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FIGHTING CANCER TOGETHER

South Korea's National Cancer Control

Case Study from the National Cancer Center of Korea



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1. FOREWORD FROM UICC

The Union for International Cancer Control (UICC) is honoured to partner with the National Cancer Center Korea (NCC Korea) and to jointly present this case study featuring national cancer control planning efforts in the Republic of Korea. We are very grateful to the NCC Korea for having taken the time to share their story of how they have supported national cancer control planning and implementation over the past 20 years.

National cancer control plans (NCCPs) are the foundation for cancer policy, programmes and services allowing countries to identify, prioritise and implement the most impactful and cost-effective interventions to reduce the national cancer burden and improve patient outcomes. The 2017 World Health Assembly resolution on cancer control recommended that governments develop NCCPs to guide all cancer control activities undertaken in a country across the cancer control continuum starting with prevention through to early detection and treatment as well as supportive and palliative care. NCCPs also represent a public commitment to action on a political level and are a means to enhance collaboration between national and international stakeholders, through multisectoral partnerships with civil society and relevant private sector partners.

The example of the Republic of Korea proves that implementing a well-designed, context specific and well-resourced NCCP can lead to measurable improvements for cancer patients. The progress achieved in survival rates is truly remarkable.

In recent times, the importance of strong health systems to address the burden of all diseases including cancer has become even more evident. Cancer is not only on the rise globally but is also an important contributor to catastrophic health spending in many countries. As we move towards Universal Health Coverage (UHC), developing and implementing effective cancer programmes is essential to address the growing burden of

non-communicable diseases. NCCPs are instrumental in guiding health planners to assess which cancer services can be included in national UHC packages and which can be further developed and implemented to expand coverage.

I would like to personally thank the NCC Korea for their efforts and collaboration and their willingness to share their experiences and best practices with UICC members. I am grateful for our partnership, their regional engagement and support towards the UICC Technical Fellowship Programme and wish the NCC Korea team all the best for their 20th anniversary.



President,
Union for International Cancer Control
HRH Princess Dina Mired of Jordan

2. FOREWORD FROM NCC KOREA



Cancer is the second leading cause of death worldwide. In Korea, cancer is responsible for one out of every three deaths. The Korean government kicked off the National Cancer Control Plan (NCCP) in 1995 and, following the adoption of the National Cancer Center Act in 2000, the National Cancer Center Korea (NCC Korea) was finally established in 2001.

NCC Korea continues to serve as a think-tank for the 3rd phase of the NCCP (2016-2020) and supports the government's cancer control activities, thus contributing to reducing the national cancer burden. With our collective effort, the 5 year-survival rate of all cancers in Korea has increased from 43% in the 1990s to 70.4% in 2017, which is much higher than the average of OECD countries.

NCC Korea would like to take this opportunity to introduce the achievement of the NCCP in Korea and is also eager to collaborate with other countries who may find our experience useful and relevant to their setting. By actively carrying out partnership activities, NCC Korea aligns with those who want to defeat cancer where together we can achieve UICC's vision, 'To reduce the global cancer burden and to promote greater equity'.

Next year is the 20th anniversary of the establishment of NCC Korea. The goal of the NCC is to be one of the world's best national cancer centers by developing a new paradigm in cancer research, rendering the best quality care to cancer patients and functioning as an educational and training hub for young cancer specialists.

NCC Korea continues to evaluate the 3rd phase of the NCCP and is currently preparing the 4th phase (2021-2025). NCC Korea will undertake the new initiative- 'National Cancer Screening for Lung Cancer' and also run the 'Korean Colonoscopy Screening Pilot Study'. In addition, NCC Korea will accelerate the Big Data Platform to build the national cancer control data base. The National Cancer Center Graduate School of Cancer Science and Policy (NCC-GCSP) is very pleased to host the UICC Technical Fellowship program for translational cancer research and public health fellowships. In collaboration with UICC members worldwide, NCC Korea is accelerating efforts to reach our mutual goal-the fight against cancer for mankind- and we shall be and always be at the forefront of cancer control. We are delighted to collaborate with UICC on this case study.



