If the woman tests positive for hepatitis B surface antigen (HBsAg), the results should be verified with an HBeAg test and the pregnant woman should be instructed on how to take measures to prevent perinatal hepatitis infection. In order to receive the cost of the hepatitis B perinatal infection measures back from the national government, a copy of the test results during the pregnancy should be submitted to the child delivery facilities.

Figure 6-2 | Program to Prevent Perinatal Hepatitis B



Source: Chung, CW (2011), "Study of Perinatal Hepatitis B Prevention Programs in South Korea," Health and Disease Weekly Center for Disease Control and Prevention 4(28), pp.498 (in Korean)

b. Hepatitis B Prevention Handbook Issued

- Issued to pregnant women who tested positive for HBsAg (including those who tested positive for HBeAg)
- Handbook was issued immediately after delivery.

- Issued coupons so that the individuals could receive immunizations and examinations according to the immunization schedule.

c. Immunoglobulin Immunization and First Hepatitis B Immunization

- 12 hours after birth, immunoglobulin immunization and hepatitis B immunization

d. Immunizations for Preterm Infants

- For preterm infants less than 2 kg and under 37 weeks
- Immunization at birth and preterm immunization coupons for booster shots, this is for infants after one month (0-1-2-6 immunization schedule)

1.4.2. Immunization Facilities

a. Check Live Births of Mothers who have Tested Positive for Hepatitis B Surface Antigen (HBsAg) and Training

- Questionnaire, asking about past immunization history and maternal disease history, is administered when the hepatitis B immunization is given
- Verify targets through the guardian's hepatitis B prevention booklet

b. Implementation of Second and Third Hepatitis B Immunizations

- Second hepatitis B immunization at 1 month old (at least 4 weeks after the first immunization)
- Third hepatitis B immunization at 6 months old (at least 8 weeks after the second immunization and at least 16 weeks after the first immunization)

c. Goals

• Hepatitis B antigen and antibody tests (primary test)

- Subjects: Infants of mothers who tested positive for hepatitis B surface antigen (HBsAg) who have completed the hepatitis B immunoglobulin and 3 hepatitis immunizations as infants
- Implementation of antigen-antibody tests using the EIA, ECL, or CIA quantitative methods at 9-15 months of age and after the infant has completed the basic course of hepatitis immunizations

• Hepatitis B immunization (first dose)

- Subjects: Based on the first hepatitis B antigen and antibody test, individuals who do not have antibodies

- The first hepatitis immunization is administered within one week of obtaining the test results

• Hepatitis B antigen and antibody tests (secondary test)

- Second antigen-antibody test is administered at least one month after the first hepatitis B immunization

• Hepatitis B immunization (second and third doses)

- Subjects: Based on the second antigen-antibody tests for hepatitis B, individuals who do not have any antibodies and receive coupons for the second and third hepatitis B immunizations

- Third antigen-antibody test is administered

- Secondary antigen-antibody tests after the first immunization

1.4.3. Public Health Center

a. Management of Medical Facilities

• Institutions for prenatal care

- Identify medical facilities that offer prenatal care under the local jurisdiction, and cover publicity for the Perinatal Hepatitis B Infection Prevention Project

- Store examination results for women who have tested positive for hepatitis B surface antigen (HBsAG) and educate them to submit the results to the childbirth delivery facility when giving birth

b. Registration of Medical Institutions

• New medical institutions should apply for registration at the public health center, and be certified by the Korea Centers for Disease Control and Prevention.

c. Registration and Management

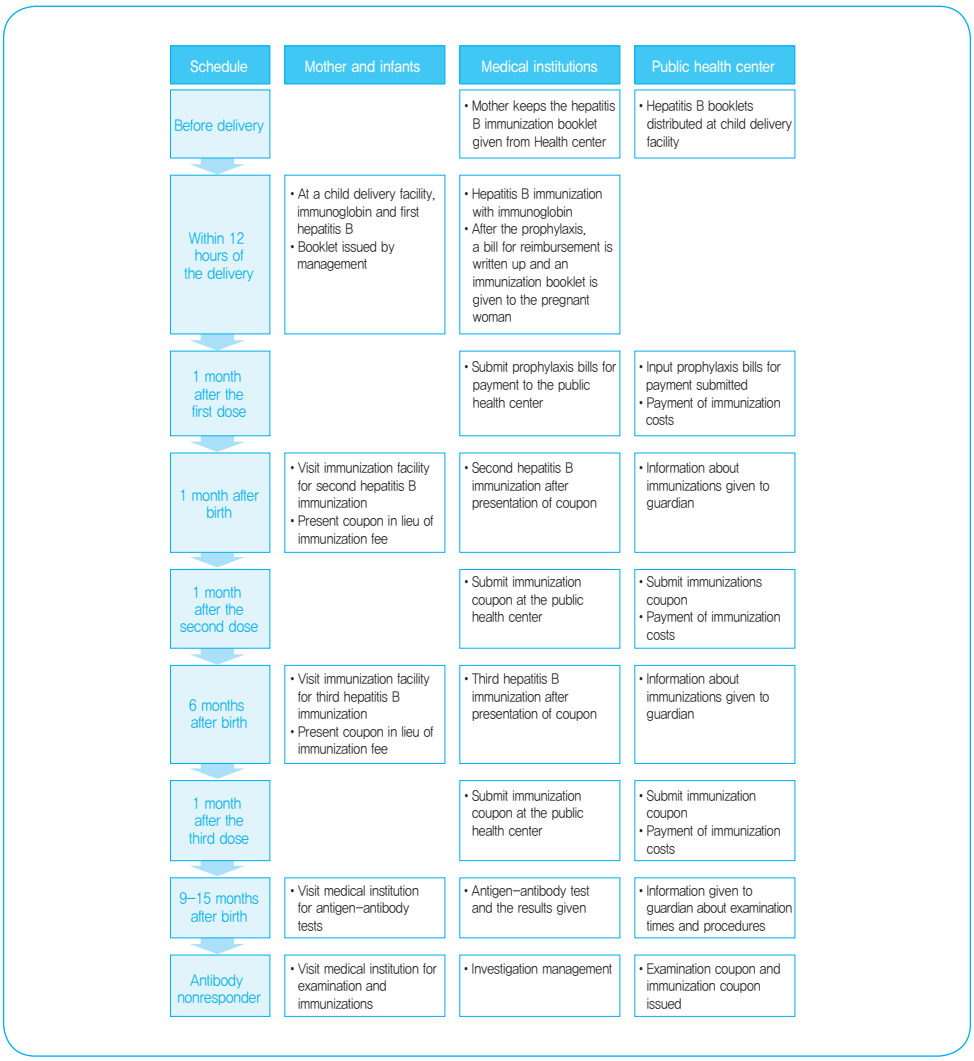
• Targets of Registration: immunizations and examination coupons by a medical facility that is under the public health center's jurisdiction

• Registration method:

- In case of immunizations at the public health center, immunizations are verified on the perinatal B hepatitis website after the individual's immunization history is registered.

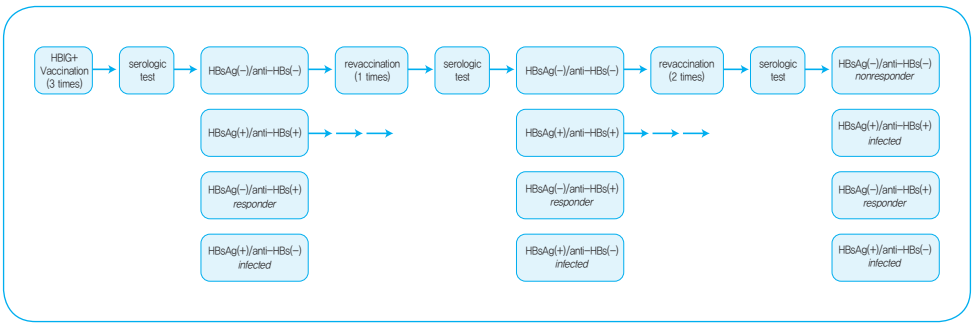
- If a pregnant woman registers at a medical institution that is under the jurisdiction of a public health center, the pregnant woman's information will be automatically forwarded to her address and the fees for the immunization will be reimbursed and sent to her address [Figure 6-2, 3, 4].

Figure 6-3 | Procedures in the Program to Prevent Perinatal Hepatitis B Infection



Source: Administrative reports of Korea Centers for Disease Control and Prevention

Figure 6-4 | Flowchart of the Program to Prevent Perinatal Hepatitis B Infection



Source: Administrative reports of Korea Centers for Disease Control and Prevention

1.5. Implications

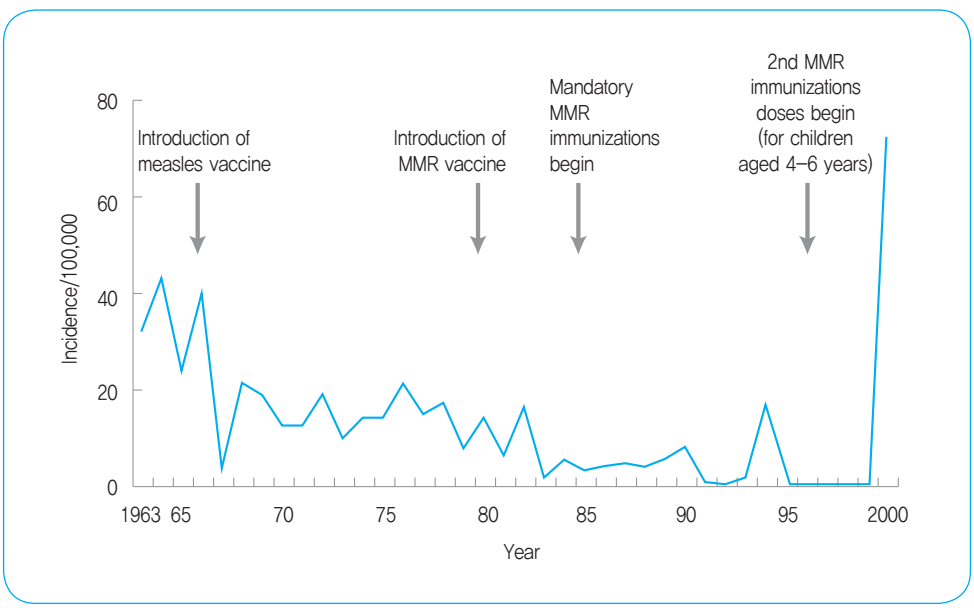
In Korea, hepatitis B spread rapidly from the 1970s until 1995, when it was included in the essential national immunizations. From that time on, we can see a drastic reduction in the incidence of hepatitis B. This decline was not merely the result of an increase in immunization coverage. Rather, it was the result of a multidimensional effort to actively enlighten people through public health education and enhanced infection management with a primary focus on the national government and public health centers. Consequently, the number of pregnant women who tested positive for hepatitis B surface antigen has gradually declined. Nevertheless, as 15,000 live births were exposed to perinatal hepatitis B every year, an aggressive government policy was necessary. As a result, in 2002, a perinatal hepatitis B prevention program was introduced. An estimated 96% of newborns who were targeted were registered and received health care. Due to the aggressive participation of medical facilities, the program was very successful. In addition, for better program management, a computerized immunization program was developed. Through this program, institutions ranging from the central government to public health centers and private medical institutions can verify individuals in the program and manage their medical histories. This has proved to be a very important strategy in the hepatitis B perinatal infection prevention program. Through this program, the accessibility of immunizations for newborn infants exposed to hepatitis B infection was greatly increased. It also cut cases of perinatal infections by more than 95%.

2. Measles

2.1. Background

In the past, measles was common among children, causing many deaths among the young population. In 1965, the measles vaccination was introduced in Korea and consequently the number of measles cases slowly declined. In 1983, measles was included in the list of national essential immunizations. Since then, small measles epidemics have occurred repeatedly every 4-6 years and in 1994, a pandemic occurred. Both situations caused panics in the general public. In 2000, 71.9 cases were identified per 100,000 persons and in 2001, a total of 55,000 measles patients were reported. Two deaths due to measles occurred in 2000 and 5 deaths in 2001. Due to these events, the Korea Centers for Disease Control and Prevention switched its strategy from managing measles to fighting the disease. This focused national attention on the problem and as a result, the measles epidemics were brought to a halt. Through an enhanced measles monitoring system, the number of occurrences of measles was analyzed and now a level of 0.12 persons are infected with measles per million persons [Figure 6-5].

