Trend analysis of major cancer statistics according to sex and severity levels in Korea

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Abstract

Existing epidemiologic reports or studies of cancer statistics in Korea lack sufficient data on cancer severity distributions and observed survival rates. This study analyzed trends in major cancer statistics according to sex and severity levels in Korea from 2006 to 2013. We included eight cancers (hepatocellular carcinoma, and thyroid, colorectal, gastric, lung, prostate, breast, and cervical cancer), using Korea Central Cancer Registry data. Severity level was classified by Surveillance, Epidemiology, and End Results (SEER) stage as follows: localized, regional, distant, or unknown. Numbers of incident cancer cases from 2006 to 2013 were described by sex and SEER stage. We estimated up to 8-year observed survival rates of major cancers by sex and SEER stage, and provided prevalence rates by sex and SEER stage in 2011, 2012, and 2013. Although increases in new cancer cases are slowing and the total number of incident cancer cases in 2013 decreased for the first time since 2006, the number of prevalent cancer cases was 663,530 in 2013, an increase of 13.3% compared to 2011. Among the five cancers affecting both sexes, sex-related differences in 5-year observed survival rates for lung cancer were greatest in the localized stage (men, 31.9%; women, 48.1%), regional stage (men, 20.0%; women, 31.3%), and unknown stage (men, 24.3%; women, 37.5%). The sum of the proportions of localized and regional stages for thyroid and breast cancer was over 90% in 2013, while the sum of the proportions of localized and regional stages for lung cancer was only 56.7% in 2013. Differences in observed survival rates between men and women were prominent in lung cancer for all SEER stages. The reported epidemiologic data from this study can be used to obtain a more valid measure of cancer burden using a summary measure of population health.

Introduction

The burden of cancer is substantial not only in developed countries but also in developing countries [1]. In 2013, 8.2 million people died from cancer, 14.9 million people were newly diagnosed with cancer, and cancer was the cause of 196.3 million disability-adjusted life years (DALYs) worldwide [2]. The incidence of cancer is expected to increase continuously and strain the world’s healthcare resources owing to population growth and aging [3]. In South
Korea (hereinafter Korea), cancer is the leading cause of death. In 2013, there were 75,334 deaths due to cancer, and 225,343 cancer cases were newly diagnosed [4]. Furthermore, the burden of cancer in 2012 was 3,471.79 DALYs per 100,000 persons [5] and DALYs due to all neoplasms accounted for 8.44% of total DALYs [6].

Measuring the disease burden is essential for proper allocation of healthcare resources [7]. In the case of cancer, it is also important to measure the cancer burden to determine priorities for healthcare services and research. In this context, generating accurate cancer statistics is required to establish cancer control and prevention strategies [4]. Accordingly, many countries such as the United States [8], Japan [9], Canada [10], and Australia [11] have been attempting to improve the collection and analysis of cancer data and release annual reports of national cancer statistics. Korea also publishes annual reports of cancer statistics, including incidence rates, mortality rates, relative survival rates, and prevalence rates by sex [4], and several studies have provided descriptive epidemiology of various cancers [12–15].

However, existing epidemiologic reports or studies of cancer statistics in Korea have two limitations. First, data regarding cancer severity distributions were insufficient, and only incidence rates of cancer based on the Surveillance, Epidemiology, and End Results (SEER) stage were available. When estimating DALYs due to cancer using the prevalence-based approach, the main method of the study of global burden of disease, prevalence data regarding severity distribution are required to accurately calculate the DALYs [16]. Second, survival data in annual reports and previous studies were based on relative survival rates, not observed survival rates. In terms of relative survival rates, values above 100% can be estimated in some groups of patients, and this result appears counterintuitive for patients. Furthermore, observed survival rates by severity level provide patients with more accurate prognostic information for cancer, compared to overall relative survival rates.

