

Special Article



History of Acquired Immune Deficiency Syndrome in Korea

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Conflict of Interest

No conflicts of interest.

ABSTRACT

The first human immunodeficiency virus (HIV) infection was reported in Korea in 1985. The number of HIV-infected persons domestically increased in the 1990s showing epidemic indigenization. Since then, the number of new infections gradually increased every year, and recently more than 1,000 newly infected cases were reported per year. A total of 12,522 infected individuals have been reported up to 2015, of which 2,020 died. The male to female ratio was 15.4:1, and 34.2% of them were under 30 years old. The infection route was homosexual and bisexual contact in 60.1% of cases and heterosexual contact in 34.6% of cases. Candidiasis, Pneumocystis pneumonia, tuberculosis were common as a AIDS (acquired immune deficiency syndrome)-defining illness. But with the introduction of antiretroviral therapy in the late 1990s, non-AIDS defining illnesses such as metabolic complications, cardiovascular diseases, bone diseases, and neuropsychiatric disorders such as neurocognitive dysfunction, depression, and anxiety are emerging as new health problems. The management policy switched its focus from regulating and monitoring of HIV-infected persons to ensuring access to treatment and promotion of voluntary HIV testing in high-risk groups. Also as the age of the infected persons increases, a need for various supports such as social rehabilitation, life counseling, and welfare has emerged.

Keywords: Acquired immune deficiency syndrome; Human immunodeficiency virus infection; Human immunodeficiency virus; History; Korea

OUTBREAK AND EPIDEMIC OF HIV INFECTION IN KOREA

1. Number of HIV-infected persons in Korea

The first human immunodeficiency virus (HIV) infection in Korea was reported in 1985. Until 1994, less than 100 cases per year were reported. However, between 1995 and 2003 this increased to more than 100 cases per year, followed by more than 500 cases per year after 2003, and more than 1000 cases per year after 2013 [1]. Since the first diagnosis in 1985, a total of 12,522 infected individuals have been reported up to December 2015, of which 2,020 died, and 10,502 have survived so far (Fig. 1).

Author Contributions

These authors contributed equally to this manuscript.

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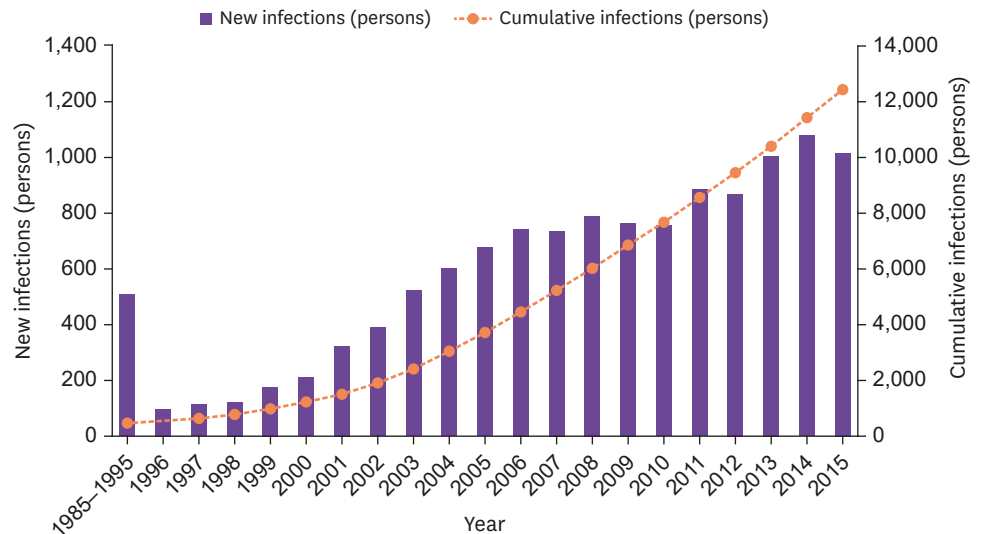


Figure 1. New and cumulative human immunodeficiency virus infections in Korea according to year.