Figure 6-5 | Measles Incidences per Year (1963-2000)



Source: Center for Disease Control and Prevention (2006), "White Paper on a five-year national campaign against measles," *Center for Disease Control and Prevention*, p.3 (in Korean)

2.2. Program Timeline

2000: Immunization program planned during the height of a measles pandemic
Project to survey national measles immunity
Establishment of a 5 year national plan to eradicate measles
Measles immunizations of children and those with no antibodies

2001: Procurement of MR vaccines for immediate measles immunization
Memorandum of understanding between UNICEF and the MR vaccine suppliers
Mass measles immunization catch-up program (for 6 weeks)
Implementation of project for follow-up doses of measles immunizations for school children

2002-2005: Maintaining a program to check measles immunizations, measles eradication, and program evaluation and monitoring

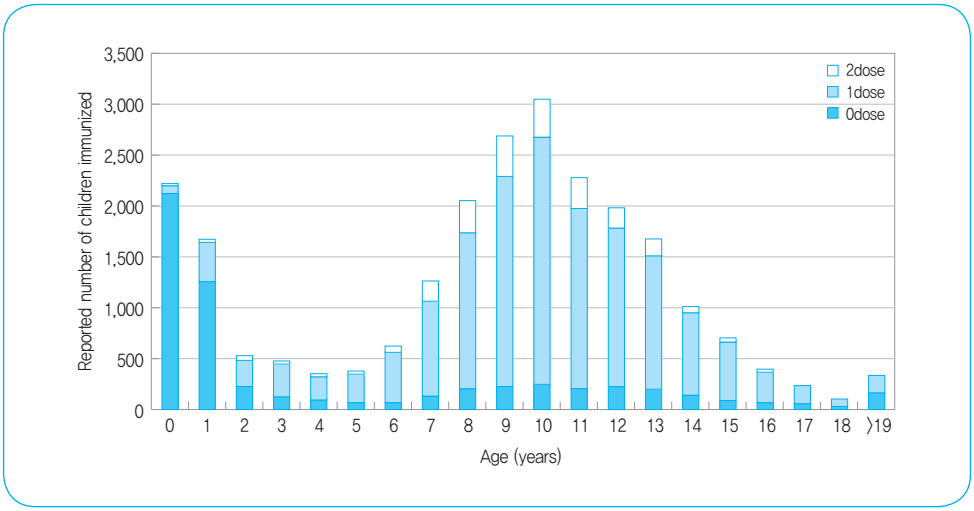
2006: Declaration of national measles eradication

2.3. Program Implementation and Execution

2.3.1. History of Measles Immunization with MMR Vaccines

During the measles outbreak from 2000 to 2001, basic immunization coverage according to the ages of the patients who had a measles MMR vaccine was as follows: among patients between one and three years, 34.9% had been immunized. In particular, 21.2% of children above age one had been immunized, and 12.5-27.6% of children aged 12-15 months had been immunized. This was relatively lower than the immunization rate for children older than 17 months, which was 29.7%- 51.2% [Figure 6-6]. In the case of the patients between 12 and 15 months, it was usually verified that the individuals had not received basic immunizations. The immunization coverage for measles patients from four to six years of age was 72.1%. There was no special difference in the immunization coverage for measles patients seven to fifteen years old, which was 72.9%-79.0%. Through these numbers, we can see that individuals over three years of age became infected with measles even after being immunized.

Figure 6-6 | Status of Measles Immunization History by Age



Source: Center for Disease Control and Prevention (2006), "White Paper on a five-year national campaign against measles," *Center for Disease Control and Prevention*, p.6 (in Korean)

2.3.2. Results of a Study on Elementary and Middle School Immunization Coverage Rate

In addition to routine immunization targets, the measles susceptibility level per age was identified for school age children aged seven and older. Investigation on the measles immunization coverage and serological immune investigations were performed in order to select the ages that required immediate measles immunizations. The government conducted random sampling in the public health centers in all cities and provinces by a simple random sampling method -- selecting one individual out of a thousand between the ages of 7 to 18 years. Then they randomly selected one student from every elementary, middle, and high school of the city or town. Finally, they selected 283 students for approximately every 23,000 students of elementary, middle, and high school. The survey questionnaire on immunization history was filled out directly by the parents. According to the results of this study, 86.2% of all elementary students had received the first immunization, but only 37.7% had received the second immunization <Table 6-3>.

Among the age groups targeted for immediate immunizations (the Catch-Up Campaign), considering the recent prevalence in measles and the susceptibility rate, individuals who were fully susceptible to the disease accounted for 82.4% of the target group whereas the percentage of students from the first grade in elementary school to the third year in middle school who tested positive for antibodies fell just short of 95%.

Table 6-3 | Survey Results of Elementary and Middle School Students

(Unit: people, %)

School year	Entire Immunization Course		
	Total number of students targeted	Number of students who had the first immunization (%)	Number of students who had the second immunization (%)
Elementary school			
1	1,571	1,368(87.1)	682(43.4)
2	1,631	1,439(88.2)	600(36.8)
3	1,599	1,391(87.0)	527(33.0)
4	1,604	1,366(85.2)	-
5	1,583	1,341(84.7)	-
6	1,507	1,277(84.7)	-
Total	9,495	8,182(86.2)	1,809(37.7)
Middle school			
1	1,631	1,322(81.1)	-
2	1,507	1,205(80.0)	-
3	1,399	1,111(79.4)	-
Total	4,537	3,638(80.2)	-
Grand total	14,032	11,820(84.2)	1,809(37.7)

Source: Center for Disease Control and Prevention (2006), "White Paper on a five-year national campaign against measles," *Center for Disease Control and Prevention*, p.13 (in Korean)

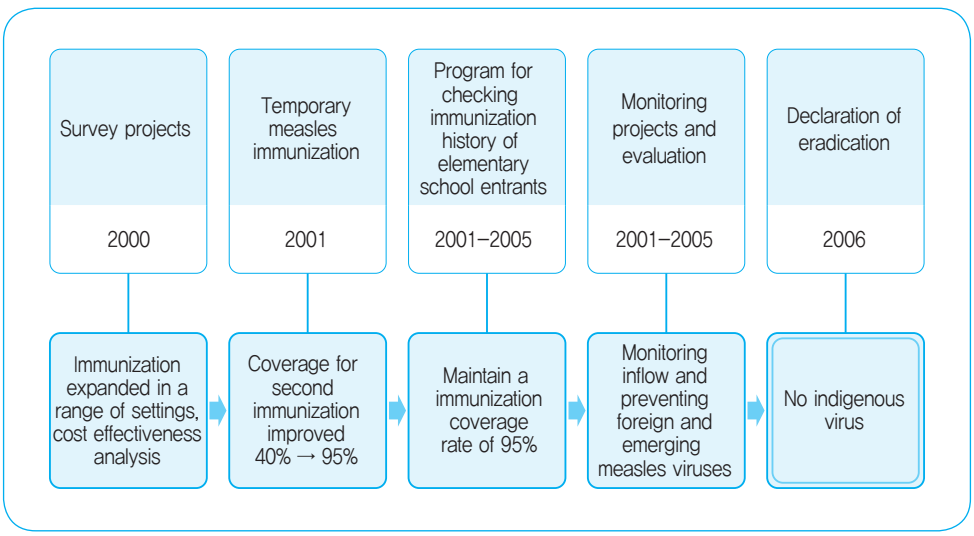
2.3.3. Plan for the Eradication of Measles

Until 2005 in order to eradicate measles in Korea, children between 12 and 15 months were immunized with the first dose of measles vaccine and children between 4 and 6 years were immunized with a second dose so that the total immunization coverage was maintained at 95% of the young population. In addition, 5.8 million children from the ages of 8 to 16 years of age were administered immediate immunizations. They also ensured the eradication of the indigenous endemic by strengthening the surveillance system of laboratories and monitoring measles patients [Figure 6-7].

Important parts of the eradication history are as follows. First, the Catch-Up Measles Immunization Campaign was implemented to improve collective immunity and to raise the level of protection against measles propagation by temporarily targeting groups that are susceptible to measles. Second, the Keep-up Immunization Campaign was implemented

to maintain an immunization coverage rate of 95% for children ages four to six. Twelve to fifteen months after the first immunization, a second immunization was given. This was verified by checking the computerized immunization records of each individual's immunization history before the students entered elementary school. Finally, for those who contracted measles, the source of the infection was tracked down and simultaneously, a surveillance system of laboratories and patients' medical histories was set up so that the epidemic could be stopped in its early stages.

Figure 6-7 | Staged Goals and Programs for Measles Eradication

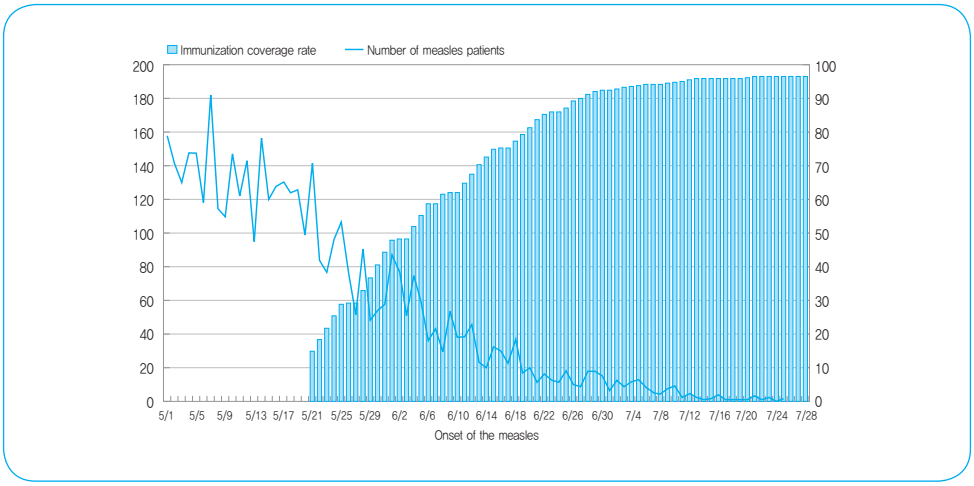


Source: Center for Disease Control and Prevention (2006), "White Paper on a five-year national campaign against measles," *Center for Disease Control and Prevention*, p.22 (in Korean)

2.3.4. Measles Patients that Contracted the Disease after the Immediate Immunizations

The total number of measles patients from January 2001 to July of that year was 121,865. (In January, 7,398, in February 2,774, in March 2,831, in April 4,062, in May 3,388, in June 1,257, and in July till the 28th, 182.) Every month there were thousands of new patients. However, due to the immediate measles immunizations and the mandatory submission and confirmation of second immunizations implemented in March 2001, the overall measles immunization coverage was dramatically improved and diagnosed cases were significantly reduced. As a result, the 2000-2001 measles outbreak which had claimed more than 55,000 people was under control by August [Figure 6-8].

Figure 6-8 | Relationship between Incidence of Measles and Measles Immunization Coverage



Source: Center for Disease Control and Prevention (2006), "White Paper on a five-year national campaign against measles," *Center for Disease Control and Prevention*, p.37 (in Korean)

2.4. Implications

The '5 Year National Measles Elimination Project' set up as a countermeasure for the measles epidemic in 2000-2001, is a good example of successfully eradicating measles at the national scale. Out of the 55,696 patients diagnosed with measles, there were 7 deaths in this national outbreak. In response, a national survey on the measles immunization coverage and the collective immunity to measles was immediately conducted. In conclusion, the major problems were narrowed down as following: the outbreak stemmed from individuals failing to acquire immunity after the first immunization and the poor rate of second immunizations. In order to solve this, a program was implemented in 2001 to make sure that school children had received the second immunization. In addition, 5.8 million school age children were given immediate measles immunizations. Immediate mass immunizations were implemented nationally focusing on 244 public health centers in 16 metropolitan areas, and doctors, nurses, and other reporting personnel mobilized into 11,940 teams for this. As a result, the immunization coverage rate was raised to 97.4% through immediate immunizations. That is, the incidences of the measles, which had been on the rise till the middle of 2001, had drastically reduced. From 2002 to 2006, less than one out of a population of a million was infected with measles. And for the first time on November 7, 2006 the World Health Organization's Western Pacific Region Office declared that measles had been eradicated in Korea.