In the present study, we analyzed the trends in major cancer statistics in Korea according to sex and severity levels from 2006 to 2013. Specifically, we described the number of incident cancer cases by sex and SEER stage from 2006 to 2013. Furthermore, we estimated up to 8-year observed survival rates of major cancers by sex and SEER stage. We also provided the 5-year prevalence rates of major cancers by sex and SEER stage in 2011, 2012, and 2013.

Materials and methods
A total of eight cancers (hepatocellular carcinoma, thyroid cancer, colorectal cancer, gastric cancer, lung cancer, prostate cancer, breast cancer, and cervical cancer) were included in the present study.

Data
We used data from the Korea Central Cancer Registry (KCCR) of the National Cancer Center Korea. More than 190 hospitals participate in the KCCR, and data regarding over 90% of newly diagnosed cancers in Korea are collected [17]. The KCCR offers annual national cancer incidence, survival, and prevalence data, and the KCCR database includes information regarding patients with cancer, such as sex, age, and date of diagnosis [4]. From the KCCR, we obtained the number of cancer patients by sex, age, and severity level from 2006 to 2013, as well as follow-up data for mortality for up to eight years. Furthermore, we utilized mid-year population data based on resident registration from the Korean Statistical Information Service of Statistics Korea to calculate incidence rates and prevalence rates [18]. The severity level was classified by SEER stage as follows: localized stage, regional stage, distant stage, and unknown stage. The SEER stage was based on the time of diagnosis.
Analysis

First, we described the number of incident cancer cases according to sex and SEER stage from 2006 to 2013. The incidence rates by sex and SEER stage were determined as the number of incident cancer cases by sex and SEER stage divided by the mid-year population by sex. The means of incidence rates and their 95% confidence intervals from 2006 to 2013 according to Poisson distribution assumption were estimated by type of cancer, sex, and SEER stage. Furthermore, we conducted statistical tests for linear trend of overall incidence rates and proportions of incidence rates by stage.

Patients with cancer identified in 2006 underwent follow-up for all-cause mortality and observed survival rates by sex and SEER stage. All-cause mortality and observed survival rates by sex and SEER stage in each follow-up year were calculated as the number of patients with cancer alive by sex and SEER stage in each follow-up year divided by the total number of patients with cancer by sex and SEER stage in 2006.

Finally, we estimated the prevalence rates for eight cancers by sex and SEER stage in 2011, 2012, and 2013. Fig 1 shows the method of estimating the number of prevalent cases. We assumed that patients with cancer who lived more than five years past their diagnosis were recovered from the cancer, and these patients were excluded from the prevalent cases. For example, prevalent cases in 2013 included the patients with cancer who were diagnosed in 2013, as well as patients with cancer who were diagnosed since 2009 and still alive (Fig 1). As with incidence rates, the 5-year prevalence rates by sex and SEER stage were calculated as the number of prevalent cases by sex and SEER stage divided by the mid-year population by sex.

In the case of breast cancer, we only analyzed the female patients, because male patients account for a small proportion of the total patients with breast cancer. For a similar reason, all
analyses were restricted to individuals aged ≥ 30 years. In particular, in the case of prostate cancer, only individuals aged ≥ 50 were included in the analyses, because prostate cancer patients under age 50 are rare in Korea.

We used Microsoft Office Excel 2010 and Stata software (Stata/SE 13.1) for all analyses. In this study, P-values less than 0.05 were regarded statistically significant.

Ethical approval
Ethical approval and consent to participate were unnecessary because we used publicly available data without any personal identifiers.

Results

Incident cancer cases

Figs 2 and 3 show the proportions of incident cancer cases for a total of eight cancers by sex and SEER stage from 2006 to 2013. S1 File shows additional details of the number of incident cancer cases, mean incidence rates, and statistical tests for linear trend of overall incidence rates and proportions of incidence rates by SEER stage (S1 File). The total number of newly diagnosed cancer cases between 2006 and 2013 increased by 22,966 and 32,525 cases for men (from 60,138 to 83,104) and women (from 54,462 to 86,987), respectively. However, increases in incident cancer cases are slowing, and the number of newly diagnosed cancer cases in 2013 decreased for the first time since 2006.