2. Outbreak and epidemic of HIV infection according to the period in Korea

1) The period of first outbreak and epidemic indigenization: 1985 - 1998

HIV infection was first reported in the United States in 1981, while the first case in Korea was reported in 1985. Since then, the number of new infections gradually increased every year, and since 1995, more than 100 cases have been reported per year. At that time, the male to female ratio of infected individuals was 6.9:1, with 38.2% of cases being under 30 years old. A distinctive feature of Korea's early epidemiology is that the proportion of deep-sea fishermen among the infected was relatively high. According to the AIDS (acquired immune deficiency syndrome) Prevention Act implemented in 1987, people with occupations classified as high-risk for HIV infection were subject to mandatory screening. Deep-sea fishermen were classified as a high-risk group and went through mandatory screening until May 1993. Among the 875 infected individuals reported from 1985 to 1998, deep-sea fishermen accounted for 18.5%. In addition, at that time, the proportion of individuals infected through blood products and blood transfusions was relatively high, accounting for 4.3% of the infected cases. As opposed to the early days of domestic epidemiology, when many cases of infection were coming from foreign countries, the number of cases infected domestically increased in the 1990s. The exact timing is unknown, but it is believed that the HIV infection began to spread domestically in the 1990s.

2) The period of rapid increase in outbreak: 1999 - 2005

After the disease began to spread domestically, the number of HIV infected individuals in Korea rapidly increased every year, and since 2003, the number of new infected individuals has exceeded 500 per year. At that time, the male to female ratio of infected persons was 11.1:1, and 23.7% were under 30 years old. Globally, the rate of new infections tended to decrease around the mid-1990s, but in Korea they showed a pattern of rapid increase.

3) The period of temporary epidemic stagnation in outbreak: 2006 - 2010

During this period, the number of newly infected Koreans was between 700 and 800 each year. Along with the global trend of a decrease in new infections, the trend of increasing cases in Korea slowed down as well. At that time, the male to female ratio of infected individuals was 13.4:1, and 22.4% of them were under 30 years old. To reduce infection through blood

transfusions and blood products, reverse transcription Polymerase Chain Reactions (rtPCR) were performed on donated blood from February 2005. As a result of these efforts, no transmission through blood and blood products has been reported since 2006.

4) The period of recurrent rapid increase centering on the younger generation: 2011 - 2015

The number of newly infected Koreans that had been stagnant for about 5 years increased again from 2011, and after 2013, more than 1,000 newly infected cases were reported each year. At that time, the male to female ratio of infected persons was 15.4:1, and 34.2% of them were under 30 years old. This period was characterized by the fact that the proportion of new infections among the younger generation, 15 to 29 years old, had increased significantly. As the age of newly infected individuals became younger, there were concerns that the spread of HIV in Korea would increase. In addition, since 1985, the male to female ratio of infected persons by time period was 6.9:1, 11.1:1, 13.4:1, and 15.4:1, respectively, showing that the ratio of males steadily increased over time.

3. Transmission mode of HIV Infection in Korea

According to the analysis of cases in which the route of infection was identified, the number of infected individuals through sexual contact was 9,479 (99.4%), of which 3,839 (40.3%) were infected through homosexual contact and 5,640 (59.1%) were through heterosexual contact. However, in Korea, the infection route is identified by public health center staff through interviews with the HIV-infected persons and, considering the male to female ratio of 12.6:1, despite the official statistics that heterosexual contact is the most common route of infection, many experts have assumed that homosexual contact between men is the most important infection route. The reason for the discrepancy between the statistics and the assumption of experts is that, due to negative views on homosexual contact, infected people are likely not to disclose it. In fact, via the 'The Korea HIV/AIDS Cohort Study', Kim et al. [2] reported that the HIV infection route in Korea was homosexual and bisexual contact in 60.1% of cases and heterosexual contact in 34.6% of cases. Further, the rate of homosexual and bisexual contact was higher in younger age groups of 18 - 29 years old accounting for 71.5%, and even more surprisingly, teens 18-19 years of age accounting for 92.9%. Indeed, this confirmed that the most prevalent infection route in Korea is homosexual and bisexual contact.