In case of a death after an immunization or occurrences of other adverse side effects, a quick and careful epidemiological survey was conducted to ascertain the relevance of the vaccine to the death or severe disability. This was released to the public to instill trust in the safety of the vaccine. In this way the entire program could be reliably implemented.

Finally, the national measles eradication program, public health centers, regional medical associations, and the Department of Education efficiently implemented various parts of the immunization program despite the lack of inter-agency coordination and cooperation due to disagreements with the government's immunization policy. In a short period of time, immediate measles immunization could be implemented effectively due to the active cooperation between the Immunization Expert Committees, private citizen organizations, practicing physicians, and other related organizations. Thanks to such combined effort, measles was successfully and nationally eradicated in 2006.

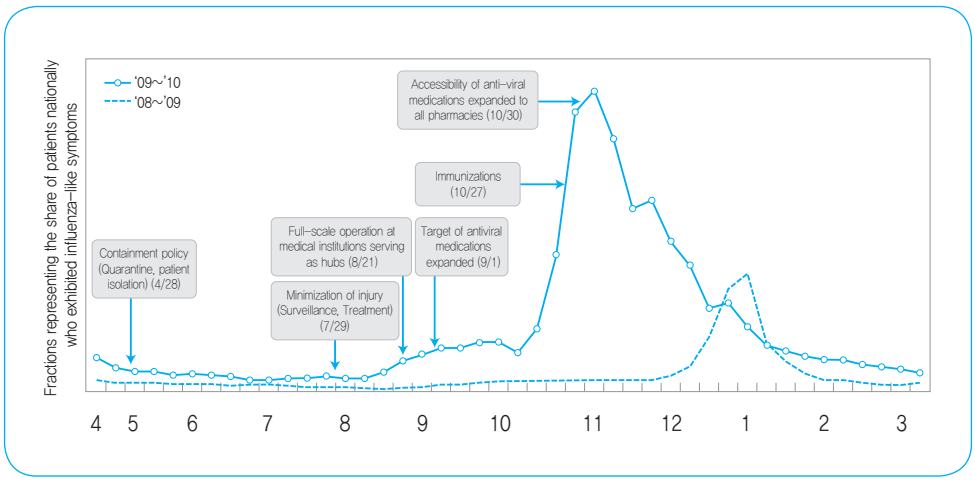
3. Pandemic Influenza A (H1N1)

3.1. Background

After April 26, 2009, when the first case of H1N1 flu was diagnosed in the United States, H1N1 flu has spread rapidly throughout the world. In Korea, the first patient was diagnosed on March 2, 2009. In mid-August, the influenza-like illnesses (ILI) exceeded the standard of 2.67 people per population of a thousand. In the beginning of October, it spread rapidly at schools and by the end of the month, it had reached its peak of 45 people per thousand having contracted the disease (CDC, 2010). [Figure 6-9] After December, the number of patients decreased. A total of 763,759 patients were diagnosed with the disease in the first three weeks of 2010. In addition, the first deaths were reported in August, which the total number due to the influenza was 270 (Lee, 2011).

The H1N1 flu was a kind of virus that humankind had not experienced before and was expected to spread rapidly. When the World Health Organization (WHO) realized that the H1N1 flu was an inter-continental pandemic, the organization declared it a pandemic on June 11, 2009. However, as the actual occurrences of the flu had only been confirmed in a subset of the patients, the number of aggregate patients were not included as of July 6. Based on sources abroad, the most obvious demographic characteristics of the pandemic appear to be patients mostly children or young adults in the age range from 5 to 24 years. In approximately 80% of the cases, the individuals were younger than 30 years old. Yet, there was no difference in the susceptibility by sex.

Figure 6-9 | Progress and Policy Regarding 2009-2010 H1N1 Influenza



Source: Center for Disease Control and Prevention (2010), "White Paper on Responses to New Strains of Influenza in 2009-2010," *Center for Disease Control and Prevention*, p. 20 (in Korean)

The large scale of H1N1 flu incidences that occurred from the autumn of 2009 to the summer of 2010 led to social turmoil, shrinking of socioeconomic activities, and inadequacy of the crisis response system. During that time, the country relied on flu vaccine supplies from overseas, so it was very difficult to temporarily raise collective immunity in response to the large scale danger. However, through these experiences, the institutional deficiencies were improved, and there was an opportunity to mend the system.

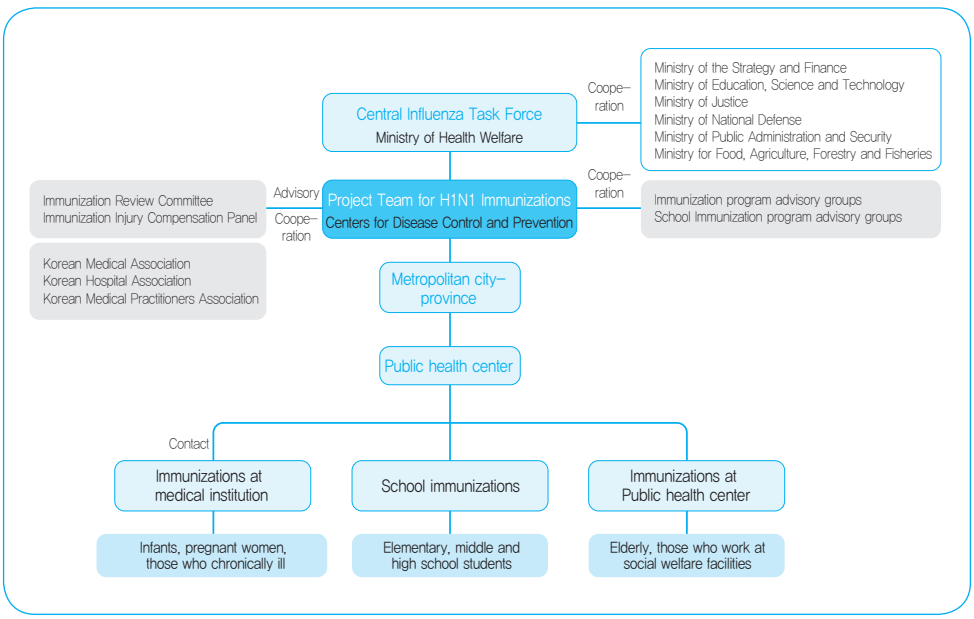
Immunizations were the primary means of preventing the flu epidemic. Through immunizations, the propagation of the flu was blocked. There was also a reduction in the severity of the illness, morbidity, and period of infection (through the reduction of complications, hospitalizations, and deaths). By shortening the time of the spread of a virus, the general pervasiveness of the flu can also be reduced. In particular, the goals of the immunization policy were as follows: first, to offer safe and effective vaccines as quickly as possible; second, to ascertain which individuals should have priority in receiving immunizations so that the spread of the pandemic could be effectively blocked and the mortality rate be lowered; third, to come up with ways to offer immunizations and assign vaccines as quickly as possible to those individuals who were targets of the immunization policy; and fourth, to continually monitor and evaluate any adverse reactions or side-effects of the immunization.

3.2. Program Implementation and System

3.2.1. Principles and Implementation System

H1N1 flu was managed based on the basic principles that the propagation of an epidemic through a community can be blocked by improving the immunization coverage of the community. Immunizations were given according to the following principles: first, when immunizations and preliminary medical examinations were voluntarily agreed; second, when immunization records were managed through the Immunization Registry Information System (IRIS); and third, when the patient was monitored to check if there were any negative side effects after the immunization. The system was implemented by the Central Influenza Task Force in the Department of Health and Human Services and the responsibility for the public health was divided among the private medical institutions, the schools, and the public health centers [Figure 6-10].

Figure 6-10 | Implementation of the H1N1Influenza Immunization Program



Source: Center for Disease Control and Prevention (2009), "Guidelines for an Immunization Campaign against New Strains of Influenza A (H1N1)," *Center for Disease Control and Prevention*, p.3 (in Korean)

3.2.2. Targets of Priority Immunizations

To solve the insufficient supply of vaccine and to prevent the temporary increase of persons that require immunizations, the Immunization Expert Committee decided to give priority to individuals who were at higher risk of infection and those who were in critical condition.

Table 6-4 | Priority Targets for the H1N1 Influenza Vaccine

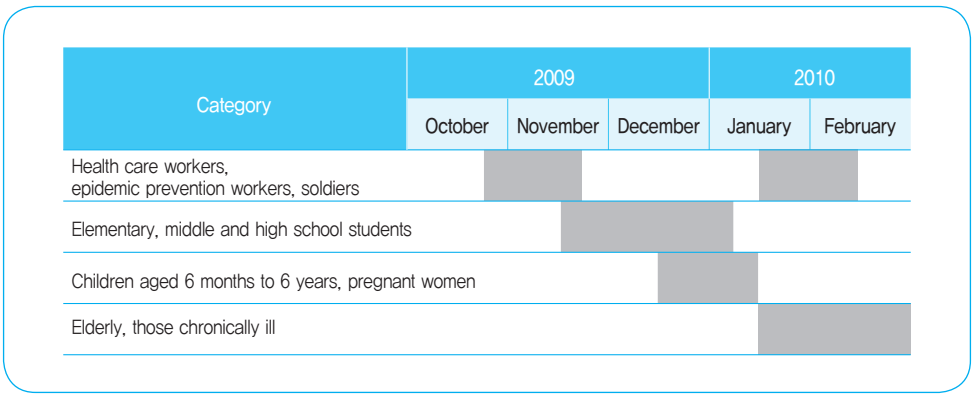
Categories	Individuals given priority for immunizations
Medical personnel (800,000)	• Workers in medical institutions • Epidemic prevention workers, first responders, those engaged in animal husbandry (such as pig breeding), 119[9] responders and police
Vulnerable (8,200,000)	• Pregnant women, children (6 months - 6 years, children aged 6 who were too young to go to school) • Those over 65 and healthy • Chronically ill patients (including those 65 and older) • Postpartum care center workers • Infant day care workers
Students (7,500,000)	• Elementary school·middle school·high school students, head nurses
Military (660,000)	• Soldiers

Source: Centers for Disease Control and Prevention (2009), "Guidelines for an Immunization Campaign against New Strains of Influenza A (H1N1)," *Centers for Disease Control and Prevention*, p.4 (in Korean)

From a holistic perspective, the lack of vaccines was not serious. However, because of the limited supply of the vaccines and the sudden increase of individuals that needed immunization, there was a mismatch of vaccines in supply and demand. In order to mitigate the temporary shortage in vaccines, the Immunization Expert Committee decided which individuals would have priority for the H1N1 flu immunizations so that the immunizations would have the most effect in blocking the spread of the disease <Table 6-4>. The government did this by securing sufficient vaccines so that those who needed an immunization could all receive it. Because vaccine production and supply was done sequentially until the end of 2009, health care workers and epidemic prevention agents, soldiers, elementary school students, middle school students, high school students, children, and pregnant woman were immunized in that order. From January 2010, the elderly and those suffering from chronic illnesses were immunized [Figure 6-11].

9. This is similar to "911" services in some other countries.

Figure 6-11 | Priorities for H1N1 Influenza Immunizations by Time Period



Source: Center for Disease Control and Prevention (2009), "Guidelines for an Immunization Campaign against New Strains of Influenza A (H1N1)," *Center for Disease Control and Prevention*, p.5 (in Korean)

The government could make sure that individuals who had received priority for immunizations were all able to be immunized by the deadline. This was possible through diversifying the providers of the immunization services and specifying the primary location for those who were targeted for immunizations <Table 6-5>.

