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Cancer Statistics in Korea: Incidence, Mortality, Survival, and Prevalence in 2013

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Purpose
This study described the 2013 nationwide cancer statistics in Korea, including cancer incidence, survival, prevalence, and mortality.

Materials and Methods
Cancer incidence data from 1999-2013 were obtained from Korea National Cancer Incidence Database and followed until December 31, 2014. Mortality data from 1983-2013 were obtained from Statistics Korea. The prevalence was defined as the number of cancer patients alive on January 1, 2014 among all cancer patients diagnosed since 1999. Crude, and age-standardized and 5-year relative survival rates were also calculated.

Results
In 2013, a total of 225,343 and 75,334 Koreans were newly diagnosed and died from cancer, respectively. The age-standardized rates for cancer incidence and mortality in 2013 were 290.5 and 87.9 per 100,000, respectively. The age-standardized cancer incidence rate increased 3.1% annually between 1999 and 2013. However, the overall cancer incidence rates have decreased slightly in recent years (2011 to 2013). The age-standardized rate for all-cancer mortality has decreased 2.7% annually since 2002. Overall, the 5-year relative survival rate for people diagnosed with cancer between 2009 and 2013 was 69.4%, which represents an improved survival rate as compared with 41.2% for people diagnosed between 1993 and 1995.

Conclusion
Age-standardized cancer incidence rates have decreased between 2011 and 2013; mortality rates have also declined since 2002, while 5-year survival rates have improved remarkably from 1993-1995 to 2009-2013 in Korea.

Key words
Incidence, Mortality, Survival, Prevalence, Neoplasms, Korea

Introduction

Cancer is a major life-threatening disease worldwide. GLOBOCAN 2012 estimated that approximately 14.1 million patients were newly diagnosed with cancer and 8.2 million people died from cancer [1]. The global burden of cancer is expected to grow rapidly due to population growth and aging [2].

In Korea, cancer accounts for one in four deaths (27.6%) and more than 200,000 new cancer cases were diagnosed in 2012 [3]. Cancer incidence and deaths are expected to increase with increasing population aging and westernized lifestyles [4]. In addition, the economic burden of cancer in Korea increased about 1.8-fold, from $11,424 to $20,858 million, between 2000 and 2010 [5].

In this context, cancer statistics are the most important indicator to assess the national cancer burden and establish

cancer prevention and control strategies. This article aims to provide nationwide cancer statistics including cancer incidence, survival, prevalence, and mortality in 2013.

Materials and Methods

1. Data sources

The Korea Central Cancer Registry (KCCR) was established by the Ministry of Health and Welfare in 1980. Until 1998, the KCCR registered cancer cases from hospitals in order to determine cancer incidence, with increasing coverage. Since 1999, the KCCR has collected cancer incidence data nationwide by integrating a hospital-based KCCR database with data from regional cancer registry programs. The KCCR currently provides the nationwide cancer incidence, survival, and prevalence statistics annually. KCCR has been described in more detail elsewhere [6].

The KCCR built the Korea National Cancer Incidence Database (KNCI DB) from hospitals, 11 population-based registries, site-specific cancer registries, and additional medical chart review. The KNCI DB includes patient case information including age, sex, region, date of birth, date of diagnosis, primary cancer site, histological type, most valid diagnostic method, and stage. The completeness of cancer incidence data for 2013 was estimated to be 97.8% based on the method proposed by Ajiki et al. [7]. Mid-year population and cancer mortality data from 1983 to 2013 were obtained from Statistics Korea (http://kosis.kr) [8]. To ascertain vital status and calculate survival and prevalence, the KNCI DB was linked to mortality data.

2. Classification

All incident cancer cases were collected and registered according to the International Classification of Diseases for Oncology, 3rd edition [9]. The all cancer cases were reported according to the International Classification of Diseases, 10th edition (ICD-10) [10] and categorized into 24 cancer types.