In men, the most common cancer in 2013 was gastric cancer (20,266), followed by colorectal cancer (16,593), and lung cancer (16,171). The incidence rate per 100,000 population was higher in the order of gastric cancer (125.7), prostate cancer (125.4), and colorectal cancer (102.9). The proportion of local stage in 2013 was largest in gastric cancer (62.3%), followed by prostate cancer (55.0%) and hepatocellular carcinoma (45.7%). The proportion of distant stage in 2013 was largest in lung cancer (43.7%), followed by hepatocellular carcinoma (15.0%) and colorectal cancer (14.2%). In gastric cancer, the proportion of local stage increased by 17.5 percentage points between 2006 and 2013 (P-trend < 0.001). However, the proportion of distant stage in the same period increased by 9.9 percentage points in lung cancer (P-trend < 0.001).

In women, the most common cancer in 2013 was thyroid cancer (34,087), followed by breast cancer (17,231) and colorectal cancer (11,025). The incidence rate per 100,000 population was higher in the order of thyroid cancer (201.9), breast cancer (102.0), and colorectal cancer (65.3). The proportion of local stage in 2013 was largest in gastric cancer (58.8%), followed by breast cancer (58.0%) and cervical cancer (54.5%). However, the proportion of distant stage in 2013 was largest in lung cancer (41.7%), followed by hepatocellular carcinoma (15.9%) and colorectal cancer (15.8%). Although the proportion of the local stage in lung cancer between 2006 and 2013 increased by 6.7 percentage points (P-trend < 0.001), the proportion of the distant stage in lung cancer during the same period increased by 5.6 percentage points (P-trend < 0.001).

Survival rates

Fig 4 shows 8-year observed survival rates for men by SEER stage. Among the six cancers, the 5-year observed survival rate of thyroid cancer was highest in all SEER stages: 95.3% (localized stage), 95.2% (regional stage), 56.4% (distant stage), and 90.9% (unknown stage). The 5-year observed survival rate for lung cancer was lowest in localized stage (31.9%), while 5-year observed survival rates for colorectal cancer and gastric cancer were over 80% in localized...
stage (81.5% and 81.1%, respectively). In regional stage and distant stage, the 5-year observed survival rate was lowest for hepatocellular carcinoma (11.3% and 3.2%, respectively).

Fig 5 shows 8-year observed survival rates for women by SEER stage. Among the seven cancers, the 5-year observed survival rate of thyroid cancer was highest in all SEER stages: 98.7% (localized stage), 98.1% (regional stage), 70.8% (distant stage), and 95.5% (unknown stage). The 5-year observed survival rate of hepatocellular carcinoma was lowest in all SEER stages: 34.8% (localized stage), 12.2% (regional stage), 2.3% (distant stage), and 30.4% (unknown stage). Among the five cancers affecting both men and women, the differences in the 5-year observed survival rates of lung cancer were greatest in localized stage (31.9% in men and 48.1% in women), regional stage (20.0% in men and 31.3% in women), and unknown stage (24.3% in men and 37.5% in women). In the case of distant stage, the differences in the 5-year observed survival rates of thyroid cancer were greatest (56.4% in men and 70.8% in women). S2 File shows additional details for observed survival rates of up to eight years by sex and SEER stage (S2 File).
Table 1 shows the trends in overall 5-year prevalence rates of cancers by sex and SEER stage from 2011 to 2013. The number of prevalent cancer cases was 663,530 in 2013, which represented a 13.3% increase compared to 2011. The sums of proportions of localized stage and regional stage for thyroid cancer and breast cancer were over 90% in 2013, while the sum of proportions of localized stage and regional stage for lung cancer was only 56.7% in 2013.