Table 6-5 | Methods of Providing H1N1 Influenza Immunization Service according to the Individuals Targeted by the Program

Categories	Immunization location	Immunization costs
Infants, pregnant women, those with chronic illnesses	Commissioned medical institutions	Cost for immunizations at private medical institutions are borne by the individual * Vaccine supplied at no cost
Elementary, middle and high school students	School and commissioned medical institutions	School immunizations at no cost * If private medical institutions were used, cost is borne by the individual
Healthy and older than 65	Public health center and medical institutions	Public health center immunizations at no cost * If private medical institutions were used, cost is borne by the individual

Source: Center for Disease Control and Prevention (2009), "Guidelines for an Immunization Campaign against New Strains of Influenza A (H1N1)," *Center for Disease Control and Prevention*, p.4 (in Korean)

3.2.3. H1N1 Influenza Immunization Management System

In 2009, the H1N1 flu immunization registry management system was developed and implemented. The system included immunization records (including personal information along with individual immunization records), immunization statistic lookups, adverse reactions that had been reported, vaccine supply management (vaccine request, acknowledgement, surplus/waste), and information management for schools (school immunization applicant status, whether students had been immunized or not). The system for the H1N1 flu immunization management system could be accessed through the system for health and diseases <Table 6-6>.

Table 6-6 | Major Features of the H1N1 Influenza Immunization Management System

System configuration	Major features
Immunization reservation	Immunization appointments directly or through a medical institution
Immunization statistics	Reservation status management
Immunization records registration/enrollment	Immunization records, registration, sending SMS (text messaging)
Immunization statistics query	H1N1 flu immunization history
Reports of adverse reactions	Report adverse reactions
Management of vaccine supply	Requests, approval, and management of vaccines
Management of school information	Management of school immunizations, modify school information

Source: Administrative reports of Korea Centers for Disease Control and Prevention

In order to offer immunizations to the general public, an immunization assistant website was set up at (http://nip.cdc.go.kr). The general public or those who had been recommended to get the H1N1 flu immunization could connect to the site, make an appointment for an immunization, and be notified about their appointment by an SMS text message. On the scheduled day, the medical institutions conducting the immunization would register the immunization in the immunization records for that individual.

3.2.4. Management of H1N1 Influenza Vaccine Supply

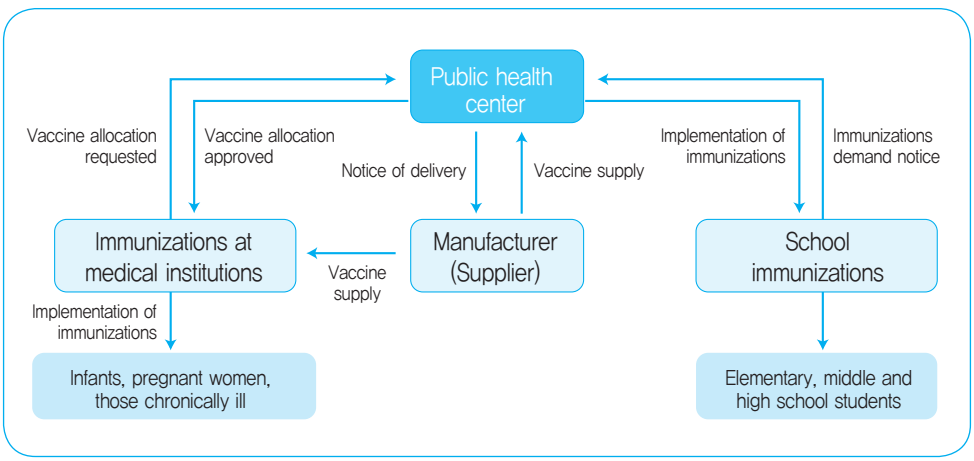
Vaccines were kept in refrigerated vehicles to keep the supply cold. In the case of medical institutions, they were supplied by the local public health center [Figure 6-12].

a. Vaccine Supply by Facility

1. Public health center: supplies for school immunizations or public health center immunizations
2. Medical institutions: depending on the demand, vaccines were supplied through the public health center

* When health care workers were immunized, base hospitals or general hospitals received direct vaccine shipments. Other medical institutions received supplies through their public health center.

Figure 6-12 | Supply System for the H1N1 Influenza Vaccine

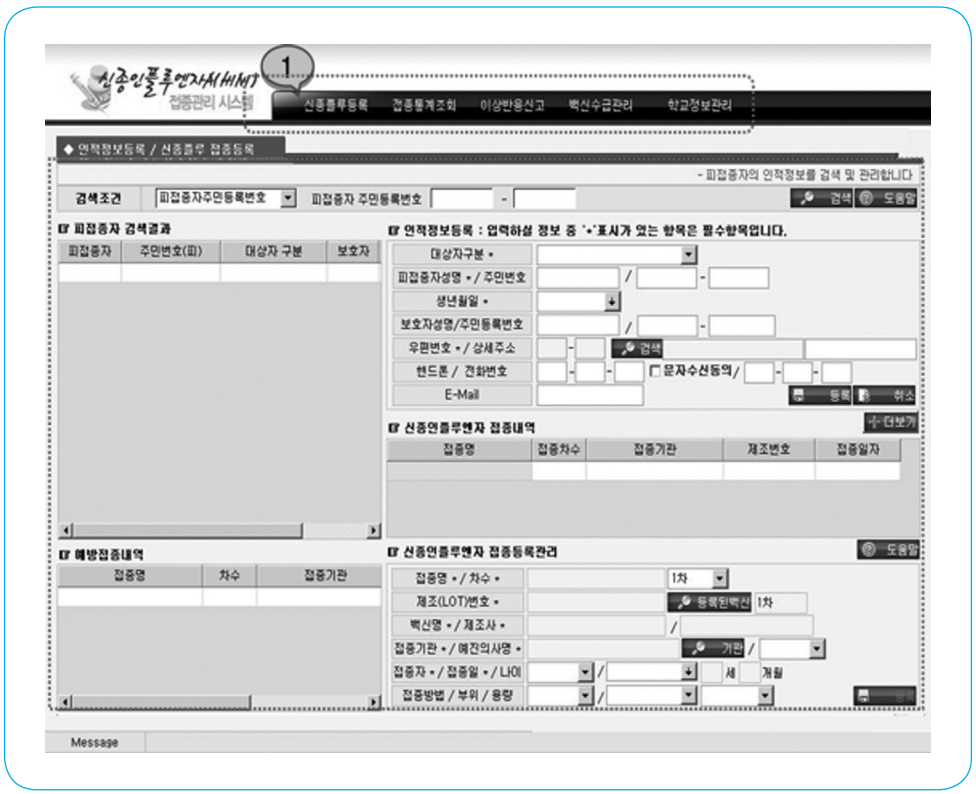


Source: Administrative reports of Korea Centers for Disease Control and Prevention

3.3. Program Implementation

From October 2009 to May 2010, approximately 14,750,000 dosages of vaccine were used. This was 75.4% of the entire doses (18,890,000) that were originally planned. From October to December 2009, health care workers, epidemic response personnel, and students were scheduled for immunizations. Of those targeted, 64.4% received immunizations. From January to March 2010, children from six months to six years old, pregnant women, elderly, and those with chronic illnesses were targeted. Of those targeted, 39.9% were immunized. All immunization records – temporary immunization, immunization area, vaccine lot number, and immunization username registration – were managed from the H1N1 flu immunization management system [Figure 6-13].

Figure 6-13 | Screenshot of the H1N1 Influenza Immunization Registry Information System



3.4. Implications

Even before the outbreak of H1N1 flu in 2009, the influenza immunization coverage in Korea was quite high. This is because the government predicted the outbreak even before it started and continued to watch it as it unfolded. Those at high risk of contracting the disease (such as the elderly and hospital workers) had seasonal influenza immunizations every year, and the vaccines in public health centers were well stocked. Furthermore, the government continued to monitor the situation, issue advisories, and educate the public about the flu.

The Immunization Registry Information System which had been already operating before the outbreak of the flu epidemic, set up immunization appointments in advance. This system targeted those who were at high risk and who met the vaccine supply capacity with gradual immunization schedules. Computerized registration for the general public was available at public health centers and medical institutions. Through the computerized system, the sudden temporary lack of vaccines could be spotted at once. Accordingly, the problem of having a large influx of citizens clamoring for immunizations could be prevented. Also, due to the system's operation, immunization coverage was very high.

Sudden shortages of flu vaccine had occurred for many years, but Korea is ready to produce vaccines now. So, when there is an outbreak of an epidemic, the government would be ready. The government could smoothly facilitate the supply of vaccines and the H1N1 flu pandemic could be adequately controlled.

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Chapter 7

Strategies for Increasing Public Participation

1. Vaccination Week
2. Immunization Reference Website
3. Short Message Service (SMS) for Confirmation of Immunization and Notification of Next Immunization Schedules
4. Vaccination Training for Health Care Providers

Strategies for Increasing Public Participation

1. Vaccination Week

1.1. Background

The last week of every April is "Vaccination Week," enacted by the World Health Organization (WHO). During this week, the importance of vaccination is promoted and the attempts to eradicate diseases are reviewed. In addition, in order to improve the children's vaccination rate and further increase public awareness, the global society is cooperating and working together. After Vaccination Week, initiated by the WHO, was first enacted in the Pan-American Health Organization (PAHO) in 2002, it has been implemented in the European Union (EU) since 2005, and the Eastern Mediterranean Regional Office (EMRO) since 2010. This event has become a global campaign to evaluate the outcome of immunization programs and to cooperate for the eradication of infectious diseases.

Vaccination Week was introduced in the Western Pacific Regional Office (WPRO) in 2011. 31 countries[10] including Hong Kong, Macao, and 29 countries of the Western Pacific region such as Korea, Japan, and China, participated in this project. In particular, the purposes of the Vaccination Week are ① the improvement of the vaccination rate, ② the celebration of the outcome of the immunization program, ③ the education of parents and guardians on the importance of vaccination, and ④ the increase of public and media awareness. Korea has also established its own goals for Vaccination Week as follows: ①

10. The following countries (or regions) participated in the WHO Vaccination Week: Republic of (South) Korea, American Samoa, Brunei, Cambodia, China (PRC), Cook Islands, Fiji, Polynesia, Guam, Japan, Kiribati, Laos, Marshall Islands, Micronesia, Mongolia, Nauru, New Caledonia, New Zealand, Niue, Northern Mariana Islands, Papua New Guinea, Philippines, Samoa, Solomon Islands, Tokelau Islands, Tonga, Tuvalu, Vanuatu, Vietnam, Hong Kong, and Macao.

the increase of public awareness about vaccination, ② a united front against infectious disease control among associated organizations, and ③ the attainment of the core goals of the national immunization program.

1.2. Project Promotion Process

1.2.1. The First Vaccination Week

The first Vaccination Week held in Korea was April 24 - 30, 2011 and its slogan was "Vaccination for Tomorrow." The first Vaccination Week was proclaimed at the WHO Western Pacific Regional Office in Manila on April 25, 2011. On this day, the government, health care, and vaccination-related representatives such as the Korean Minister of Health and Welfare and the director of the Korea Centers for Disease Control and Prevention participated in the official proclamation. In addition, a publicity campaign to inform the public about the importance of vaccination was carried out through diverse media outlets including newspapers and broadcasting stations. This event included the screening of a documentary on the National Immunization Program describing the history and the outcomes of the Korean immunization program, showing appreciation to those who have significantly contributed to the success of this project so far, naming an honorary ambassador for the project, commemorating the significance of "vaccination for a healthy tomorrow" through performances such as sand art, and inviting guest speakers to lectures on the history and significance of vaccination.

1.2.2. The Second Vaccination Week

The second Vaccination Week was held in April 21 - 28, 2012. Its slogan was "A Healthy Future for Your Family." For the commemoration event, a famous children's program 'TV Kindergarten: Let's Come Together . . . That's Right!' and a musical puppet show about vaccination drew the attention of children aged 4 through 12. They were the main targets for follow-up vaccinations along with their parents and guardians. In addition, various events and campaigns such as the naming of an honorary ambassador for this program and an exhibition of life-size optical illusions were held.

1.3. Suggestions

It is not easy to draw conclusions about the Vaccination Week yet because Korea has had only limited experience with this program. However, it is expected to be a worthwhile strategy in raising public awareness of the importance of vaccination and reminding parents and guardians of the immunizations that could be missed on the vaccination schedule for children.