3. Statistical analyses

Rates were expressed as crude and age-standardized rates (CR and ASR, respectively) per 100,000 individuals. The crude rate was calculated as the total number of incidence/mortality cases divided by the mid-year population of the specified years. The sum of the expected age-specific rates was obtained by multiplying the age-specific incidence rates among study population by the proportion of population in the corresponding age-specific groups among standard population. Next, the age-standardized incidence rates per 100,000 people were calculated as the sums of the expected age-specific rates divided by the sum of the standard population [11]. We used Segi's world standard population to calculate the age-standardized rates [12]. Age-specific rates were also calculated for given age groups. The cumulative risk of developing cancer from birth to life expectancy were calculated using cumulative rates; that is, the sum of the age-specific rates from birth to life expectancy, as follows [13]:

$$\text{Cumulative risk of developing cancer from birth to life expectancy} = 100\times\left(1-e^{-\frac{\text{cumulative rate}}{100}}\right)$$

Trends in incidence/mortality rates were summarized as annual percentage change (APC). APC is the average percentage change of rates and is calculated as follows [11]:

$$APC=\frac{R_{y+1}-R_y}{R_y}\times 100=(e^{b1}-1)\times 100$$

, where $\log(R_y)=b_0+b_1 y$,

$\log(R_y)$ is the natural log transformed age standardized rates.

y=year, b_0=intercept, b_1=slope

The survival duration for each cancer case was determined as the interval between the date of initial diagnosis and the date of death, date of loss of follow-up, or closing date for follow-up (December 31, 2014). Relative survival rates were calculated using the Ederer II method [14] with some minor corrections, based on an algorithm by Paul Dickman [15]. The 5-year relative survival rates were calculated as the ratios of the observed survival of the cancer patients to the expected survival of the general population, which was derived from the standard life table provided by Statistics Korea. Trends in 5-year relative survival rates were evaluated as percentage differences in 5-year relative survival rates from 1993-1995 and 2009-2013.

Prevalent cases were defined as the number of cancer patients alive on January 1, 2014 among all cancer patients diagnosed between 1999 and 2013. Limited-duration prevalences were calculated using SEER*Stat software to calculate 1-, 3-, and 5-year prevalent cases.

P-values less than 0.05 were considered statistically significant. SEER*Stat 8.2.1 (National Cancer Institute, Bethesda, MD) and SAS 9.3 (SAS Institute Inc., Cary, NC) were used to calculate the incidence, mortality, survival, and prevalence and to perform the statistical analyses.

Table 1. Cancer incidence, deaths and prevalence by sex in Korea, 2013

Site/Type	New cases			Deaths			Prevalent cases[a]		
	Both sexes	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female
All sites	225,343	113,744	111,599	75,334	47,079	28,255	1,370,049	603,524	766,525
Lip, oral cavity, and pharynx	3,041	2,181	860	1,078	821	257	18,539	12,476	6,063
Esophagus	2,382	2,186	196	1,448	1,320	128	8,090	7,321	769
Stomach	30,184	20,266	9,918	9,180	5,995	3,185	224,352	148,926	75,426
Colon and rectum	27,618	16,593	11,025	8,199	4,659	3,540	190,094	113,547	76,547
Liver	16,192	12,105	4,087	11,405	8,421	2,984	55,049	41,203	13,846
Gallbladder[b]	5,283	2,707	2,576	3,783	1,874	1,909	16,021	8,195	7,826
Pancreas	5,511	2,982	2,529	4,831	2,615	2,216	7,757	4,185	3,572
Larynx	1,196	1,116	80	403	369	34	9,149	8,592	557
Lung	23,177	16,171	7,006	17,177	12,519	4,658	58,653	37,399	21,254
Breast	17,292	61	17,231	2,244	13	2,231	147,012	596	146,416
Cervix uteri	3,633	-	3,633	892	-	892	45,989	-	45,989
Corpus uteri	2,212	-	2,212	248	-	248	17,053	-	17,053
Ovary	2,236	-	2,236	1,038	-	1,038	15,362	-	15,362
Prostate	9,515	9,515	-	1,629	1,629	-	55,756	55,756	-
Testis	254	254	-	19	19	-	2,440	2,440	-
Kidney	4,333	2,992	1,341	937	664	273	29,069	19,621	9,448
Bladder	3,762	3,025	737	1,280	975	305	27,440	22,360	5,080
Brain and CNS	1,813	941	872	1,196	625	571	9,302	4,828	4,474
Thyroid	42,541	8,454	34,087	393	120	273	300,851	49,119	251,732
Hodgkin lymphoma	262	169	93	63	41	22	2,194	1,401	793
Non-Hodgkin lymphoma	4,828	2,668	2,160	1,581	929	652	29,347	15,797	13,550
Multiple myeloma	1,327	694	633	804	437	367	4,325	2,256	2,069
Leukemia	3,011	1,716	1,295	1,593	945	648	16,309	9,002	7,307
Other and ill-defined	13,740	6,948	6,792	3,913	2,089	1,824	79,896	38,504	41,392