In 2011, the highest prevalence rate per 100,000 population in men was for gastric cancer (495.9), followed by prostate cancer (477.8) and colorectal cancer (403.6). In 2013, the highest prevalence rate per 100,000 population in men was for prostate cancer (519.0), followed by gastric cancer (511.1) and colorectal cancer (429.4). In 2011, the highest prevalence rate per 100,000 population in women was for thyroid cancer (806.5), followed by breast cancer (404.8) and colorectal cancer (248.1). In 2013, the highest prevalence rate per 100,000 population in women was for thyroid cancer (952.8), followed by breast cancer (444.0) and colorectal cancer.

Fig 3. Number of incident cases for seven cancers in women according to SEER stage from 2006 to 2013.

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Among five cancers affecting both men and women, thyroid cancer was about 4.4 times more common in women, while hepatocellular carcinoma, colorectal cancer, gastric cancer, and lung cancer were more common in men.

**Discussion**

In the present study, we analyzed the number of incident cancer cases, observed survival rates, and prevalence rates by sex and SEER stage for eight cancers (hepatocellular carcinoma, thyroid cancer, colorectal cancer, gastric cancer, lung cancer, prostate cancer, breast cancer, and cervical cancer) from 2006 to 2013 in Korea. The main strength of this study is that we described national cancer statistics for major cancers considering the severity level of the cancer. Because data regarding severity level are often scarce [16, 19], the results from this study...
will be helpful to allow more accurate estimation of the scale of the burden of disease. When collecting national epidemiologic data for other diseases, such as diabetes mellitus and asthma, it will be necessary to collect information regarding severity level using a functional scale.

Another strength of the present study is that we provided up to 8-year observed survival rates by gender and SEER stage. Following a cancer diagnosis, patient often wonder about their prognosis, including successful treatment rates and survival rates [20]. Accurate information concerning disease prognosis is necessary to enable cancer patients to select treatment options and plan their own lives. The results from this study regarding observed survival rates will assist medical professionals in providing more accurate prognostic information about
their disease to patients with cancer, compared to overall relative survival rates. Most of the previous studies regarding cancer statistics in Korea have reported relative survival rates, not observed survival rates [4, 12–15]. Although a relative survival rate has the advantage of

Table 1. Number of cancer cases and prevalence rates of cancers by sex and SEER stage from 2011 to 2013.