President,
National Cancer Center Korea
Dr. Eun Sook Lee

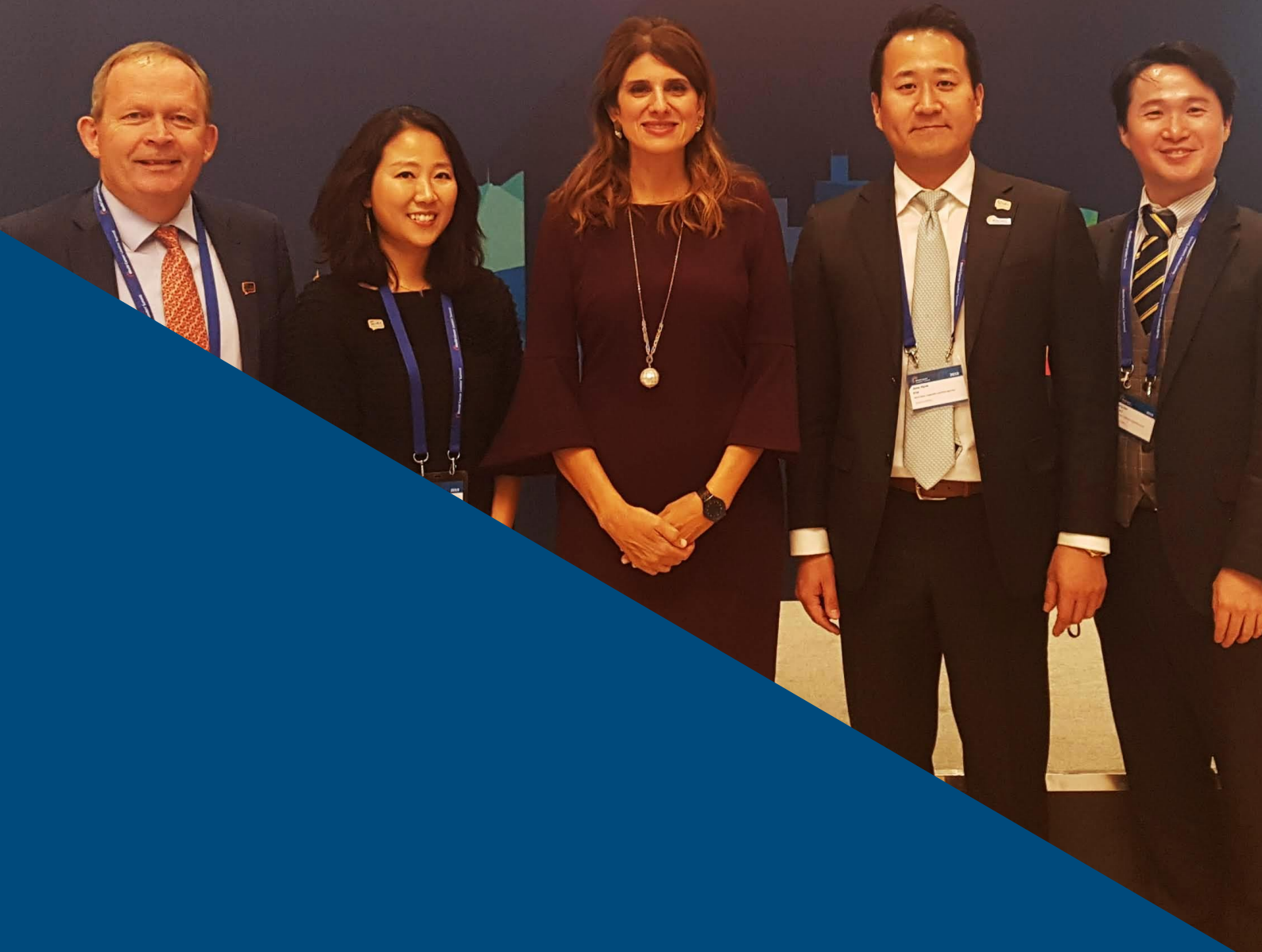


World Cancer Leaders' Summit

Cancer and

Universal Health Coverage

15-17 October 2019
Nur-Sultan, Kazakhstan



National Cancer Control Plan Case Study

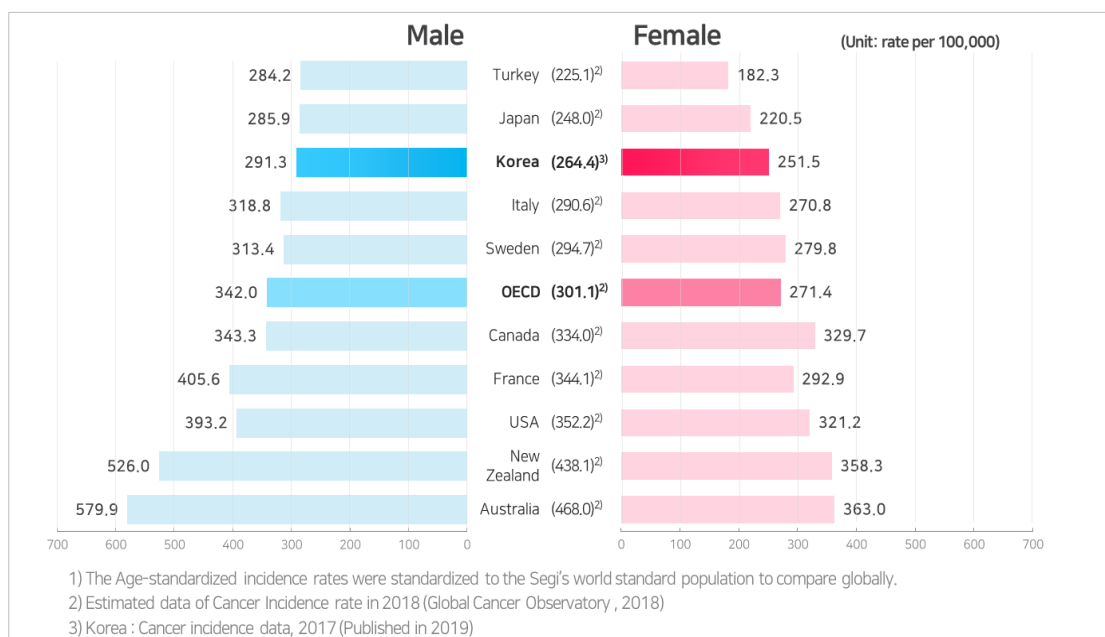
3. INTRODUCTION

Cancer Burden in South Korea

Cancer is now the second leading cause of death globally. The global burden of cancer has risen to 18.1 million cases and 9.6 million deaths as of 2018. This trend emphasizes the importance of implementing appropriate cancer control policies at national and regional levels. Though commonly perceived as a disease reserved for high-income countries, cancer mortality is higher in low- and middle-income countries. The International Agency for Research on Cancer (IARC) estimates that cancer deaths in low- and middle-income countries account for 75% of all global cancer deaths. It is now the time to recognize cancer as a major health threat to every country regardless of its performance in socioeconomic development.