CNS, central nervous system. [a]Limited-duration prevalent cases on January 1, 2014. These are patients who were diagnosed between January 1, 1999 and December 31, 2013 and who were alive on January 1, 2014. Multiple primary cancer cases were counted multiple times, [b]Includes the gallbladder and other/unspecified parts of the biliary tract.

Selected Findings

1. Incidence

A total of 225,343 cases were newly diagnosed with cancer during the study period (Table 1). Of these cases, 113,744 (50.5%) were men and 111,599 cases (49.5%) were women. Thyroid cancer was the most commonly diagnosed cancer in 2013, and followed by stomach, colorectal, lung, and breast cancer in 2013. The overall cumulative risk of developing cancer from birth to life expectancy was 36.6%. However, the cumulative risk of developing cancer from birth to life expectancy was higher in men (38.3%) than in women (35.0%).

The total CR and ASR for overall cancer incidence in 2013 were 445.7 and 290.5 per 100,000, respectively (Table 2). According to sex, CRs for all sites combined were 449.9 per 100,000 in men and 441.5 per 100,000 in women. The ASRs were 316.5 and 281.8 per 100,000 in men and women, respectively. Stomach cancer (CR, 80.2 per 100,000) was the most common cancer in men, followed by colorectal (CR, 65.6 per 100,000), lung (CR, 64.0 per 100,000), liver (CR, 47.9 per 100,000), and prostate cancer (CR, 37.6 per 100,000). These five cancers accounted for 65.6% of newly diagnosed cancer in men during the study period. In contrast, thyroid cancer (CR, 134.9 per 100,000) was the most common cancer among women, followed by breast (CR, 68.2 per 100,000), colorectal (CR, 43.6 per 100,000), stomach (CR, 39.2 per 100,000), and lung cancer (CR, 27.7 per 100,000). These five cancers accounted for 71.0% of cases in women.

Table 2. Crude and age-standardized cancer incidence rates by sex in Korea, 2013

Site/Type	Crude incidence rate per 100,000			Age-standardized incidence rate per 100,000[a]		
	Both sexes	Male	Female	Both sexes	Male	Female
All sites	445.7	449.9	441.5	290.5	316.5	281.8
Lip, oral cavity, and pharynx	6.0	8.6	3.4	4.0	6.0	2.2
Esophagus	4.7	8.6	0.8	2.9	6.0	0.4
Stomach	59.7	80.2	39.2	37.4	55.3	22.4
Colon and rectum	54.6	65.6	43.6	34.0	45.6	24.4
Liver	32.0	47.9	16.2	20.2	32.8	9.0
Gallbladder[b]	10.4	10.7	10.2	6.1	7.4	5.0
Pancreas	10.9	11.8	10.0	6.6	8.2	5.2
Larynx	2.4	4.4	0.3	1.5	3.1	0.2
Lung	45.8	64.0	27.7	27.4	44.2	14.9
Breast	34.2	0.2	68.2	23.0	0.2	45.7
Cervix uteri	7.2	-	14.4	4.8	-	9.5
Corpus uteri	4.4	-	8.8	2.9	-	5.8
Ovary	4.4	-	8.8	3.1	-	6.0
Prostate	18.8	37.6	-	11.4	26.2	-
Testis	0.5	1.0	-	0.5	1.0	-
Kidney	8.6	11.8	5.3	5.7	8.3	3.4
Bladder	7.4	12.0	2.9	4.4	8.3	1.4
Brain and CNS	3.6	3.7	3.4	2.9	3.2	2.7
Thyroid	84.1	33.4	134.9	60.1	24.0	96.6
Hodgkin lymphoma	0.5	0.7	0.4	0.4	0.6	0.3
Non-Hodgkin lymphoma	9.5	10.6	8.5	6.7	8.0	5.6
Multiple myeloma	2.6	2.7	2.5	1.6	1.9	1.4
Leukemia	6.0	6.8	5.1	5.0	6.0	4.2
Other and ill-defined	27.2	27.5	26.9	17.8	20.5	15.6

CNS, central nervous system. [a]Age-adjusted using the world standard population, [b]Includes the gallbladder and other/unspecified parts of the biliary tract.