Infection via transfusions and blood products was the infection route for a large number of infected people in the early stages of the epidemic in developed countries such as the United States and Japan, but only a small number of people were infected through blood transfusions and blood products in Korea. Forty-six persons were infected via blood transfusions and blood products, of which 13 were infected through blood transfusions abroad, 17 through blood products, and 16 through blood transfusions in Korea [3]. All of the infections caused by blood transfusions were from blood in which the enzyme immunoassay test conducted by the Red Cross was negative. Thus, it is likely that the blood was donated by infected individuals during the window period, that is the period of time during which HIV antibodies are not yet present. Since 1987, HIV antibody tests have been conducted on all donated blood in Korea to reduce HIV infection caused by blood transfusion. In addition, to avoid missing cases in the window period, nucleic acid amplification tests have been conducted on all donated blood since February 2005. Consequently, there have been no reports of HIV infection through blood and blood products since 2006.

The total number of infected people through vertical transmissions was 9, and it occurred sporadically until 2014. The number of infections through contaminated syringes during

recreational drug administration was 4. There have been no cases of infection through needle stick injuries in a medical institution.

The most common reason for getting HIV diagnostic tests was the manifestation of clinical symptoms directly or indirectly related with HIV infection. Further, the rate of voluntary testing is gradually increasing.

4. Molecular epidemiological characteristics of HIV infection in Korea

The most prevalent HIV subtype in Korea is subtype B. According to the molecular biology analysis, Korean Clade B, which differs from the virus found in other countries, was the most common isolate [4]. Cases of HIV-2 infection among Koreans have also been reported [5].

CLINICAL CHARACTERISTICS OF HIV INFECTION IN KOREA

Since its discovery and until the late 1980s, infected persons diagnosed with acquired immune deficiency syndrome (AIDS) died within a year of diagnosis. However, when the use of effective antiretroviral treatments became widely available in the late 1990s, the incidence of opportunistic infections due to immunosuppression was significantly decreased. In Korea, with the introduction of antiretroviral therapy, the incidence of opportunistic infections in HIV-infected persons decreased significantly in the 2000s, and instead, non-AIDS defining illness such as metabolic complications, cardiovascular diseases, renal diseases, bone diseases, and neuropsychiatric disorders are emerging as new health problems.

1. Immune status of HIV-infected persons at diagnosis in Korea

In Korea, many patients already have a weakened immune state when first diagnosed with HIV infection, and thus, patients with opportunistic diseases at diagnosis are not uncommon. A previous study showed that the proportion of HIV-infected persons who have already progressed to a number of CD4 positive T cells below 200/ μ L at the time of diagnosis has been increasing up until the late 2000s [6], thus emphasizing the need for early diagnosis [7].

2. Opportunistic infections in HIV-infected persons in Korea

There are numerous types of opportunistic diseases that can occur in people with HIV. Opportunistic diseases display various and distinctive clinical features depending on the region, country, race, and environment. According to a survey of 176 HIV-infected persons from 1985 to 2000 in Korea, Pneumocystis pneumonia, tuberculosis, cytomegalovirus infection, HIV wasting syndrome, and esophageal candidiasis were common as a AIDS-defining illness. Further, oral candidiasis, oral leukoplakia, folliculitis, and cervical lymphadenopathy also occurred [8]. According to a study published in 1999 on 173 infected persons, tuberculosis was the most common opportunistic disease [9]. In 2013, a survey on 1,086 infected persons showed that the frequent opportunistic diseases were, in order, candidiasis, Pneumocystis pneumonia, and tuberculosis (Table 1). Further, they showed that a low CD4-positive cell count, a history of tuberculosis, smoking, and drinking at the time of diagnosis were risk factors for opportunistic disease [10]. In a survey of 30 homeless HIV-infected persons, the incidence of tuberculosis and cytomegalovirus infection was high.