2. Immunization Reference Website

2.1. Background

The Korea Centers for Disease Control and Prevention has provided an immunization reference website <http://nip.cdc.go.kr> for convenient access to immunization information. This website provides services such as immunization information, the immunization schedule, Q&A, the National Vaccine Injury Compensation Program (VICP), information on immunization-related programs, a reporting system for side effects after vaccination, and issuance of immunization records. For user's convenience, both PC and mobile versions are supported.

2.2. Project Promotion Process

The immunization reference website was developed in 2002. In 2004, a self-reporting system about vaccination side effects for parents and guardians was available and a retrieval system for technical immunization information was established in 2007. Parents and guardians could access their children's immunization records anytime after signing up and undergoing real-name authentication <Table 7-1, 2>. From 2011, a mobile application service has been available, which total number of downloads was 113,738, including 80,275 for Android users and 33,463 for iPhone users.

Table 7-1 | Number of Members Registered in the Immunization Reference Website

(Unit: persons)

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011
Number of members	1,699	11,712	16,370	13,389	23,977	32,019	108,076	74,009	226,560

Source: Administrative reports of Korea Centers for Disease Control and Prevention

Table 7-2 | Number of Visits to the Immunization Reference Website

(Unit: persons)

Classification	2005	2006	2007	2008	2009	2010	2011
Click rate (number of visits)	38,944	37,750	63,160	91,879	259,572	216,987	514,971

Source: Administrative reports of Korea Centers for Disease Control and Prevention

3. Short Message Service (SMS) for Confirmation of Immunization and Notification of Next Immunization Schedules

3.1. Background

As private clinics started to actively participate in the national immunization program, the registration rate of personal immunization records has increased in the Immunization Registry Information System (IRIS). Hence, most immunization records are now computerized. Yet, the information of where and how the data has been collected and computerized has become an important political issue. Based on these immunization records for children, the KCDC provides Short Message Service (SMS) about immunization information and the next scheduled immunization date through mobile phones.

3.2. Project Promotion Process

3.2.1. Immunization Confirmation Service

An immunization confirmation service was established in March 2009. This service applies to immunization cases in medical institutions that participate in the medical expense reimbursement system. For instance, if children aged 0 through 12 have received their core required immunizations including BCG, Hepatitis B, DTaP, Td, IPV, MMR, varicella, Japanese encephalitis, DTaP-IPV, and Tdap, the next day, parents and guardians will receive a confirmation of the children's immunization information as follows: "Your child received [vaccine name] at the [clinic name] on [month and date]."

3.2.2. SMS Immunization Reminder Service

Since December 2010, KCDC has provided a recall SMS for children who have been registered in the immunization registry system and have agreed to receive SMS text

messages. If the immunization record for children aged 0 through 12 has been updated in the registry system, the next immunization date is automatically calculated and the parent or guardian is informed by an SMS text message as follows: "The next immunization date for [child's name] is coming up. Please check your child's immunization history at http://nip.cdc.go.kr."

4. Vaccination Training for Health Care Providers

4.1. Background

The public health conditions in South Korea in the 1960s and 70s were extremely poor due to the spread of infectious diseases and the poor public health infrastructure. The number of health care providers was far from meeting the demand. Moreover, the supply of physicians, nurses, and even nurse aids was also terribly insufficient in public health centers and their branches. Thus, the health personnel of public health center branches in towns (*eup*) and sub-counties (*myeon*) had only been trained on the skills and knowledge of vaccinations by physicians of the public health centers, appointed branch office directors, and physicians who could practice in only a limited area. In addition, most health personnel in the towns (*eup*) and sub-counties (*myeon*) were unlicensed middle or high school graduates; thus, it would be difficult to categorize them as public health experts. Accordingly, at that time, systematic immunization training for physicians and health personnel was not realistic. However, as socioeconomic conditions in Korea have improved, physicians and health personnel in public health centers were also trained by the National Institutes of Health. Furthermore, physicians in private clinics have been educated by academic societies.

Meanwhile, public health centers had no motivation to take leadership over private clinics in immunization projects. When private clinics were first allowed to participate in the National Immunization Program in 2009, physicians and specialists in private clinics were systematically provided with education by the government. In other words, with the establishment of the government policy for the participation of private clinics, a cooperation system between the public health centers and the private clinics was also established. If a private clinic had not received training for vaccination, it could not participate in the National Immunization Program (reimbursement system).

4.2. Project Promotion Process

4.2.1. Online Training for Medical Institutions

In the beginning of 2009, classroom-based training was performed for those in medical institutions involved in the required immunization support program (NIP), the reimbursement program for private clinics, and the H1N1 prevention program. However, classroom training has now been replaced with online training in order to increase the accessibility to trainees.

Online education for medical institutions that provide immunization services include a basic training course and a refresher training course. Online training courses are being administered by the KCDC training system at http://edu.cdc.go.kr.

It was recommended that the basic training course be completed by every immunization-related health care provider including physicians, nurses, and nurse aids. In particular, this course must be completed by more than one physician before the medical institution makes a contract to participate in the medical billing reimbursement system. A total of 7 courses are provided. In addition, the refresher training course should be completed by every medical institution with a vaccination contract at least once a year <Table 7-3>.

Table 7-3 | Online Training Courses for Medical Institutions in 2012

Classification	Basic training course title	Refresher training course title
1st class	Introduction to the National Immunization Program (NIP)	Introduction to NIP
2nd class	How to use the Immunization Registry Information System (IRIS)	Standards and methods for vaccination (I)
3rd class	How to use the medical expense reimbursement system	Standards and methods for vaccination (II)
4th class	Standards and methods for vaccination (I)	-
5th class	Standards and methods for vaccination (II)	-
6th class	Adverse reactions after vaccination	-
7th class	Handling and storage of vaccines	-

Source: Administrative reports of Korea Centers for Disease Control and Prevention

4.2.2. Offline Training for Health Care Providers

Special offline training courses have been conducted for various participants including vaccination staff, staff of the prevention program for perinatal transmission of hepatitis B, influenza vaccination staff, vaccination physicians in cities/provinces/and public health centers, and call center (129) representatives in the Ministry of Health and Welfare (MOHW) <Table 7-4>.

Table 7-4 | Special Offline Vaccination Training Courses for Health Care Providers

(Unit: days, persons)

Training Course Title	2009		2010		2011	
	Days for training	Number of attendees	Days for training	Number of attendees	Days for training	Number of attendees
Special training for vaccination staff in cities, provinces, and public health centers	One day	333 people	One day	343 people	One day	194 people
			One day	384 people	One day	338 people
Training for staff of prevention program for vertical transmission of hepatitis B in cities, provinces, and public health centers	-	-	One day	290 people	One day	270 people
Training for influenza vaccination staff in cities, provinces, and public health centers	One day	448 people	Two days	387 people	Two days	378 people
Special training for vaccination physicians in cities, provinces, and public health centers	-	-	one day	187 people	one day	182 people

Training Course Title	2009		2010		2011	
	Days for training	Number of attendees	Days for training	Number of attendees	Days for training	Number of attendees
Special training for H1NI vaccination staff in cities, provinces, and public health centers	One day	409 people	-	-	-	-
Training for call center (129) representatives of MOHW	One day One day One day	42 people 21 people 100 people	-	-	-	-
Training for vaccination consultants	3 days 3 days	27 people 27 people	-	-	-	-

Source: Administrative reports of Korea Centers for Disease Control and Prevention

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Chapter 8

Monitoring of Immunization Outcomes

1. Korean National Immunization Survey
2. Factors Affecting the Immunization Rate

Monitoring of Immunization Outcomes

1. Korean National Immunization Survey

1.1. Introduction

The immunization rate is a very important indicator that shows the outcomes of vaccination. With this rate, the vaccination level can be monitored, preventable infectious diseases can be brought toward the eradication level, and immunization rates can be compared among different countries. Thus, each country has developed various survey methods to determine the immunization rate. In addition, several studies are focusing on the frequency needed for surveys and the data sources.

In several countries other than Korea, a survey is conducted once a year. Survey methods include telephone surveys (CDC, 2010), ground mail surveys (Public Health Agency of Canada, 2006), household interviews (World Development Report, 1993; WHO, 1993; Ministry of Health, 2007), and computerized data surveys (Immunization Advisory Centre, 2010; The NHS Information Centre, 2010). Target age groups are also diverse.

Since 1982, the Korean Immunization Survey has been conducted as part of the National Survey on Fertility, Family Health and Welfare in Korea. This is conducted once every three years; however, the survey design has been inadequate and the survey itself has not been performed every year. Furthermore, despite the fact that household interviews in specific areas (Shin, et al., 2005) and telephone/household surveys at the national scale (Park, et al., 2011; Park, et al., 2009) were conducted, these should be characterized as pilot studies that are used to evaluate various possible samples and their accuracies rather than official national statistics.

Even though the immunization rates in Korea have been estimated using administrative and vaccine supply data for convenience, the reliability of the data and the accuracy of statistics were inadequate. Since 2002, the Immunization Registry Information System (IRIS) has been administered on the internet; however, the IRIS system is not for every vaccine from all immunization providers, but only from voluntary providers. Thus, accurate statistics on the immunization rate remain limited (Lee, et al., 2009; Lee, et al., 2012). Accordingly, since 2011, the immunization rates have been determined by a nationally standardized survey method which is designed to calculate the immunization rates at the national, metropolitan, and province levels.

1.2. Introduction to the Survey

1.2.1. Subjects

Following the prescribed schedules for each immunization, the subjects of the survey are three-year-old children, who should have completed the core required immunizations, and seven-year-old children, who are at the age of having all of their follow-up immunizations completed. As indicated by required residential registration at the appropriate local government office, the target populations are three- and seven-year-old children whose immunization records have been registered in KCDC IRIS at least once. IRIS is the computerized system that was implemented in 2002. Through this system, subjects' information can be more accessible than from other data sources as variables related to immunization are included and consent for official data collection has already been given in advance. Moreover, the data from IRIS is valuable for determining the immunization rates because of the high data accuracy and registration rate.

1.2.2. Sampling Methods

The samples are distributed from each of the 16 metropolitan cities and provinces. The samples in the provinces including cities and counties, that is, urban and rural areas, are distributed by the population rates between the cities and counties. The same number of minimum sampling was selected only as an original sample. It was designed so that the substitute sample was selected with the up and down order of the substitute sample.

1.2.3. Data Collection

a. Three-Year-Old Children

- Vaccination lists for the survey
  - National core required immunizations (National Immunization Program; NIP): tuberculosis vaccine (BCG; intradermal injection), hepatitis B three doses, diphtheria, tetanus and acellular pertussis vaccine (DTaP) four doses, inactivated polio vaccine (IPV) one dose, measles, mumps, and rubella (MMR) one dose, varicella (Var) one dose, and Japanese encephalitis (JEV; inactivated vaccine) three doses
- Immunization records (for the lists mentioned above), immunization dates, type of immunization clinic, and names/areas of immunization medical institutions
- Factors affecting immunization rates

b. Seven-Year-Old Children

- Vaccination lists for the survey
  - National core required immunizations (National Immunization Program; NIP): BCG (intradermal injection), hepatitis B three doses, DTaP five doses, IPV four doses, MMR two doses, varicella one dose, and JEV (inactivated vaccine) four doses
- Immunization records (for the lists mentioned above), immunization dates, type of immunization clinic, and names/areas of immunization medical institutions
- Factors affecting the immunization rate

1.2.4. Methods

A computer-aided telephone interview (CATI) is used and the source of data is personal immunization records. Only the vaccination lists in these immunization records are included in the survey.

1.2.5. Calculation of Weighted Values

The immunization rate is calculated after being treated with a weighted value so that the result of the sample survey is representative. For the estimated immunization rate of the survey population by nation/metropolitan city/and province, the variables used for correction are residential area (urban or rural) and sex.