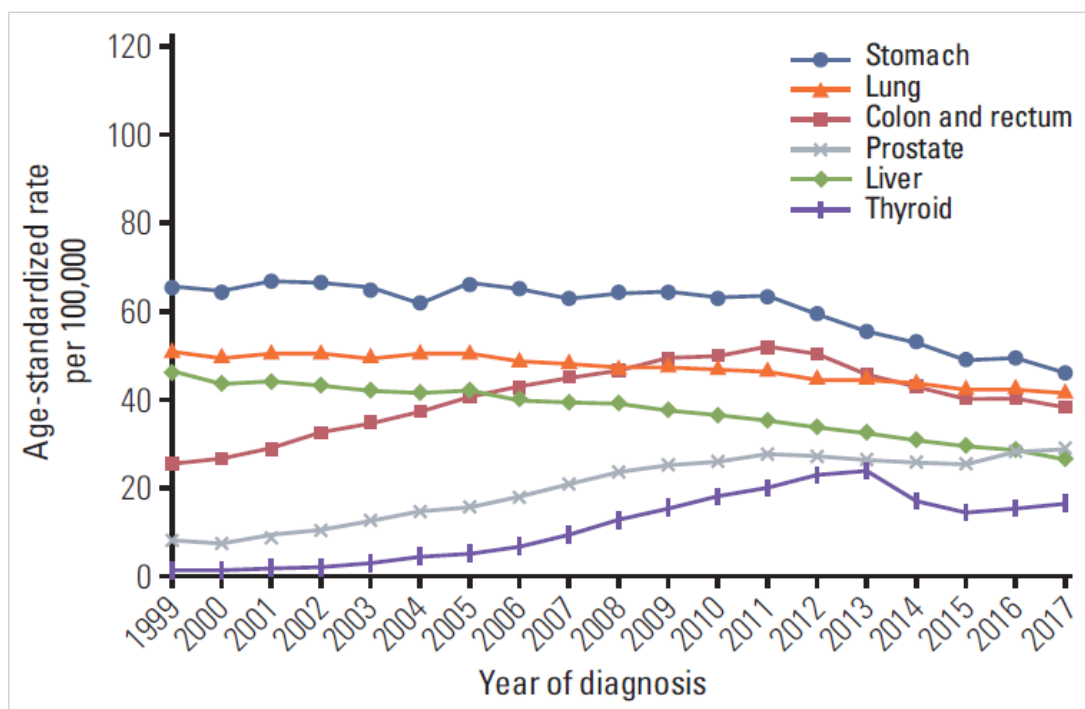
South Korea is a country in East Asia that has been successfully controlling cancer through systematic nationwide plans since the 1990s. Cancer has been the leading cause of death since 1983 in South Korea. The incidence of cancer is on a constant rise due to an aging population and changes in lifestyle. Compared with other OECD countries, South Korea remains slightly above average in cancer incidence rates for both males and females. For males, the age-standardized incidence rates for colon and rectum cancer and prostate cancer have been steadily increasing since 1999. For females, the age-standardized incidence rate for breast cancer has been in a steep rise since 1999, marking approximately 63 per 100,000 in 2017. For males, the three leading types of cancer are stomach cancer, lung cancer, and colon and rectum cancer; for females, they are breast cancer, thyroid cancer, and colon and rectum cancer in 2017.

FIGURE 1: INTERNATIONAL COMPARISON OF CANCER INCIDENCE RATES¹



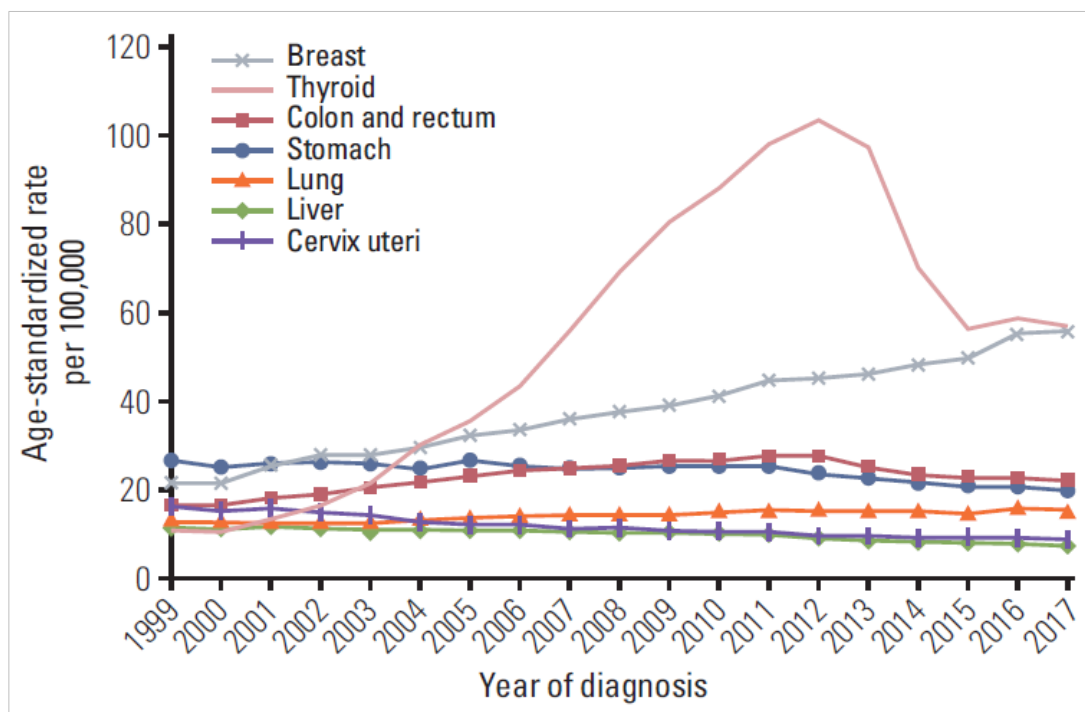
¹ Ministry of Health and Welfare, Korea Central Cancer Registry, National Cancer Center (Dec 24, 2019). "National Cancer Statistics in Korea, 2017".

FIGURE 2: TRENDS IN AGE-STANDARDIZED INCIDENCE RATES OF MAJOR CANCERS: MALE (1999-2017)²



*Age-standardized rates were standardized to the Segi's world world standard population.