Tuberculosis is a very common opportunistic infection among HIV-infected persons in Korea, and in a survey of 143 infected persons between 1988 and 1997, the incidence of

Table 1. Types and frequency of opportunistic diseases in HIV-infected persons in Korea

Year	1999 [9]	2003 [8]	2016 [10]
Number of subjects	173	176	1,086
Frequency of opportunistic diseases, number of subjects (%)			
Oral candidiasis	37 (21)	36 (15.5)	120 (11.0)
Esophageal candidiasis	16 (9.2)	14 (6.1)	53 (4.9)
Tuberculosis	44 (25)	29 (12.5)	120 (11.0)
Atypical mycobacterial infection	3 (1.7)	-	2 (0.2)
Pneumocystis pneumonia	18 (10)	37 (15.9)	121 (11.1)
Cytomegalovirus infection	17 (9.8)	21 (9.1)	42 (4.7)
Shingles	35 (20)	9 (3.9)	44 (4.0)
Herpes simplex virus infection	14 (8.1)	3 (1.3)	8 (0.7)
Recurrent pneumonia	-	-	7 (0.7)
Progressive multifocal leukoencephalopathy	2 (1.2)	2 (0.9)	6 (0.6)
Cryptococcosis	3 (1.7)	4 (1.7)	6 (0.6)
Toxoplasmosis	-	3 (1.3)	4 (0.4)
Isosporiasis	3 (1.7)	-	1 (0.09)
Malignant lymphoma	2 (1.2)	3 (1.3)	4 (0.4)
Kaposi's sarcoma	3 (1.7)	2 (0.9)	8 (0.7)
Cervical cancer	-	1 (0.4)	1 (0.09)

tuberculosis was 9.6/100 person-years, but in a survey of 1,301 infected persons between 1998 and 2010, conducted by the same institution, the incidence of tuberculosis decreased to 1.19/100 person-years [11]. In a survey of 1,265 infected persons between 1985 and 2012, the incidence of tuberculosis was 4.2/100 person-years, and the risk factors for tuberculosis, compared to the control group with a matching number of CD4 cells, were low body mass index (BMI) and smoking [12]. One study reported that the risk of developing active tuberculosis was significantly higher if the interferon- γ releasing assay (IGRA) were positive [13]. Since the incidence of tuberculosis in Korea is relatively high, prophylactic therapy for tuberculosis in HIV-infected persons is important.

Frequent parasitic infections among HIV-infected persons in Korea include *Cryptosporidium* infections and *Isospora* infections [14]. Amoebic liver abscess among HIV-infected persons has also been occasionally reported [15]. The incidence of syphilis among HIV-infected persons began to increase in the 2000s and it is still currently on epidemic. The incidence of syphilis is high among homosexual men not only in Korea but also in Asia. The prevalence of human papilloma virus (HPV) infection, which causes cervical cancer, is also high among Korean women with HIV. Given that the high-risk HPV genotype which often causes cervical cancer is prevalent, regular screening for cervical cancer is required [16]. According to the 'The Korea HIV/AIDS Cohort Study', the positive rate was 6.09% for hepatitis B antigen (HBsAg) and 1.78% for hepatitis C antibody (anti-HCV Ab). In young infected persons in Korea, the positive rate for hepatitis A antibody is low, and thus, vaccination is recommended [17].

3. Non-infectious diseases in HIV-infected persons in Korea

Some nervous system diseases and malignant tumors are also opportunistic diseases in HIV-infected individuals in Korea. Nervous system diseases include not only central nervous system diseases such as HIV-associated dementia or opportunistic infections but also peripheral nervous system disorders such as multiple neuritis. In addition to AIDS-defining illnesses caused by a weakened immune system such as lymphoma or Kaposi's sarcoma, malignancies such as lung cancer, rectal cancer, and prostate cancer occur more frequently than general population.