2. Mortality

In 2013, cancer was the most common leading cause of death in Korea (Table 3). The total number of deaths from cancer was 75,334 in 2013, accounting for 28.3% of all deaths (Table 3). According to sex, 62.5% and 37.5% of cancer deaths occurred in men and women, respectively (Table 1).

The total CR and ASR for cancer deaths were 149.0 and 87.9 per 100,000, respectively, in 2013 (Table 4). The total CR and ASR for cancer deaths per 100,000 were higher among men (ASR, 130.1) than in women (ASR, 57.5).

According to the cancer sites, lung cancer (CR, 49.5 per 100,000) was the leading cause of death in men, followed by liver (CR, 33.3 per 100,000), stomach (CR, 23.7 per 100,000), colorectal (CR, 18.4 per 100,000), and pancreatic cancer (CR, 10.3 per 100,000). The top five causes of deaths from cancer in women included lung (CR, 18.4 per 100,000), colorectal (CR, 14.0 per 100,000), stomach (CR, 12.6 per 100,000), liver (CR, 11.8 per 100,000), and breast cancer (CR, 8.8 per 100,000).

3. Trends in cancer incidence and mortality rates

The trends in overall cancer incidence and mortality rates by sex are shown in Fig. 1. The ASR for all-cancer incidence increased 3.1% annually from 1999 to 2013 (Table 5, Fig. 1). However, in recent years, ASR for all-cancer incidence has decreased slightly, from 303.8 per 100,000 in 2011 to 290.5 per 100,000 in 2013 (APC, –2.1%). In contrast, ASR for all-cancer mortality has decreased 2.7% annually from 2002 to 2013 (Fig. 1).

The ASR for all-cancer incidence in women (APC, 5.1%; 95% confidence interval [CI], 4.6 to 5.6) has increased more

Table 3. The top 10 leading causes of death in Korea, 2013

Rank	Cause of death	No. of deaths	Percentage of all deaths	Age-standardized death rate per 100,000[a]
	All causes	266,257	100.0	309.4
1	Cancer	75,334	28.3	87.9
2	Cerebrovascular disease	25,447	9.6	27.0
3	Heart disease	25,365	9.5	27.9
4	Intentional self-harm (suicide)	14,427	5.4	20.3
5	Diabetes mellitus	10,888	4.1	11.6
6	Pneumonia	10,809	4.1	11.2
7	Chronic lower respiratory diseases	7,074	2.7	7.3
8	Disease of liver	6,665	2.5	8.3
9	Transport accidents	6,028	2.3	8.7
10	Hypertensive diseases	4,732	1.8	4.9
	Others	79,488	29.9	94.4

Source: Mortality Data, 2013, Statistics Korea [8]. [a]Age-adjusted using the world standard population.

rapidly than that in men (APC, 1.3%; 95% CI, 1.0 to 1.6) (Tables 6 and 7) since 1999, whereas ASR for all-cancer mortality in men (APC, –3.1%; 95% CI, –3.3 to –2.8) has decreased faster than that in women (APC, –2.2%; 95% CI, –2.5 to –1.9) since 2002 (Fig. 1).

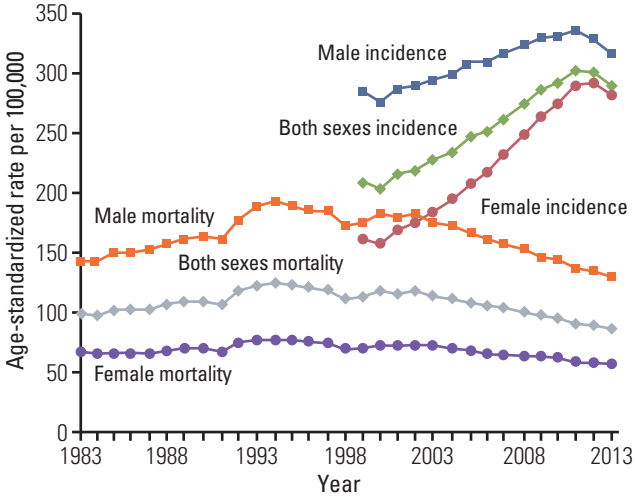


Fig. 1. Annual age-standardized cancer incidence and death rates by sex for all sites from 1983 to 2013 in Korea. Age standardization was based on the Segi's world standard population.