FIGURE 3: TRENDS IN AGE-STANDARDIZED INCIDENCE RATES OF MAJOR CANCERS: FEMALE (1999-2017)³

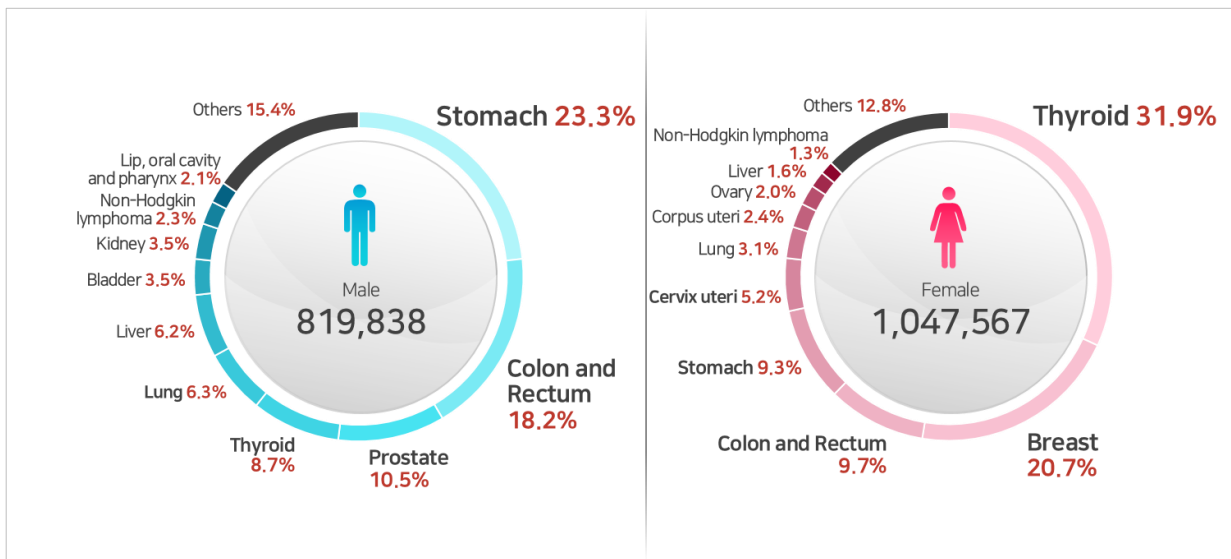


*Age-standardized rates were standardized to the Segi's world world standard population

² Hong S, Won YJ, Park YR, Jung KW, Kong HJ, Lee ES. Cancer Statistics in Korea: Incidence, Mortality, Survival, and Prevalence in 2017. *Cancer Res Treat.* 2020 Apr;52(2):335-50.

³ Ibid.

FIGURE 4: CANCER PREVALENCE BY SEX (2017)⁴



In terms of mortality, lung cancer, liver cancer and stomach cancer account for over half of all male cancer deaths; lung cancer, colon and rectum cancer, pancreatic cancer and liver cancer are the four that cause most cancer deaths in females in 2017. Mortality rates for some types of cancer, such as prostate cancer and breast cancer, have increased since 1999.

While the incidence of cancer in Korea is on the rise, the survival rate has also increased mainly due to the comprehensive National Cancer

Control program put in place that is underpinned by the development of successive National Cancer Control Plan (NCCP) as well as the development of medical technologies over the past few decades. The total participation rate in the National Cancer Screening Program, which is a core initiative of the NCCP, has nearly doubled since 2005. Compared to the early 1990s, when the 1st Plan was implemented, the five-year relative cancer survival rate has increased by 30 percent.

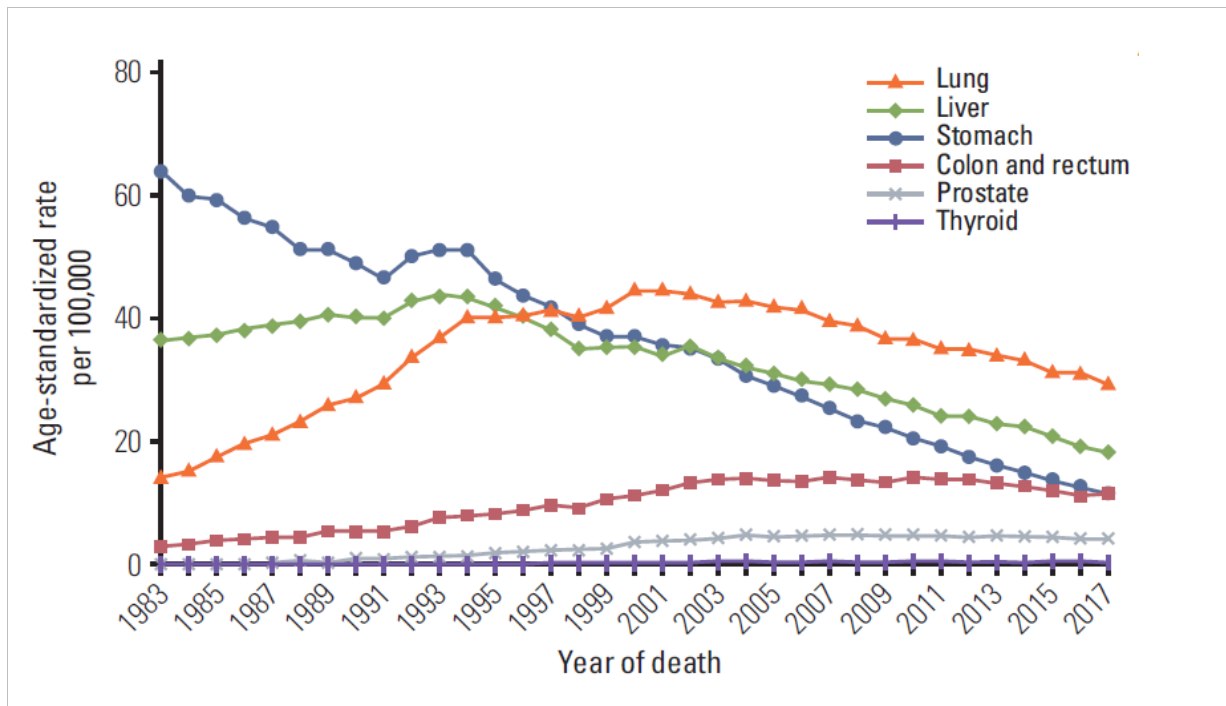
Milestones of the National Cancer Control Plan⁵



⁴ Ministry of Health and Welfare, Korea Central Cancer Registry, National Cancer Center (Dec 24, 2019). "National Cancer Statistics in Korea, 2017".