Since the 2000s when antiretroviral treatment was widespread, HIV infection was no longer an acute disease with a high mortality but instead became a chronic disease, with patients being able to lead a long and healthy life if the condition is properly managed. As the long-term survival of HIV-infected persons became possible, several chronic diseases emerged as new problems in infected individuals in Korea.

Chronic diseases that HIV-infected Koreans are suffering from include lipodystrophy, dyslipidemia, metabolic syndrome, diabetes, arteriosclerosis, osteoporosis, renal disease, and neurocognitive dysfunction, and as the age of the infected persons increases, the prevalence or incidence rate of these diseases is expected to increase, as has been observed in foreign countries.

According to a study that tracked 1,079 person-years in 215 infected persons from 1995 to 2006 in Korea, the incidence of diabetes was 1.39/100 person-years [18]. According to a cross-sectional study on 1,096 infected individuals, the percentage of those that had hypercholesterolemia, high low-density lipoprotein cholesterol, and hypertriglyceridemia were 6.0%, 5.5%, and 32.1%, respectively [19]. Diabetes or dyslipidemia can exacerbate arteriosclerosis and cause vascular diseases such as myocardial infarction or stroke. According to a study conducted on 145 infected Koreans using carotid artery ultrasound, plaques were observed in 23.4% of infected individuals [20]. Although there have been no reports of an increase in myocardial infarction or stroke, the risk of cardiovascular disease may increase in the future, as it did in foreign countries, and so caution should be taken [21]. Bone diseases such as osteoporosis and kidney diseases are also long-term complications in HIV-infected persons in Korea.

As reported in foreign countries, psychological problems such as neurocognitive dysfunction, depression, and anxiety are also problems that appear in HIV-infected Koreans. According to a study analyzing cognitive function tests done on 200 HIV-infected persons in Korea, 26.3% showed neurocognitive dysfunction [22]. According to a cross-sectional study on 840 infected persons, 32% and 36% had depressive symptoms and anxiety, respectively [23]. Korea is a country with a discrimination, prejudice, and stigma against HIV-infected persons, and these are one of the causes of depression and anxiety in infected persons.

4. Antiretroviral treatment for HIV-infected persons in Korea

In Korea, antiretroviral treatment began in the late 1990s. Continuous antiretroviral treatment can reduce the viral replication in the blood to below detectable limits, and thus, the virus can be suppressed for a long time. According to a study analyzing 141 infected persons in Korea who underwent antiretroviral therapy for more than an year until 2005, viral replication was suppressed to below 400 copies/mL in 73% of infected persons at 6 months after starting therapy [24]. In a study analyzing infected persons who started antiretroviral treatment in a hospital from 2011 to 2014, 35 out of 137 subjects changed medications due to side effects of antiretroviral drugs, which included rash, epigastric pain, diarrhea, and hyperbilirubinemia [25]. When HIV acquires drug resistance associated with mutations due to suboptimal compliance, antiretroviral treatment would fail. The incidence of resistant mutations in Korea is not yet high, but has shown an increasing trend and thus more attention should be paid to it [26].

5. Causes of death of HIV-infected persons in Korea

According to a study published in 1998, causes of death included pneumonia, tuberculosis, cryptococcal meningitis, cytomegalovirus infection, and suicide [27]. In 2003, Kim

et al. reported that 25.7% of the HIV-infected individuals died due to tuberculosis and Pneumocystis pneumonia respectively, 20% due to bacterial pneumonia, 8.5% due to HIV-associated dementia, and 5.7% due to cryptococcal meningitis [8]. A study analyzing 327 infected persons who started antiretroviral therapy between 1998 and 2006 reported that 30.8% died within 5 years after starting treatment, and the causes of death due to AIDS-defining illnesses included tuberculosis, Pneumocystis pneumonia, HIV wasting syndrome, and Non-Hodgkin lymphoma, while the causes of death due to non-AIDS related conditions were liver disease, cardiovascular disease, suicide, and bacterial infection [28].