1.2.6. Accuracy Validation

Immunizations are documented in medical records, IRIS, and personal immunization records. Technically, these three sets of records should correspond; however, mismatches occur for various reasons. There are advantages of using personal immunization records such as its convenience, the acquisition of consent, and the completeness of the data. On the other hand, it also has various disadvantages. Thus, the validation accuracy should be considered to guarantee the accuracy of the data. For this, using the data from personal immunization records collected through CATI, the following data sources are reviewed: 1) IRIS, 2) medical records, and 3) a copy of the content from the personal immunization records.

1.3. Survey Results

1.3.1. NIP Immunization Rates (from the core required immunization list) and Schedule

The rates of immunization based on the list and schedule of the core required immunizations in 2011 were as follows: BCG, 98.8%; the first dose hepatitis B vaccination, 99.0%; the second dose hepatitis B vaccination, 99.3%; the third dose hepatitis B vaccination, 98.7%; the first dose DTaP vaccination, 99.6%; the second dose DTaP vaccination, 99.5%; the third dose DTaP vaccination, 99.1%; the fourth dose DTaP vaccination, 93.5%; the first dose polio vaccination, 99.4%; the first dose MMR vaccination, 99.2%; varicella, 97.7%; the first dose JEV vaccination, 97.9%; the second dose JEV vaccination, 95.9%; and the third dose JEV vaccination, 90.7%. The first dose DTaP vaccination showed the highest immunization rate, at 99.6%, whereas the lowest rate was 90.7% for the third JEV vaccination <Table 8-1>.

Table 8-1 | Immunization Rates by Schedule for the Core Required Immunization List in 2011 (Three-year-old Children)

Vaccination		Time of administration	Cities		Counties		Nation	
			%	(95%CI)	%	(95%CI)	%	(95%CI)
BCG	One dose	Within 4 weeks	98.8	(±0.4)	99.2	(±0.6)	98.8	(±0.4)
Hepatitis B	First dose	0 months	98.9	(±0.4)	99.1	(±0.6)	99.0	(±0.4)
	Second dose	One month	99.3	(±0.4)	99.5	(±0.6)	99.3	(±0.4)
	Third dose	Six months	98.7	(±0.4)	98.3	(±1.0)	98.7	(±0.4)
DTaP	First dose	Two months	99.6	(±0.2)	99.6	(±0.4)	99.6	(±0.2)
	Second dose	Four months	99.5	(±0.2)	99.3	(±0.6)	99.5	(±0.2)
	Third dose	Six months	99.1	(±0.4)	98.7	(±0.8)	99.1	(±0.4)
	Fourth dose	15-18 months	93.5	(±1.0)	93.0	(±2.0)	93.5	(±0.8)
Polio	First dose	Two months	99.4	(±0.2)	99.4	(±0.6)	99.4	(±0.2)
	Second dose	Four months	99.3	(±0.2)	98.2	(±2.0)	99.3	(±0.2)
	Third dose	Six months	98.5	(±0.4)	97.3	(±2.0)	98.4	(±0.4)
MMR	One dose	12-15 months	99.2	(±0.4)	99.2	(±0.6)	99.2	(±0.4)
Varicella	One dose	12-15 months	97.7	(±0.6)	97.8	(±1.2)	97.7	(±0.6)
JEV	First dose	12-36 months	97.9	(±0.6)	98.1	(±1.0)	97.9	(±0.6)
	Second dose	12-36 months	95.9	(±0.8)	95.8	(±1.6)	95.9	(±0.6)
	Third dose	12-36 months	90.7	(±1.6)	91.6	(±2.9)	90.7	(±1.4)

1.3.2. Rate of Complete Immunization from the Core Required Immunization List (NIP)

Completed immunization rates for the vaccinations on the NIP list are as follows: 98.2% for Hepatitis B three doses, 93.2% for DTaP four doses, 98.4% for polio three doses, and 61.4% for JEV three (or two) doses. Completed immunization rate by series are as follows: 3:3:3:1 series, 91.9%; 4:3:1 series, 95.9%; 4:3:1:3:1 series, 90.4%; 4:3:1:3:1:1 series, 88.7%; and 4:3:1:3:1:1:3 series, 56.3% <Table 8-2>.

Table 8-2 | Completed NIP Immunization Rates in 2011 (Three-year-old Children)

Type of vaccine	Cities		Counties		Nation	
	%	(95%CI)	%	(95%CI)	%	(95%CI)
Hepatitis B						
Three doses	98.2	(±0.4)	97.5	(±1.2)	98.2	(±0.4)
DTaP						
Three doses	99.0	(±0.4)	98.7	(±0.8)	99.0	(±0.3)
Four doses	93.2	(±1.0)	92.6	(±2.0)	93.2	(±0.8)
Polio						
Three doses	98.5	(±0.4)	97.0	(±2.0)	98.4	(±0.4)
JEV						
Three (or two) doses	61.8	(±1.8)	56.1	(±3.9)	61.4	(±1.6)
Series						
3:3:3:1[1]	92.1	(±1.0)	90.1	(±2.7)	91.9	(±1.0)
4:3:1[2]	96.1	(±0.6)	93.4	(±2.4)	95.9	(±0.6)
4:3:1:3:1[3]	90.6	(±1.0)	88.0	(±2.9)	90.4	(±1.0)
4:3:1:3:1:1[4]	88.8	(±1.2)	86.7	(±2.9)	88.7	(±1.0)
4:3:1:3:1:1:3[5]	56.8	(±1.8)	50.3	(±4.0)	56.3	(±1.7)

1) Series 3:3:3:1: DTaP three doses, polio three doses, hepatitis B three doses, and BCG one dose

2) Series 4:3:1: DTaP four doses, polio three doses, and MMR one dose

3) Series 4:3:1:3:1: DTaP four doses, polio three doses, MMR one dose, hepatitis B three doses, and BCG one dose

4) Series 4:3:1:3:1:1; DTaP four doses, polio three doses, MMR one dose, hepatitis B three doses, BCG one dose, and varicella one dose

5) Series 4:3:1:3:1:1:3: DTaP four doses, polio three doses, MMR one dose, hepatitis B three doses, BCG one dose, varicella one dose, and JEV three (or two) doses

1.4. Implications

The Korea immunization rate survey has been performed as a part of the Maternal Child Health Services survey. Thus, the immunization survey could not be designed for measuring accurate immunization rates. Besides, these intermittent immunization surveys were not meant to be official national data. It was not until 2011 that an official immunization survey was launched. This survey has been conducted with a standardized survey method developed by the KCDC.

The 2011 survey data reveals high immunization rates because of parents' keen interest in immunization, free immunization services at public health centers, parents' high trust for the immunization services at public health centers, and the fact that NIP is now available in private clinics. However, the immunization rates for the optional recommended immunizations (which are not included in NIP) are low. Therefore, active policies to address the low rate should be developed.

2. Factors Affecting the Immunization Rate

2.1. Background

The most important factors in immunization are to maintain higher immunization rates than the optimum level, to administer immunizations at appropriate times (ages and intervals), and to complete every necessary immunization for raising the public's immunity (Santoli, et al., 2000; Hull, McIntyre, 2006). It is not easy to complete all immunizations on time because of the numerous types of vaccinations and different complex schedules of the core required immunization list. Furthermore, some immunization records might be incomplete. Thus, to improve the immunization rate, groups that are at risk of missing immunizations should be identified so that concrete strategies can be developed.

Socio-demographic characteristics, health care systems, factors affecting immunization policies, and psychological variables are well-known factors related to immunizations. Socio-demographic factors are pre-determined. Thus, risk groups could be identified based on these factors; however, the strategies that have been developed targeting such groups are limited. For accessibility to the health care system, public interest and relevant strategies are crucial in eliminating obstacles. Hence for this, the NIP coverage project (the medical expense reimbursement system) has been implemented since 2009. Psychological variables including knowledge, attitudes, and beliefs about immunization could be improved by education and campaigns. Therefore, considering socio-demographic characteristics and psychological variables, immunization rates can be improved through a systematic and detailed strategy (Gust, et al., 2005).

2.2. Survey Introduction

Since 2011, the Survey on Factors Affecting Immunization Rates has been performed as part of the National Immunization Survey. In the 2011 survey, CATI asked parents and guardians of three-year-old children to check the following information: parents' ages, parents' education levels, parents' employment, residential areas, parents' existence, health care security status (i.e. type of insurance held), birth weights, the total number of children,

main parent or guardian who brings children to clinics for immunizations, and obstacles to immunization.

2.3. Survey Results

2.3.1. Parents' Ages

With the group of fathers 45 years old and above used as a reference, the rates of completed immunization were 2.62 times higher than the group of 30- to 34-year-old fathers, 2.07 times higher than the group of 29-year-old and younger fathers, 1.99 times higher than the group of 35- to 39-year-old fathers, and 1.40 times higher than the group of 40- to 44-year-old fathers. In the case of mothers, the rate of completion was 1.95 times higher than the group of 30- to 34-year-old mothers. These data were all statistically significant <Table 8-3>.

Table 8-3 | Relationship between Parents' Ages and Rates of Completed Immunization

Parent and age		N	p-value	Odds ratio	95% confidence interval	
					Lowest	Highest
Father's age		6,381	0.000	0.94	0.93	0.96
	29 years old and younger	127	0.024	2.07	1.10	3.89
	30-34 years old	1,415	0.000	2.62	1.90	3.61
	35-39 years old	2,915	0.000	1.99	1.49	2.65
	40-44 years old	1,557	0.025	1.40	1.04	1.89
	45 years old and older	367		1.00	-	-
Mother's age		6,921	0.000	0.97	0.96	0.99
	29 years old and younger	551	0.254	1.44	0.77	2.70
	30-34 years old	2,883	0.026	1.95	1.08	3.51
	35-39 years old	2,730	0.189	1.48	0.82	2.66
	40-44 years old	674	0.626	1.16	0.63	2.15
	45 years old and older	83		1.00	-	-

Note: 1. Dependent variable: completely vaccinated three-year-old children (0, standard) and completely vaccinated three-year-old children (1)

2. The complete immunization of three-year-old children is defined as 13 total doses of NIP vaccinations excluding JEV. In other words, four doses of DTaP, three doses of poliovirus, one dose of MMR, three doses of hepatitis B, one dose of BCG, and one dose of varicella

2.3.2. Parents' Education Level

The complete immunization rates were higher in highly educated parents. In other words, the complete immunization rate of fathers who graduated from college or a higher level was 1.52 times higher than those who graduated from high school or a lower level. In addition, it was 1.42 times higher for mothers who graduated from college or a higher level than those who graduated from high school or less. All of these data were statistically significant <Table 8-4>.

Table 8-4 | Relationship between Parents' Education Level and Rate of Completed Immunizations

Parent and education level		N	p-value	Odds ratio	95% confidence interval	
					Lowest	Highest
Father's education level		6,293	0.000			
	Graduated from high school or below	2,011		1.00	-	-
	Graduated from college or above	4,282	0.000	1.52	1.30	1.79
Mother's education level		6,837	0.000			
	Graduated from high school or below	2,624		1.00	-	-
	Graduated from college or above	4,213	0.000	1.42	1.22	1.65

2.3.3. Parents' Employment

The rate of immunization completion was 1.86 times higher in the group of employed fathers, and this difference was statistically significant <Table 8-5>.

Table 8-5 | Relationship between Parents' Employment and Rate of Completed Immunization

Parent and employment status		N	p-value	Odds ratio	95% confidence interval	
					Lowest	Highest
Father's employment status		6,421	0.000			
	Unemployed	146		1.00	-	-
	Employed	6,275	0.004	1.86	1.22	2.83
Mother's employment status		6,968	0.000			
	Unemployed	4,491		1.00	-	-
	Employed	2,477	0.093	0.88	0.75	1.02

2.3.4. Health Care Security Status

Compared to medical aid beneficiaries, the rate of completed immunization of those with national health insurance was 1.35 times higher, and this difference was statistically significant <Table 8-6>.