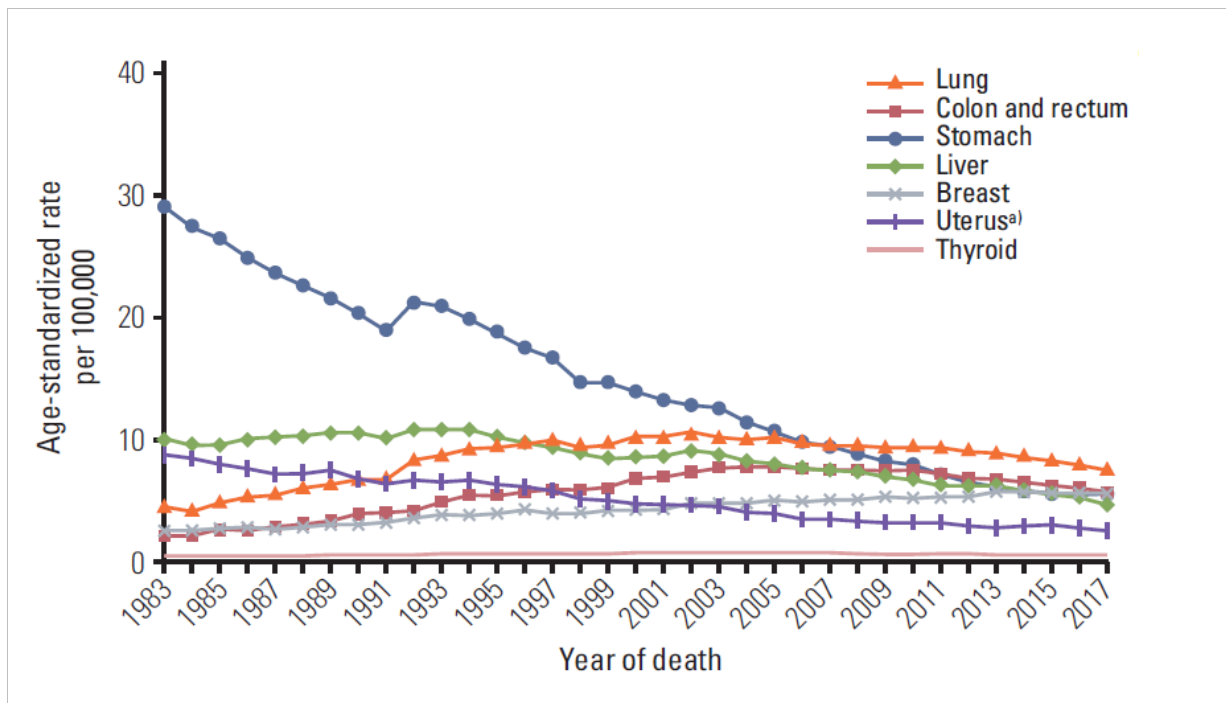
⁵ Introduction on National Cancer Center, Korea. Presentation presented at; 2019; National Cancer Center.

FIGURE 6: AGE-STANDARDIZED MORTALITY RATES OF MAJOR CANCERS; MALE (1983-2017)⁶



Age-standardized rates were standardized to the Segi's world world standard population.