PREVENTION AND CONTROL AGAINST HIV INFECTION IN KOREA

With the introduction of combination antiretroviral therapy in the mid-1990s, AIDS, which used to be called the 'modern black plague', became a controllable chronic disease, such as diabetes and hypertension. In line with this, the government's management policy switched its focus from regulating and monitoring of HIV infected individuals in early period to ensuring access to treatment, promotion of voluntary HIV testing in vulnerable groups, establishment of a social support system for the infected, and resolving discrimination and prejudice against HIV [29].

1. The period of enforcement of quarantine and isolation in Korea: 1985 - 1994

When AIDS, which was known as a fatal unidentified disease abroad, was introduced in Korea in 1985, it caused great shock and anxiety to the public and health officials. Given the absence of effective treatment or preventive measures at the time, inhibiting additional transmission was the most important policy goal. In line with this, infected persons were isolated and measures for screening of blood products and HIV testing in foreigners were implemented and strengthened. The quarantining of infected persons for the purpose of prevention lacked scientific evidence and was also likely to be considered a human rights violations, but in November 1987, the AIDS Prevention Act was enacted. The main contents of this act were mandatory notification of infected persons to government, enlisting of infected persons, compulsory examination of certain workers with high-risk occupation, blood product management, quarantine, and prohibition of acts which can cause transmission. Based on this law, isolation of infected persons, follow-up management of infected persons through designated medical institutions, and compulsory screening in vulnerable groups were conducted (Table 2). Meanwhile, around the time of the 1988 Olympics, amendments

Table 2. Major changes in the AIDS Prevention Act in Korea

History	Main Contents	Note
Enacted in 1987	Notification of HIV-infected persons to government, Enlisting of infected persons, Compulsory testing of workers with high risk, Management of blood products, Isolation of HIV-infected persons, Prohibition of acts which can cause transmission	Established legal basis for management to prevent the spread of HIV infection after the identification of the first HIV infection in Korea in 1985
The 2nd Revision in 1995	Established the basis for consignment of education and publicity to prevent AIDS to NGOs, Strengthened tests on imported blood products	Considering the nature of HIV infection, established the basis for preventive education and promotional activities through NGOs
The 4th Revision in 1999	Abolished the isolation policy and designation of medical institutions for infected persons, Establishment of free anonymous screening system and shelter of infected persons	To avoid discriminatory medical practices that may violate human rights
The 8th Revision in 2008	Prohibited discrimination against infected employees, Introduced anonymous screening systems at medical institutions other than public health centers	Strengthened protection and support for human rights of the infected based on the 2005 report of the National Human Rights Commission of Korea

were made to strengthen the screening of foreigners. However, the foreigner screening policy was controversial in many countries between protection of nationals and ineffective discrimination. Since 1989, the medical expenses related with HIV treatment have been covered, and a free anonymous screening system has been introduced.

Given that HIV infection requires a higher degree of expertise compared to other health concerns and has a high degree of psychosocial stigma, countries around the world are working with non-governmental organizations (NGOs) to implement HIV prevention policy and support programs. In Korea, the Korean Association for AIDS Prevention and the Korea Federation for HIV/AIDS Prevention have been established since 1993. These associations have been supported by the government to carry out HIV-related projects. In the Korean Association for AIDS Prevention, its representative projects include running of a counseling support center, nursing care services, support services for the infected living at their home, and shelters for the infected. In the Korea Federation for HIV/AIDS Prevention, its main projects include conducting professional counseling programs for homosexuals and foreigners, distribution of condoms, and the publication of professional newsletters.