Table 8-6 | Relationship between Health Care Security Status and Rate of Completed Immunization

Health care security status		N	p-value	Odds ratio	95% confidence interval	
					Lowest	Highest
Health care security status		7,040	0.000			
	National Health Insurance	6,601	0.035	1.35	1.02	1.77
	Medical Aid	439		1.00	-	-

Medical aid members: Those with a household income below a certain threshold qualify for subsidized coverage of health insurance costs

2.3.5. Total Number of Children and Birth Order

The more children were in a family, the lower the rates of completed immunization. (With one additional child, the completed immunization rate was 0.84 times lower.) Furthermore, comparing the completed immunization rates between groups (three-year-old children) who were the fourth child or beyond and those who were an only child, the completed immunization rate was 2.32 times higher in the only child group. In addition, it was 3.12 times higher in the first child group and 1.97 times in the second child group. In

other words, the complete immunization rates were higher in the early birth order groups. These differences were statistically significant <Table 8-7>.

Table 8-7 | Relationship among the Total Number of Children, Birth Order, and Rate of Completed Immunization

Total number of children and birth order		N	p-value	Odds ratio	95% Confidence interval	
					Lowest	Highest
Total number of children		7,040	0.001	0.84	0.76	0.93
Birth order of three-year-old children		7,040	0.000			
	Only child	1,314	0.003	2.32	1.34	4.03
	The first child among multiple children	2,198	0.000	3.12	1.81	5.37
	The second child among multiple children	2,716	0.013	1.97	1.16	3.37
	The third child among multiple children	730	0.293	1.35	0.78	2.35
	The fourth or additional child among multiple children	82		1.00	-	-

2.3.6. Barriers to Immunization

The biggest barrier to immunization was forgetting the scheduled immunization dates. The completed immunization rate in respondents noting this reason was 0.62 times lower than those reporting no obstacles. The rate was 0.70 times lower in parents who responded that they were too busy to visit a clinic for immunization. However, the rate of completed immunization was 1.49 times higher in parents who responded that the cost of vaccination was expensive. These differences were all statistically significant <Table 8-8>.

Table 8-8 | Relationship between Obstacles to Immunization and Complete Immunization Rates

Types of barriers	N	p-value	Odds ratio	95% confidence interval	
				Lowest	Highest
Forgetting immunization dates	7,040	0.000			
Not an obstacle	5,755		1.00	-	-
Is an obstacle	1,285	0.000	0.62	0.52	0.74
Too busy to visit a clinic	7,040	0.000			
Not an obstacle	6,503		1.00	-	-
Is an obstacle	537	0.000	0.70	0.54	0.89
Too expensive	7,040	0.000			
Not an obstacle	2,619		1.00	-	-
Is an obstacle	4,421	0.000	1.49	1.29	1.73
Concerned about side effects	7,040	0.000			
Not an obstacle	6,665		1.00	-	-
Is an obstacle	375	0.136	1.32	0.92	1.89
Low quality of the public health center	7,040	0.000			
Not an obstacle	6,901		1.00	-	-
Is an obstacle	139	0.410	0.81	0.50	1.33
Accessibility to the public health center (transportation)	7,040	0.000			
Not an obstacle	6,991		1.00	-	-
Is an obstacle	49	0.781	1.14	0.45	2.88
Missing immunization dates because children had been sick during immunization periods	7,040	0.000			
Not an obstacle	6,994		1.00	-	-
Is an obstacle	46	0.736	0.86	0.36	2.04

2012 Modularization of Korea's Development Experience
Korean National Immunization Program for Children

Chapter 9

Directions for Future Development

Directions for Future Development

Immediately after Korea was liberated from Japan and established a government in 1948, the Korean War occurred from 1951 through 1953. As a result, the public health system could not meet its demand because the structure of the public health system, along with the broader socioeconomic system, was completely destroyed by the war. From this point, South Korea has developed its public health system over the past 60 years, culminating in the modern system of today. The specific reasons for the success of the early immunization program despite the insufficient public health infrastructure are as follows:

First of all, technical support from developed countries including the WHO was applied efficiently. The Saemaeul ("New Community") Movement (a pan-national campaign for local community development beginning in the 1970s), environmental hygiene projects initiated by the recommendation of WHO advisors, and family planning services including children's health care were important opportunities to enlighten residents at the village level. Such opportunities were the foundation of the comprehensive immunization program as these projects were implemented based on the growth of the national economy.

Secondly, public health branches and health workers were systematically distributed throughout towns. Even though the national socioeconomic condition was terrible several decades ago, strongly driven by a policy named "the solution for a doctorless town," the Korean government built public health branches in every town, which was a fundamental administrative unit. In addition, health care providers in charge of family planning services, maternal and child health care, and the tuberculosis control program were assigned to control acute and chronic infectious diseases and to provide family planning services, which were the most urgent needs. Providing public training and services by visiting each village, collective education and practice were possible. In other words, the village was the unit in which community-based participatory health programs were carried out.

Thirdly, mobile mass immunization was conducted by mobilizing resources on a grand scale. Various infectious diseases such as dysentery, typhoid, cholera, Japanese encephalitis, polio, and measles occurred year after year and the deaths caused by these diseases were difficult to control given the insufficient infrastructure. In particular, people could rarely access the public health clinics due to the shortage of clinics and limited transportation. In these circumstances, having a legal imperative for a mobile mass immunization program, for the distribution of access to physicians and for the mobilization of health care workers, was an important and effective strategy.

Lastly, the government actively implemented the policy of "the solution for a doctorless town" by distributing physicians to towns. To place physicians and nurses in public health institutions, the government provided a scholarship covering tuition fees and additional expenses for students in the health care professions. After graduation, they were expected to work in areas assigned by the government. Afterward, the government continued to distribute physicians in each town (the primary unit by law) and also used incentive systems. Physicians had finally been placed in every town by 1983, and infectious diseases were successfully controlled by public health worker education and infectious disease controls in the 1960s and 70s.

As mentioned above, even right after the war, outstanding results were possible due to the central and local governments' efforts to distribute medical benefits to the basic unit, the town, in a short period of time. However, this outcome only occurred in urgent situations and could not be suggested as a future-oriented immunization plan. By the 2000s, successful experiences of infectious disease control had accumulated, including hepatitis B perinatal transmission prevention, measles eradication, and the rapid control of influenza A virus subtype H1N1. As the socioeconomic level continues to improve, additional immunization projects will be needed to control future infectious diseases with the proper immunization programs. Concrete suggestions are as follows:

First of all, strategies for the eradication of infectious diseases that can be prevented by vaccination need to be established. The immunization rate in South Korea is over 95% because people are now having few children due to successful family planning with high education-oriented parenting and massive interest in their children. Due to these conditions, decisions should now be made on the priority of projects for eradicating infectious diseases that can be prevented by vaccination.

Secondly, in light of data on the measles and H1N1 pandemics, existing and new infectious diseases threaten the public with either a 10-year cycle or a 5- to 6-year cycle. Thus, preparation must be made for these types of epidemics and crises. In addition, public information and education strategies should always be ready.

Thirdly, trained immunization experts should be secured to study and control infectious diseases. The ability to react to the outbreak of infectious diseases must be developed by studying the ones that could threaten the public in the future. Sufficient knowledge and experience should be accumulated to prepare for the influx of infectious diseases from foreign countries. Furthermore, proper strategies for maintaining safety from foreign infectious diseases need to be provided to protect Koreans overseas.

Fourthly, vaccine production capacity must be securely established. When a pandemic breaks out, the supply of vaccines could be temporally limited. As a result, the public would not be able to get vaccinated. Thus, uninterrupted investment and research are needed to increase the quality of vaccine production. The capacity to generate a self-sufficient supply is surely an important public health and safety issue.

Finally, even though South Korea has a high vaccination rate of over 95%, the participation of vulnerable social groups in vaccination programs must be expanded, and more types of vaccines should be covered by the government (i.e., be included in NIP). Recently, a large number of foreign immigrants have settled in South Korea from many countries that have different vaccination programs, which means different types of vaccines are provided by the government and methods of vaccination are different. Thus, active vaccination strategies for foreign immigrants are needed. In addition, it should be noted that parents still have an economic burden because some vaccines have not been included in the core required immunizations of the National Immunization Program.

In conclusion, even though South Korea has achieved a high immunization rate, has succeeded in controlling and eradicating serious infectious diseases, and has established an outstanding public health system in a short period of time, the work of predicting and protecting Koreans from infectious diseases is not completed yet. Therefore, ongoing investment and research will establish Korea as a country safe from infectious diseases.

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1. National Publications

1. Notification

2011 Standards and Methods for the Implementation of Immunization Notification

2. Guidelines

2006 Varicella Management Guideline

2011 Epidemiology and Management of Infectious Diseases Targeted for Immunization

2011 Management Guidelines on Infectious Diseases Targeted for Immunization

2011 Post-immunization Allergic Reaction Management Guideline

2012 Infectious Disease Management Project Guideline

2011 Epidemiology and Management of Infectious Diseases

2011 Infectious Disease Surveillance and Reporting Guideline

2012 Management Guidelines on Core Required Immunization Support Project of Medical Institutions (used in public health centers)

2012 Guideline for the Project on Vaccination of School Children

2011-2012 Seasonal Influenza Management Guideline

2012 Hepatitis B Project Guideline (used in public health centers)

2009 H1N1 Immunization Project Guideline

3. Publications

2004 Measles White Paper

2006 5-year National Measles Elimination Project White Paper

2009-2010 H1N1 Countermeasure White Paper

2011 Disease Management White Paper (annual)

2011 Health and Welfare Statistical Yearbook (annual)

2011 Disease and Health Joint Management System White Paper
Sample Surveillance Newsletter on Infectious Diseases at Schools (weekly)
Sample Surveillance Newsletter on Infant Infectious Diseases (weekly)

Weekly Report on Health and Disease (weekly)

Infectious Disease Occurrence Weekly Bulletin (weekly)

Immunization Monthly Newsletter (monthly)

4. Educational Materials

2011 New Education for Immunization Managers Working for City, Provincial, and Public Health Centers

2011-2012 Seasonal Influenza Education Material

2011 Standards on Professional Education Material and Safety Management of Immunization

2011 Education on Core Required Immunization Support Project (Immunization Expansion Project)

2011 Educational Material on Project to Prevent Perinatal Transmission of Hepatitis B

5. Internet Websites

Ministry of Health and Welfare (http://www.mw.go.kr)

Korea Centers for Disease Control and Prevention (http://www.cdc.go.kr)

Disease and Health Joint Management System (http://is.cdc.go.kr)

Immunization Helpdesk Website (http://nip.cdc.go.kr)

Infectious Disease Web-based Statistics System (http://stat.cdc.go.kr)

2. Main Content of "Law on the Prevention and Management of Infectious Diseases"

① The responsibility of the national and local governments (Article 4)

- Establishing preventive measures on infectious diseases
- Diagnosis, education, and PR on infectious diseases
- Nurturing professional human resources for infectious disease prevention
- Establishing and implementing the immunization plan for disease prevention

② Establishment of committees such as the Infectious Disease Management Committee (Article 9)

- Immunization Expert Committee
- Immunization Injury Compensation Expert Committee
- Tuberculosis Expert Committee
- Epidemiological Research Expert Committee
- Infectious Disease Crisis Countermeasure Expert Committee, etc.

③ Reporting of individuals, such as doctors (Article 11)

- When allergic reactions occur after immunization, one must immediately report to the director of the public health center.

④ Routine immunizations (Article 24)

- Types: Diphtheria, Polio, Measles, Tetanus, Tuberculosis, Hepatitis B, Mumps, Rubella, Varicella, Japanese encephalitis, and infectious diseases designated by the Minister of Health and Welfare
- The person in charge of routine immunization: Mayor, head of the county, district chairman (director of public health center)
- Immunization institution: Public health center and private medical institution

⑤ Record reporting

- Public health center: report to mayor, provincial governor, or the Minister of Health and Welfare
- Private medical institution: report to mayor, head of the county, or district chairman (president of public health center)

⑥ Confirmation of the completion of immunizations - Target institutions: elementary schools, middle schools, kindergartens, daycare centers

- Person in charge: Mayor, head of the county, or district chairman (director of public health center)

⑦ Planning and Producing Vaccines

- The president of the Korea Centers for Disease Control and Prevention can have the necessary amount of immunization medication produced beforehand.