| Cancer          | Stage       | 2011       | 2012       | 2013       |
|-----------------|-------------|------------|------------|------------|
|                 | Men N       | Women N    | Men N      | Women N    |
|                 | Rate        | Rate       | Rate       | Rate       |
| Hepatocellular carcinoma | Localized | 17,633 113.2 | 5,859 35.9 | 18,731 118.1 | 6,085 36.6 | 19,502 120.9 | 6,277 37.2 |
|                 | Regional    | 6,233 40.0 | 1,901 11.6 | 6,548 41.3 | 1,952 11.7 | 6,754 41.9 | 2,071 12.3 |
|                 | Distant     | 2,615 16.8 | 930 5.7 | 2,605 16.4 | 969 5.8 | 2,484 15.4 | 930 5.5 |
|                 | Unknown     | 5,668 36.4 | 2,437 14.9 | 5,117 32.2 | 2,226 13.4 | 4,858 30.1 | 2,139 12.7 |
|                 | Total       | 32,149 206.4 | 11,127 68.2 | 33,001 208.0 | 11,232 67.6 | 33,598 208.3 | 11,417 67.6 |
| Thyroid cancer  | Localized   | 9,502 61.0 | 58,221 356.7 | 11,324 71.4 | 66,821 402.1 | 12,744 79.0 | 71,361 422.6 |
|                 | Regional    | 13,489 86.6 | 60,721 372.0 | 16,499 104.0 | 70,773 425.9 | 19,105 118.5 | 77,613 459.6 |
|                 | Distant     | 138 1.9 | 855 5.2 | 297 1.9 | 878 5.3 | 292 1.8 | 852 5.0 |
|                 | Unknown     | 2,407 15.4 | 11,846 72.6 | 2,487 15.7 | 11,333 68.2 | 2,511 15.6 | 11,074 65.6 |
|                 | Total       | 25,693 164.9 | 131,643 806.5 | 30,609 192.9 | 149,805 901.5 | 34,652 214.9 | 160,900 952.8 |
| Colorectal cancer | Localized  | 26,136 167.8 | 15,416 94.4 | 29,057 183.1 | 16,987 102.2 | 30,414 188.6 | 17,812 105.5 |
|                 | Regional    | 25,434 163.3 | 17,182 105.3 | 27,137 171.0 | 18,453 111.0 | 28,522 176.8 | 19,268 114.1 |
|                 | Distant     | 5,689 36.5 | 3,924 24.0 | 5,902 37.2 | 4,083 24.6 | 5,907 36.6 | 4,120 24.4 |
|                 | Unknown     | 5,622 36.1 | 3,981 24.4 | 4,947 31.2 | 3,559 21.4 | 4,413 27.4 | 3,245 19.2 |
|                 | Total       | 62,881 403.6 | 40,503 248.1 | 67,043 422.5 | 43,082 259.3 | 69,256 429.6 | 44,445 263.2 |
| Gastric cancer  | Localized   | 49,667 318.8 | 23,671 145.0 | 54,142 341.2 | 25,638 154.3 | 57,037 353.6 | 26,904 159.3 |
|                 | Regional    | 17,676 113.5 | 8,722 53.4 | 17,767 111.4 | 8,685 52.3 | 17,468 108.3 | 8,710 51.6 |
|                 | Distant     | 3,981 25.6 | 1,924 11.8 | 3,973 25.0 | 1,921 11.6 | 3,737 23.2 | 1,783 10.6 |
|                 | Unknown     | 5,940 38.1 | 3,570 21.9 | 4,948 31.2 | 2,983 18.0 | 4,196 26.0 | 2,696 16.0 |
|                 | Total       | 77,264 495.9 | 37,887 232.1 | 80,739 508.8 | 39,227 236.1 | 82,438 511.4 | 40,093 237.4 |
| Lung cancer     | Localized   | 8,043 51.6 | 4,709 28.9 | 8,137 56.0 | 5,477 33.0 | 9,528 59.1 | 6,185 36.6 |
|                 | Regional    | 10,291 66.1 | 3,842 23.5 | 10,921 68.8 | 4,230 25.5 | 11,434 70.9 | 4,552 27.0 |
|                 | Distant     | 9,517 61.1 | 5,112 31.3 | 9,844 62.0 | 5,312 32.0 | 10,640 66.0 | 5,673 33.6 |
|                 | Unknown     | 5,329 34.2 | 3,516 21.5 | 4,876 30.7 | 3,242 19.5 | 4,711 29.2 | 3,153 18.7 |
|                 | Total       | 33,180 213.0 | 36,071 222.0 | 34,530 217.6 | 34,261 199.9 | 36,313 225.1 | 19,563 115.8 |
| Breast cancer   | Localized   | - - | - - | - - | - - | - - | - - |
|                 | Regional    | - - | - - | - - | - - | - - | - - |
|                 | Distant     | - - | - - | - - | - - | - - | - - |
|                 | Unknown     | - - | - - | - - | - - | - - | - - |
|                 | Total       | - - | - - | - - | - - | - - | - - |
| Cervical cancer | Localized   | - - | - - | - - | - - | - - | - - |
|                 | Regional    | - - | - - | - - | - - | - - | - - |
|                 | Distant     | - - | - - | - - | - - | - - | - - |
|                 | Unknown     | - - | - - | - - | - - | - - | - - |
|                 | Total       | - - | - - | - - | - - | - - | - - |
| Prostate cancer | Localized   | 19,149 275.5 | - - | 21,505 295.2 | - - | 23,100 304.3 | - - |
|                 | Regional    | 6,817 98.1 | - - | 7,779 108.6 | - - | 8,733 115.1 | - - |
|                 | Distant     | 2,213 31.8 | - - | 2,408 33.0 | - - | 2,567 33.8 | - - |
|                 | Unknown     | 5,035 72.4 | - - | 4,962 68.1 | - - | 4,989 65.7 | - - |
|                 | Total       | 33,214 477.8 | - - | 36,654 503.1 | - - | 39,389 519.0 | - - |