FIGURE 7: AGE-STANDARDIZED MORTALITY RATES OF MAJOR CANCERS; FEMALE (1983-2017)⁷

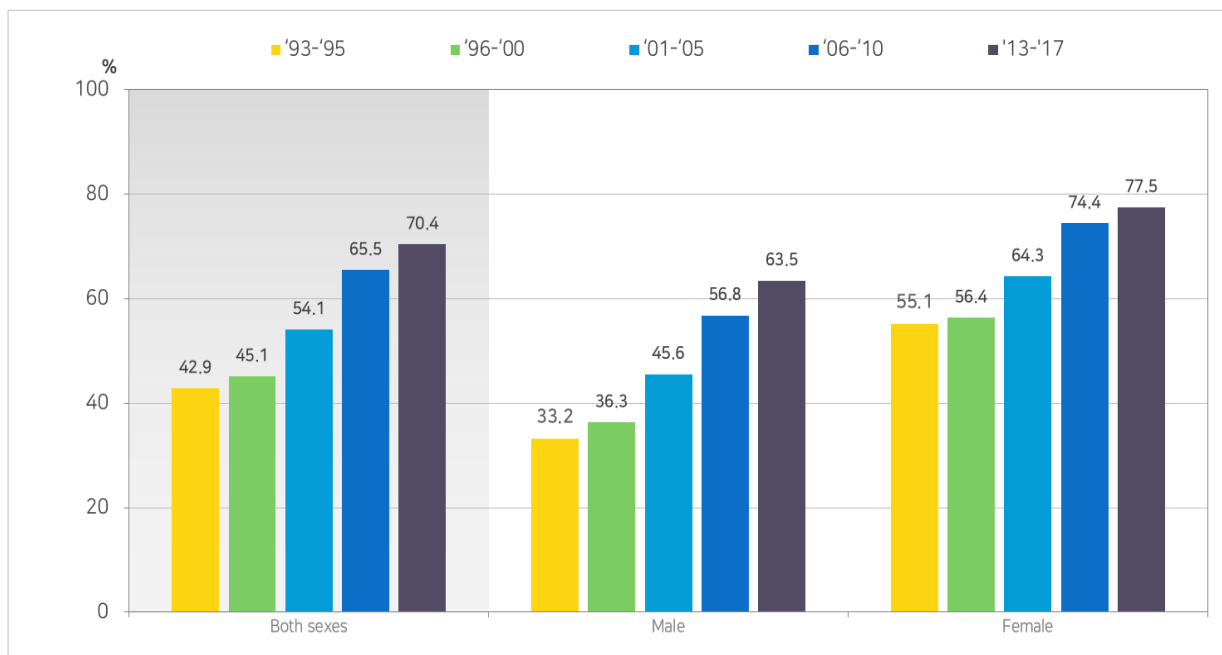


Age-standardized Rate (ASR) was standardized to the Segi's world world standard population.

⁶ Hong S, Won YJ, Park YR, Jung KW, Kong HJ, Lee ES. Cancer Statistics in Korea: Incidence, Mortality, Survival, and Prevalence in 2017. *Cancer Res Treat.* 2020 Apr;52(2):335-50.

⁷ Ibid.

FIGURE 8: FIVE-YEAR RELATIVE CANCER SURVIVAL RATES (1993-2017)⁸



⁸ Ministry of Health and Welfare, Korea Central Cancer Registry, National Cancer Center (Dec 24, 2019). "National Cancer Statistics in Korea, 2017".

4. THE 3rd NATIONAL CANCER CONTROL PLAN (2016-2020)

The Goal

The 3rd National Cancer Control Plan (NCCP), conceived by the National Cancer Center Korea, has four main goals.⁹ First, it aims to reduce the incidence rate of cancer to the average rate seen in OECD countries. Second, it focuses on increasing early detection and survival. Third, it aims to improve the quality of life for cancer patients and survivors. Lastly, it is designed to solidify the foundation for customized, precise medical treatment.

Focus Areas

The Plan has six focus areas, each of which consists of several initiatives based on an assessment of the health system. The following is a brief review of the initiatives in each focus area.

Surveillance and Prevention

South Korea has established a solid foundation for a cancer registration system to support effective surveillance and prevention. Based on the cancer registration statistics, the epidemiological profile of cancer was identified at a national level, and cancer prevention regulations were tailored accordingly. However, the current utilization of the system is limited in that it does not include variables such as information on patients' socioeconomic level. One of the major initiatives is to expand the sources of information collected to external institutes other than the National Cancer Center. Data such as incidence of secondary cancer, recurrence and cancer treatment prognosis need to be collected to improve data on cancer outcomes and inform policy making. Also, to strengthen the cancer registration system, the Plan proposes to bolster the regional cancer control plan by producing a 'cancer map' based on the incidence rates of cancer in different regions. Other initiatives include building an

evaluation system of carcinogens in Korea, effectively managing the risk factors of preventable types of cancer such as HPV, smoking and alcohol consumption, and establishing long-term plans for cancer-related education and advocacy. South Korea's most prevalent types of cancer like stomach cancer, colorectal cancer, lung cancer, liver cancer, and breast cancer are preventable through effectively managing the risk factors. With an exception of smoking, elemental research and management of other risk factors such as alcohol, obesity, infection, diet, and insufficient physical activity are identified as areas that require attention. To control those risk factors, a key initiative includes producing tailored health promotion campaign strategies for different age, sex and occupation groups.

Early Detection

Since the National Cancer Screening Program (NCSP) was launched in 2002 to provide gastric, breast, and cervical cancer screening services, the NCSP has been expanded to include 5 cancer types: gastric cancer, liver cancer, colorectal cancer, breast cancer, and cervical cancer. The 3rd NCCP introduces screening for lung cancer which is the leading cause of cancer death. According to the 3rd Plan, a pilot study was conducted to evaluate the effect of lung cancer screening. Based on the results of the pilot study, lung cancer screening with low dose chest CT scanning for 30+ pack per year smokers between the age of 54 and 74 was adopted to the NCSP in 2019. Another key initiative is to establish a process to improve the NCSP. Furthermore, the interval of liver cancer screening has changed from 1 year to 6 months, and the starting age of cervical cancer screening has changed from 30 years old to 20 years old. The 3rd NCCP aims to improve the quality of the screening by establishing a system for quality assurance and strengthening the education for health professionals.

⁹ The 3rd ('16-'20) National Cancer Control Plan. Ministry of Health and Welfare; 2016.

Diagnosis, Treatment and Survivorship

Through the 1st and 2nd National Cancer Control Plans, South Korea cut the medical costs for low-income cancer patients, introduced new diagnostic and treatment tools to improve survival, and conducted thorough research to provide a support system for cancer survivors. However, as the current system still lacks comprehensive support for cancer patients and survivors, including children, the 3rd Plan includes greater attention to supporting programmes and services for survivorship than previous plans. Key initiatives include producing a support system specialized for childhood cancer survivors, including managing side effects and promoting physical and psychosocial health, and developing care guidelines for cancer survivors (both children and adults) in rehabilitation and relapse prevention.

Palliative Care

South Korea's health system highlights the need for hospice institutes that specialize in palliative care. However, the numbers of hospice institutes are limited and access to palliative care is low compared to other high-income countries. To assure quality palliative care, the Plan proposes to diversify types in which palliative care services are delivered, such as introducing a system of home-based palliative care. Also, as the Plan recognizes that current paediatric cancer palliative care system is basic and limited, it proposes conducting studies on its supply and demand and constructing a national model of paediatric cancer palliative care based on the studies. Other initiatives include improving the quality of services the hospice centers provide through periodic inspections and recertification processes.