⑧ The Coverage of Immunization Costs

• Nation

- Infectious disease education and PR costs
- Production costs for immunization medication and research costs
- Immunization-related injury compensation costs
- More than 1/2 of the expense of what every city and province covers

• Metropolitan City and Province

- Immunization costs
- 2/3 of the expense of what every city, county, and district covers

• City, County, and District

- Immunization costs
- A part of the expense on immunization from the commissioned medical institution

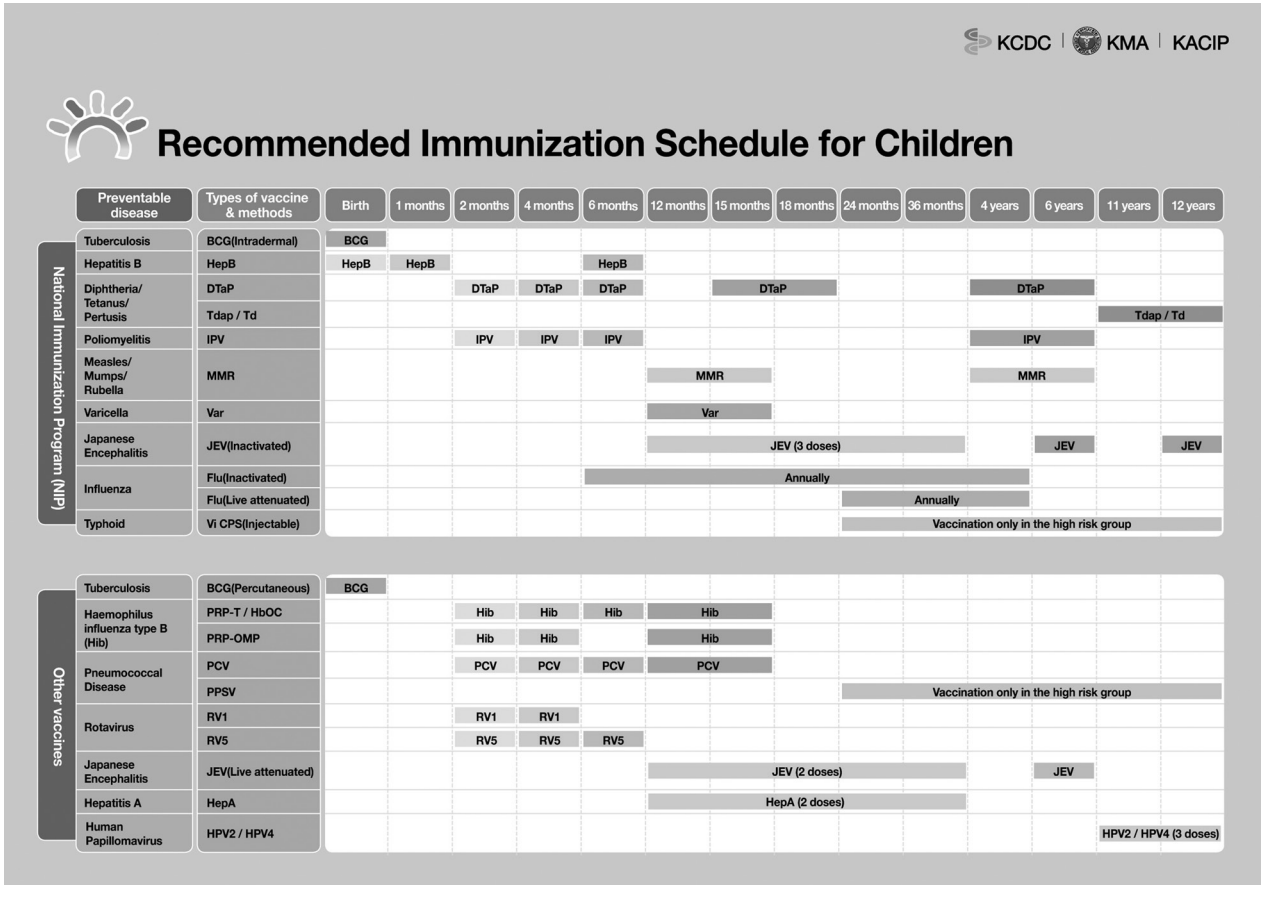
3. The Main Contents of the 'Notice Regarding the Implementation, Criteria, and Methods for Immunization'

Area	2002	2005 Revision	2006 Revision	2010 Revision	2011 Revision
Laws and regulations applicable to epidemics	1. Diphtheria, polio, pertussis, measles, tetanus, tuberculosis, hepatitis B, mumps, and rubella – a total of 9 infectious diseases	1. Diphtheria, polio, pertussis, measles, tetanus, tuberculosis, hepatitis B, mumps, and rubella – a total of 9 infectious diseases	1. Diphtheria, polio, pertussis, measles, tetanus, tuberculosis, hepatitis B, mumps, rubella, varicella – a total of 10 infectious diseases	1. Typhoid fever, diphtheria, pertussis, tetanus, measles, mumps, rubella, polio, hepatitis B, Japanese encephalitis, varicella	Same as on the left
Infectious diseases specified by the Ministry of Health and Welfare	2. Japanese encephalitis, typhoid, influenza, fever with renal syndrome epidemic – a total of 4 infectious diseases	2. Japanese encephalitis, typhoid, influenza, fever with renal syndrome, varicella – a total of 5 infectious diseases	2. Japanese encephalitis, typhoid, influenza, fever with renal syndrome epidemic -– a total of 4 infectious diseases	2. Tuberculosis, fever with renal syndrome epidemic, influenza.	Same as on the left
Institutions providing immunizations	① Public health care facilities ② Other facilities	Same as on the left	Same as on the left	Same as on the left	Same as on the left
Immunization providers	Trained medical personnel	Same as on the left	Same as on the left	Same as on the left	Same as on the left

Area	2002	2005 Revision	2006 Revision	2010 Revision	2011 Revision
Obligations of immunization providers	1. Recording immunization histories and issuing coupons 2. Training and publicity regarding immunizations 3. Check if there are any immunization contraindications	Same as on the left	Same as on the left	Same as on the left	Same as on the left
Recording and archiving	Record and preserve matters relating to the immunization record, in particular: 1. Vaccinee personal information and immunization history 2. Physical examination to determine if anything abnormal had been detected after an immunization in the past, including specific history of allergy and other local reactions	Same as on the left	Same as on the left	Record and preserve materials related to the immunization in the immunization register and the management information system 1. The biographical details of the person immunized 2. Immunization history, the order immunizations were given, vaccine used, batch number, date of immunization and immunization methods	Record and preserve the following in the electronic Immunization Registry Information System 1. The biographical details of the person immunized 2. Immunization history, the order immunizations were given, vaccine used, batch number, date of immunization and immunization methods

Area	2002	2005 Revision	2006 Revision	2010 Revision	2011 Revision
Immunization booklet	Record the type of vaccine given, the type of vaccine and the date of the immunization that should be given next in the immunization booklet brought by the guardian. Make a copy of the immunization booklet in case it gets lost. Ask the parent or guardian to record a copy of the immunization record.	Same as on the left	Same as on the left	Same as on the left	Same as on the left
Reporting obligations	The medical institutions offering immunizations should report to the public health center about the methods used for preventing infectious diseases. If there is any serious adverse effect after the immunization relating to the vaccine, this should also be reported directly to the public health center.	Same as on the left	Same as on the left	Same as on the left	Same as on the left
Vaccine purchase and storage	Public health facilities should receive the biological shipment certificate and verify the manufacturing date, the manufacturing company, the provider, the product (lot) number, the validity period, the quantity purchased, and the quantity in stock. Transport and keep the vaccines in proper containers.	Same as on the left	Same as on the left	Same as on theleft	Same as on the left

4. Recommended Immunization Schedule for Children (in English)



5. The Index of Social Health in South Korea from 1960 to 2010

Index	1960	1966	1970	1975	1980	1985	1990	1995	2000	2005	2010
Population growth rate (per 1,000 people)	3.01	2.57 ('65)	2.21	1.70	1.57	0.99	0.99	1.01	0.84	0.21	0.26
Natural population increase rate (per 1,000 people)	30.0	25.1	23.2	17.1	15.4	10.2	9.5	10.3	8.2	3.9	4.3
Crude birth rate (per 1,000 people)	42.1	34.6	31.2	24.8	22.6	16.1	15.2	15.7	13.3	8.9	9.4
Crude death rate (per 1,000 people)	12.1	9.5	8.0	7.7	7.3	5.9	5.6	5.3	5.2	5.0	5.1
Average life span (age)	52.4 (M:51.1 F:53.7)	M:54.92 F:60.99	61.93 (M:58.67 F:65.57)	63.82 (M:60.19 F:67.91)	65.69 (M:61.78 F:70.04)	68.44 (M:64.45 F:72.82)	71.28 (M:67.29 F:75.51)	73.53 (M:69.57 F:77.41)	76.02 (M:72.25 F:79.60)	78.63 (M:75.14 F:81.89)	80.79 (M:77.20 F:84.07)
Infant death rate (per 1,000 born infants)	58.2	46.2	53.0	38.0	17.3	13.3	12.8	7.7('96)	6.2('99)	4.7	3.5('08)
Maternal death rate (per 10,000 births)	-	-	8.3	5.6	4.2	3.4	3.0	2.0	1.5	1.4	1.24('08)
National income per capita (dollar)	79	125	255	607	1,660	2,355	6,303	11,735	11,292	17,531	20,562
Tuberculosis occurrence rate	-	-	4.2	3.3	2.5	2.2	1.8	68.2	41.4	72.45	72.40
Cholera contraction rate	-	-	0.6	-	0.4	-	-	0.1	-	0.03	0.02

Index	1960	1966	1970	1975	1980	1985	1990	1995	2000	2005	2010
Dysentery contraction rate	0.2	0.4	-	-	-	-	-	-	-	-	-
Typhoid contraction rate	11.2	11.8	13.1	1.5	0.5	0.5	0.5	0.8	0.5	0.39	0.27
Paratyphoid contraction rate	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.06	0.11
Smallpox contraction rate	0.3	0.0	-	-	-	-	-	-	0.1	-	-
Typhus fever contraction rate	0.1	-	-	0.0	0.0	0.5	0.3	0.3	0.1	0.18	0.21
Relapsing fever contraction rate	3.3	4.4	1.8	1.0	0.1	0.0	-	-	-	-	-
Diphtheria contraction rate	0.1	0.1	-	-	-	-	-	-	-	-	-
Epidemic cerebrospinal meningitis contraction rate	5.0	-	-	-	-	-	-	-	-	-	-
Epidemic encephalitis contraction rate	-	-	-	0.1	0.2	0.1	-	0.1	5.1	0.65	0.45
Bacillary dysentery contraction rate	-	-	0.5	0.1	0.0	-	-	-	-	-	-
Polio contraction rate	-	-	11.8	3.4	4.1	1.1	0.4	0.0	0.1	0.02	0.05
Pertussis contraction rate	-	-	11.2	14.1	13.1	3.1	8.0	0.2	68.0	0.01	0.23
Measles contraction rate	-	-	2.5	5.2	2.3	3.0	4.9	1.0	6.2	3.83	12.15

Index	1960	1966	1970	1975	1980	1985	1990	1995	2000	2005	2010
Mumps contraction rate	-	-	49.4	0.9	-	-	0.0	0.2	8.6	2.81	3.53
Malaria contraction rate	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.02
Meningococcal meningitis contraction rate	-	-	-	-	0.1	0.1	0.2	0.2	0.4	-	-
Epidemic hemorrhagic fever contraction rate	5.0	12.2	0.1	0.3	0.3	-	0.0	-	-	0.01	0.05
Japanese encephalitis contraction rate	-	-	-	-	-	-	-	0.6	3.7	13.93	11.31
Varicella contraction rate	-	-	-	-	-	-	-	-	-	3.97	48.66

* The numbers indicate the number of reports from each city and province according to the Infectious Disease Prevention Act. The number of the population is based on the mid-year population. Contraction rate=number of patients/total population x 100,000. The numbers after August 2000 include the number of doctor-patients due to the renewal of the law on reporting standards

* The unit of occurrence rate from 1960 to 1990 is per 100 people and per 100,000 people from 1995 to 2010

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