2. The period of implementation of preventive emphasis policy and introduction of antiretroviral drugs: 1995 - 2004

As the scientific knowledge and experience of HIV infection have increased, it has become universally accepted that HIV is a sexually transmitted disease that can be prevented through the use of condoms. Beginning in the late 1990s, administration of highly active antiretroviral therapy allowed HIV-infected persons to lead healthy lives. This change was also reflected in the government's policies and the AIDS Prevention Act and, in 1995, legal grounds were provided for entrusting HIV preventive education and promotional activities to NGOs. Further, measures that may violate the human rights of infected persons, such as quarantining of infected persons and designation of specific medical institutions for treatment, have been abolished. Following the initiation of education and promotional activities organized by NGOs, various activities on the subject of safe sex practices, use of condoms, and benefits of voluntary AIDS testing were developed. At this time, free condom distribution and public advertisements for HIV prevention had also begun. In addition, the Korea Catholic Red Ribbon, established in 1995, opened its first shelter for infected persons in Korea and is also providing support for vulnerable people such as those in correctional facilities and homeless people. The shelter for infected persons used as an intermediate step for those who were discharged from the hospital but cannot live their own due to physical or economical problems. They live in an ordinary home with fellow infected persons until they recover their physical and mental health. In addition, various civilian organizations such as the Salvation Army Korea and Korea Hospice Association are supporting HIV-infected persons, and the Korean Foundation for AIDS Prevention founded in 2001 is providing support for treatment costs and welfare benefits for the vulnerable infected persons.

In terms of HIV infection management, not only a distribution of therapeutic drugs but also a need for multi-faceted support such as prevention projects, combating against social prejudice, and support for recovery and social rehabilitation emerged, and in 2003, the Division for AIDS/TB (tuberculosis) Control was founded as a section of the Korea Centers for Disease Control and Prevention, strengthening the systematic policy establishment and the administrative supports.

3. The period of strengthening protection of human rights of HIV infected persons: since 2005

Led by the Division of AIDS/TB Control in the Korea Centers for Disease Control and Prevention, projects that reflect international trends and the needs of infected persons in Korea have been trialed. Representative projects include the establishment and operation of the HIV infection screening and counseling center for homosexuals and vulnerable groups and the consultation service for HIV-infected persons in medical institutions. Through the hospice centers for AIDS patients and the monitoring group for the National AIDS Project, efforts were made to improve the situation of infected persons in Korea. Regarding public relations projects, public service advertisements, which were originally on prevention measures began to address the need to resolve discrimination and prejudice as a key message. In addition, as human rights violations caused by negative perceptions of HIV infection began to attract attention, in 2005, the National Human Rights Commission of Korea conducted a survey on the human rights situation of HIV-infected persons [30]. Based on this survey, the AIDS Prevention Act was revised in 2008 to supplement the provisions on human rights such as prohibiting employers from discriminating infected persons, reinforcing support and protection of infected persons, and the establishment of anonymous screening systems in medical institutions.

The Medical Institution Consultant Project for HIV-infected Persons, which began in 2005, aimed to provide comprehensive medical services such as medication compliance, health care, life counseling, and welfare support to HIV-infected individuals. As of 2017, it provides comprehensive and effective services to infected persons in 18 institutions nationwide [31]. Due to the nature of the medical institution, trusting relationships can be formed between the infected and the consultant nurses who have a profound understanding of the disease and have completed special training regarding knowledge and consultation on HIV infection. In this way, nurses can not only educate about the illness for the infected and their families but also manage counseling on medication in order to improve treatment compliance, integrated life counseling, and linkage to community resources. The project has been shown to have an effect on the emotional stability of the infected by improving treatment compliance and reducing anxiety and depression. Further, it is also thought to contribute to the prevention of HIV infection.

In 2006, the Korea HIV/AIDS Cohort Study was launched in collaboration with the Korea Centers for Disease Control and Prevention as well as 19 university hospitals and general hospitals. In 2007, the Korean Society for AIDS was established, which laid the foundation to seek appropriate treatment and prevention policies by studying and identifying its own nature of HIV infection in Korea.

When AIDS was included in the 31 major health projects of the Health Plan 2020, established in 2010, four basic directions were proposed: 1) strengthening prevention projects for high-risk groups such as homosexual men, 2) promoting early diagnosis of HIV infection and improving treatment compliance of HIV-infected persons, 3) strengthening public education with the main message of resolving discrimination and prejudice, and 4) expanding the infrastructure of professional manpower to effectively prevent the spread of HIV infection [32].

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