Infrastructure

Currently, the regional cancer centers in South Korea support effective cancer control at a regional level. To further bolster the infrastructure for effective cancer control, the Plan suggests building a national cancer data center which standardizes comprehensive cancer-related data, such as treatment prognosis data, clinical data, and data from external public institutions

In terms of human resources for health the establishment of the Graduate School of Cancer Science and Policy at the National Cancer Center, the first national level institute for

education and research in cancer science and policy has strengthened human resources by developing cancer specialists. The school offers an interdisciplinary curriculum in cancer-related fields for a wide audience including researchers, policymakers and medical professionals with programs at the Department of Cancer Control and Population Health as well as at the Department of Cancer Biomedical Science.

Research and Development

Cancer-related research and development in South Korea has advanced over the past few decades. The national level expenditure on cancer research has increased by 13.7% annually, and during the past decade, about 2,400 patents in cancer research were registered. To further promote cancer research and development, the Plan proposes the setting up of an advisory council for cancer research, collaborating with the U.S. and Japan for cancer research projects, and constructing a long-term framework for precision medicine.

Assessment and Feedback

The first step to effectively assess the 5-year National Cancer Control Plan is to devise detailed yearly plans, which will include progress on each initiative and the standard assessment index comprised of quantitative and qualitative indicators. Quantitative indicators included in the standard assessment index will utilize cancer registration statistics and data from external agencies such as the National Health Insurance Service and the Health Insurance Review and Assessment Services; these indicators include cancer incidence, mortality and survival rates. Qualitative indicators, on the other hand, will be based on the autonomously conducted annual inspections and interviews; some examples are the level of awareness of cancer prevention guidelines and the palliative care satisfaction survey shared with patients' families. NCC Korea will analyze the annual plans based on the standard assessment index and report the results to the National Cancer Control Committee of 13 experts including the Vice Minister of the Ministry of Health and Welfare and the President of NCC Korea. Based on the assessment and feedback process, the Committee will suggest an amendment of the current goals and the developmental strategies.

5. KEY INTERVENTIONS IN THE 3rd NATIONAL CANCER CONTROL PLAN

Cancer Registration Program

The cancer registration system in South Korea is comprised of the Korea Central Cancer Registry, which is controlled by the National Cancer Center Korea, and 11 other regional cancer registries. Regional cancer statistics existed prior to 1998, but they were integrated nationally in 1998. The statistics have been collected autonomously since 1999, and the registration system now covers more than 98% of all cancer cases in Korea. The National Cancer Control Plans are built upon accurate information of the current cancer burden, yielded by compiled statistics from the registration system. NCC Korea emphasizes three preconditions to building a solid cancer registration system.

First, the government must acknowledge the registration system as the utmost fundamental component of effective cancer control. Integration of scattered hospital-based registration systems is the second factor. Cancer-related data are first recorded at the hospital a patient has visited. A national cancer registration system must integrate the registration systems of every hospital to broaden the scope of information and increase accuracy. Moreover, quality resources such as advanced medical equipment and an adept workforce are necessary. NCC Korea provides advanced medical services, such as proton therapy, along with medical staff with extensive surgical experience. Its core research centers, such as the biobank and the Good Manufacturing Practice Facility for Biomedicine Production, also contribute to the national research and development of effective cancer control interventions.

FIGURE 10: POPULATION-BASED CANCER REGISTRIES¹⁰



National Cancer Screening Program

The goal of the National Cancer Screening Program (NCSP) is to detect high burden cancers early in order to reduce the proportion of patients who are diagnosed at a late stage and ultimately increase the cancer survival rate in Korea. Since its launch in 2002, the NCSP has been providing cancer screening to Medical Aid recipients and National Health Insurance beneficiaries. Korea provides single-payer universal healthcare through the National Health Insurance Service and offers the Medical Aid Program for those who are unable to pay for their own health care coverage. According to the NCSP protocol, the National Health Insurance Service invites all eligible people via mail to cancer screening annually. Individuals with the invitation letter receive cancer screening at a nearby cancer screening institution. The screening institution

¹⁰ Ministry of Health and Welfare, Korea Central Cancer Registry, National Cancer Center (Dec 24, 2019). "National Cancer Statistics in Korea, 2017".

sends the results of the test to the examinees via mail, and the National Health Insurance Service reimburses associated fees upon the submission of the results.

Currently, the NCSP provides screening for stomach, liver, colorectal, breast, cervical, and lung cancers. The screening for stomach cancer, the most prevalent cancer among males in South Korea, is provided every two years for those over the age of 40. It is usually performed through endoscopy which is the most accurate way of diagnosis. The liver cancer screening provides Alpha Fetoprotein (AFP) Tumor Marker Test and liver sonography every six months for high risk population who are aged 40 years or older with chronic HBV or HCV infection, liver cirrhosis, or chronic liver disease. For colorectal cancer screening, annual Fecal Immunochemical Test (FIT) is provided to those over the age of 50. If an individual is tested positive for FIT, confirmatory colonoscopy or Double-Contrast Barium Enema is performed. The NCSP for breast cancer, which is the second most prevalent cancer among females, provides mammography biennially to females over the age of 40. The national cervical cancer screening is offered every two years to women over the age of 20 via the Pap smear.

TABLE 1: NATIONAL CANCER SCREENING PROGRAM¹¹

Cancer	Age	Interval	Methods
Stomach	≥40	2 years	Gastro-endoscopy or UGI
Liver	≥40 High risk group	6 months	Liver sonography & AFP
Colorectal	≥50	1 year	FOBT, if positive -> colonoscopy or DCBE
Breast	≥40, women	2 years	Mammography & CBE
Cervical	≥20, women	2 years	Pap smear
Lung	Smokers aged 54-74	2 years	Low dose lung CT

A core initiative of the 3rd National Cancer Control Plan is to introduce the lung cancer screening to the NCSP. South Korea has conducted a one-year pilot study in 2017 to evaluate the effects of national lung cancer screening, and lung cancer screening with low dose chest CT scanning for 30+ pack per year smokers between the age of 54 and 74 was adopted to the NCSP in 2019.