*Per 100,000 population

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evaluating the results of cancer treatment, it also leads cancer patients to overestimate their
survival rates. Furthermore, relative survival rates above 100% can be calculated in a cancer
with a favorable prognosis, such as thyroid cancer [21], and such values can cause difficulty for
cancer patients in understanding their prognosis.

When comparing cancers in terms of proportion of SEER stage in the incident cancer
cases, the proportions of distant stage were larger in lung cancer, hepatocellular carcinoma,
and colorectal cancer than in other cancers. Efforts should be made to detect these cancers at
an early stage. In particular, the proportions of distant stage for lung cancer in 2013 were
43.7% in men and 41.7% in women; these proportions have increased compared to 2006 (P-
trend <0.001). Based on these results, we may assume that a fair number of patients with lung
cancer had inoperable disease at the time of diagnosis. It is known that lung cancer screening
in high-risk groups can reduce lung cancer mortality, although several issues, including radia-
tion risk, overdiagnosis bias, and validity of screening method, might be reviewed [22]. If lung
cancer screening guidelines are adopted in Korea, distributions of severity level in lung cancer
can be monitored to evaluate the effectiveness of those screening guidelines.

On the other hand, in the case of gastric cancer, the proportion of local stage tended to
increase and the proportion of distant stage tended to decrease. The proportions of localized
stage for gastric cancer in 2006 were 44.8% in men and 43.3% in women, whereas theses pro-
portions in 2013 were 62.3% in men and 58.8% in women (P-trend <0.001). However, the
proportions of distant stage for gastric cancer in 2006 were 12.1% in men and 12.3 in women,
whereas theses proportions in 2013 were 10.4% in men and 10.6% in women (P-trend
<0.001). One of the hypotheses that can explain these changes is that the Korean National
Cancer Screening Program for gastric cancer is effective. It is also reported that the Korean
National Cancer Screening Program for gastric cancer has reduced the gastric cancer mortality
[23]. However, since these changes are not prominent in other cancers, there may be limita-
tions in estimating the effect of the overall Korean National Cancer Screening Program.

Another noticeable finding is the rapid statistically significant increase in the both inci-
dence of thyroid cancer cases and incidence rates of thyroid cancer. However, the majority of
thyroid cancers were either local stage or regional stage in both men and women. The propor-
tion of distant stage for thyroid cancer in 2013 was only 0.8% in men and 0.5% in women,
respectively. Furthermore, there were no differences in observed survival rates between local-
ized stage and regional stage. Accordingly, prevalence rates of thyroid cancer have also been
increasing recently in both men and women, as determined by the present study. Consistent
with the findings of previous studies [21, 24], these results can be explained as overdiagnosis of thyroid cancer in Korea. A national effort to reduce unnecessary use of ultra-
sonography screening in the asymptomatic general population is required.

In general, the observed survival rates in men were lower than those in women. The differ-
ces in observed survival rates between men and women were particularly prominent in lung
cancer for all SEER stages. The 5-year observed survival rate of lung cancer in the localized
stage was 31.9% in men and 48.1% in women, respectively. Differences in the histological type
of lung cancer are considered as a plausible explanation for these differences [25], but there
has also been speculation that men with lung cancer might be more likely to be current or for-
mer smokers than women with lung cancer, which could contribute to the presence of more
comorbid conditions in male patients than in female patients [26]. In Korea, the current smok-
ing rate in men (42.1%) was seven times higher than that in women (6.2%) in 2013 [27].
Although the current smoking rate in men has decreased since 2011, a more aggressive smok-
ing policy to prohibit smoking in men is required to reduce the gap in these lung cancer sur-
vival rates, and gender-sensitive tobacco control policies are needed [28].
Although increases in new cancer cases are slowing and the total number of incident cancer cases in 2013 decreased for the first time since 2006, the number of prevalent cancer cases was 663,530 in 2013, an increase of 13.3% compared to 2011. In most cancers, the prevalence rates showed steady increases between 2011 and 2013. The trends were the same when thyroid cancer was excluded from the prevalent cancer cases. The increased total prevalence rates of cancers most likely be due to increased prevalence rates in localized and regional stages. For example, the prevalence rate of breast cancer in the localized stage increased from 222.0 (per 100,000) to 258.2 between 2011 and 2013, but the prevalence rate of breast cancer in the distant stage increased from 14.5 to 15.5 during the same period. The prevalence rate is expected to rise continuously, considering the increasing availability of more effective treatment and diagnosis. Accordingly, evaluation and improvement of health-related quality of life in patients with cancer will become another major issue in Korea [29–31].

This study had several limitations. First, not all cancers were included in this study. We only focused on eight major cancers, which were known for their high incidence, and other cancers including leukemia, kidney cancer, and pancreatic cancer were omitted from the present study. Further study on these cancers is required. Second, analyses in this study were restricted to individuals aged ≥ 50 years for prostate cancer and individuals aged ≥ 30 for other cancers. However, this restriction would not be significant considering that it affects a small proportion of the total number of patients with cancer. Third, we estimated the 5-year prevalence of cancers owing to data limitations and general perceptions of cancer survival. This could mean that cancer survivors’ mortality might not be affected by their cancer after five years’ survival. Further studies will be needed to explore the mortality of cancer survivors beyond five years, as well as long-term follow-up data on cancer survival by SEER stage. Fourth, the cause of death could not be identified in this study. Therefore, only the all-cause mortality rate was reported, and the cause-specific mortality rate could not be reported. Fifth, this study focused on descriptive analyses. Further studies will be required to determine the factors that influence the increase or decrease of incidence and prevalence rates and the changes in severity distribution by sex and type of cancer. Sixth, we did not consider changes in population structure in this study. The reason for this is that the overall numbers of incidence and prevalence cases reported in this study are meaningful in calculating the burden of cancer. In future studies, it would be meaningful to calculate the age standardized incidence and prevalence rates according to changes in population structure in Korea.

Conclusions

In this study, we analyzed the trends in major cancer statistics according to SEER stage from 2006 to 2013 in Korea. Although increases in new cancer cases are slowing and the total number of incident cancer cases in 2013 decreased for the first time since 2006, the number of prevalent cancer cases was 663,530 in 2013, an increase of 13.3% compared to 2011. In most cancers, the prevalence rates showed steady increases between 2011 and 2013. When comparing cancers in terms of proportion of SEER stage in the incident cancer cases, the proportions of distant stage were larger in lung cancer, hepatocellular carcinoma, and colorectal cancer than in other cancers. The differences in observed survival rates between men and women were particularly prominent in lung cancer for all SEER stages. The reported prevalence rates from this study can be used to obtain a more valid measure of cancer burden using a summary measure of population health, such as DALY and quality-adjusted life year. Furthermore, it will be possible to perform additional studies estimating cancer-specific quality-adjusted life expectancy using the data regarding observed survival rates from this study.
Supporting information

S1 File. Number of incident cancer cases and mean incidence rates by sex.

(DOCX)

S2 File. Absolute survival rates of up to eight years by sex.

(DOCX)

Author Contributions

Conceptualization: Minsu Ock, Min-Woo Jo.

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