National Cancer Data Center

As high-quality cancer data is fundamental for effective cancer control policies, South Korea has built a comprehensive database for cancer. The NCC Korea has developed the Clinical Research Data Warehouse (CRDW) consisting of clinical data, genomic data, medical image data, biobank data, and public health data including the National Cancer Registry. Clinical data were obtained from patients who visited the NCC Hospital. Information on diagnosis and treatment was extracted from the electronic medical records (EMR) system. Information on genomic data was collected from targeted next-generation sequencing (NGS) analysis. Clinical data retain approximately 350 million medical records from 500,000 patients. Relevant data are de-identified when extracted from operating systems and stored in an independent data warehouse. Furthermore, these datasets have been refined into cancer registry consisting of clinically meaningful features by different cancer types: prostate cancer, lung cancer, pancreatic cancer, ovarian cancer, renal cancer, breast cancer, colorectal cancer, thyroid cancer, stomach cancer, and liver cancer. Researchers can access relevant data digitally through a website called the Clinical Research Portal.

Recently, the Cancer Control Act was revised to provide a legal basis for the safe collection and utilization of cancer data at the national level. When the Act comes into force in 2021, the National Cancer Data Center will have the authority to collect, link and utilize data held by public institutions for cancer research and policymaking. It is expected that the National Cancer Data Center will play a pivotal role in cancer research and policy development in the future.

¹¹ 2019. *Introduction on National Cancer Center, Korea.*

6. KEY LESSONS AND OUTLOOK

Key Lessons

Strong Foundation of the Cancer Registration Program

According to the National Cancer Center Korea, South Korea's effective cancer control interventions were based upon a firm cancer registration system. To battle cancer successfully, a country must recognize the breadth and depth of the disease first. Through developing a strong cancer registration system over the past two decades, South Korea monitored its performance on cancer control by tracking the incidence rate per type of cancer, survival rates and, where relevant, national screening rates. Based on the epidemiological data, the 1st, 2nd and 3rd national cancer control plans were devised. A strong cancer registration system is the essential first step to putting in place effective cancer control interventions in every country.

Collaboration

South Korea's health-related organizations have achieved great progress in cancer control through domestic and international collaborations. NCC Korea plays a central role in developing the national cancer control plans, partnering with other national organizations like the Ministry of Health and Welfare and other public hospitals. Also, NCC Korea aids the National Health Insurance Corporation (NHIC) in sending out tailored cancer control messages to the public. The NHIC holds citizens' personal information such as age, address and phone number, and dispatches messages to a group of individuals who qualify for certain cancer screening services. For instance, for colorectal cancer, the NHIC selects individuals in their 50s and sends out an invitation letter for screening at the beginning of the year. The Center for Disease Control and Prevention (KCDC) also collaborates with NCC Korea when conducting the National Nutrition Survey; the NCC Korea identifies the risk factors for cancer to incorporate into the National Nutrition Survey.

Internationally, NCC Korea collaborates with the World Health Organization (WHO) to hold biennial Cancer Leadership and Capacity Building workshops for Western Pacific countries. Also, when requested, NCC Korea oversees educational training sessions on cancer registration. With the International Agency for Research on Cancer (IARC), NCC Korea has been conducting joint research on *Helicobacter pylori* since 2013. NCC Korea has also led the establishment of the Asian National Cancer Center Alliance (ANCCA) in 2005 to address the cancer burden in the Asian region. ANCCA holds joint conferences every two years to strengthen cooperation in cancer research among its 14 member countries.

Outlook

Research and Development

Cancer-related research and development in South Korea has advanced over the past few decades. However, the system lacks a control tower and long-term strategies for cancer research. For instance, different government departments, such as the Ministry of Health and Welfare, the Ministry of Science, ICT and Future Planning and the Ministry of Trade and Industry, each carry out various cancer research projects, albeit sporadically. Also, the scope of research and development has been limited to the domestic market without any diagnostic or treatment tools competing in the international market. Though efforts have been made to reorganize the cancer research system at a national level and collaborate with the international community in research and development, NCC Korea nonetheless identifies research and development as an area for improvement.

Cancer Big Data Platform

Recently, the field of precision medicine has received much attention. Precision medicine customizes preventive medicine, diagnosis and treatment to an individual patient, especially utilizing genetic or molecular profiling. To enable precision medicine, the healthcare system must establish a solid data platform. Currently, South Korea holds mostly administrative data and medical image data, and it recognizes the scarcity of clinical data on cancer surgery, treatment or chemotherapy. Thus, the National Cancer Center identifies the Cancer Big Data Platform as its next key initiative. As a part of the Cancer Big Data Platform, NCC Korea has established the Clinical Research Data Warehouse (CRDW), which led to the establishment of a big data sharing platform, CONNECT, among 11 medical institutions. Further expanding the scope of the data platform, NCC Korea inaugurated the Cancer Proteogenomics Research Group to conduct an integrated multi-omics profiling study. The data produced from the research is collected in the Advanced poRtal of Clinical History and multi-Omics iNformation (ARCHON) database which is also linked to the CRDW. With genetic, imaging and lifelog data of more than 100,000 patients, the big data provided by the Platform will be utilized in areas such as diagnostics, treatment decision making and treatment development.

Cancer Survivorship

The cancer survival rate in Korea has been rising due to several factors outlined in this case study, including the expansion of screening, promotion of early detection and prompt referral to effective treatment. Encouragingly, this trend has raised the issue of survivorship in South Korea. Cancer patients, even after free from cancer, are under the risk of secondary cancers, recurrence, long-term toxicity from cancer treatment, co-morbid conditions, and psychosocial distress. Consequently, the NCC Korea has launched a pilot program of regional cancer survivorship support centers in 2017, which shall further be expanded in the 4th National Cancer Control Plan (2021-2025).

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