4. Trends in cancer incidence and mortality rates by common cancer sites

Between 1999 and 2013, ASR for thyroid cancer incidence has been most notably increased in both men (APC, 22.7%) and women (APC, 20.6%) (Tables 6 and 7). Among men, the age-standardized incidence rates of prostate (APC, 10.7%) and colorectal cancer (APC, 5.0%) have increased from 1999 to 2013, while the age-standardized incidence rates of liver (APC, –2.2%), lung (APC, –1.0%), and stomach cancer (APC, –0.8%) have decreased from 1999 to 2013 (Table 6, Fig. 2). Among women, the age-standardized incidence rates of breast (APC, 5.9%), colorectal (APC, 3.7%), and lung (APC, 1.7%) have increased from 1999 to 2013 (Table 7). However, the age-standardized incidence rates of cervical (APC, –3.9%), liver (APC, –1.8%), and stomach cancer (APC, –0.7%) in women have decreased from 1999 to 2013.

The age-standardized mortality rate of stomach cancer has decreased continuously in both sexes (Fig. 3). Although the age-standardized mortality rate of colorectal cancer increased from 1983 to 2003, the mortality rate of colorectal cancer has leveled off since 2003 in men. For women, the age-standardized mortality of colorectal cancer increased from 1983 to 2004, but the mortality rate has subsequently decreased. For both sexes, the age-standardized mortality of lung cancer increased from 1983 to 2002, and the mortality rates for lung cancer decreased. The mortality rates for uterine cancer in women and liver cancer in both sexes have continuously decreased since the mid-1990s. However, the breast cancer mortality rate in women and the prostate cancer mortality rate in men showed increasing trends during the observation period (1983-2013).

Table 4. Crude and age-standardized cancer mortality rates by sex in Korea, 2013

Site/Type	Crude mortality rate per 100,000			Age-standardized mortality rate per 100,000[a]		
	Both sexes	Male	Female	Both sexes	Male	Female
All sites	149.0	186.2	111.8	87.9	130.1	57.5
Lip, oral cavity, and pharynx	2.1	3.2	1.0	1.3	2.3	0.5
Esophagus	2.9	5.2	0.5	1.7	3.6	0.3
Stomach	18.2	23.7	12.6	10.5	16.4	6.1
Colon and rectum	16.2	18.4	14.0	9.3	12.9	6.7
Liver	22.6	33.3	11.8	13.8	22.9	6.1
Gallbladder[b]	7.5	7.4	7.6	4.2	5.2	3.5
Pancreas	9.6	10.3	8.8	5.6	7.2	4.4
Larynx	0.8	1.5	0.1	0.4	1.0	0.1
Lung	34.0	49.5	18.4	19.3	34.0	8.8
Breast	4.4	0.1	8.8	2.9	0.0	5.6
Cervix uteri	1.8	-	3.5	1.1	-	1.9
Corpus uteri	0.5	-	1.0	0.3	-	0.6
Ovary	2.1	-	4.1	1.3	-	2.4
Prostate	3.2	6.4	-	1.7	4.8	-
Testis	0.0	0.1	-	0.0	0.1	-
Kidney	1.9	2.6	1.1	1.1	1.8	0.5
Bladder	2.5	3.9	1.2	1.4	2.8	0.5
Brain and CNS	2.4	2.5	2.3	1.7	2.0	1.5
Thyroid	0.8	0.5	1.1	0.4	0.3	0.5
Hodgkin lymphoma	0.1	0.2	0.1	0.1	0.1	0.1
Non-Hodgkin lymphoma	3.1	3.7	2.6	1.9	2.6	1.3
Multiple myeloma	1.6	1.7	1.5	0.9	1.2	0.8
Leukemia	3.2	3.7	2.6	2.2	2.9	1.6
Other and ill-defined	7.7	8.3	7.2	4.7	6.0	3.8

CNS, central nervous system. [a]Age-adjusted using the world standard population, [b]Includes the gallbladder and other/unspecified parts of the biliary tract.

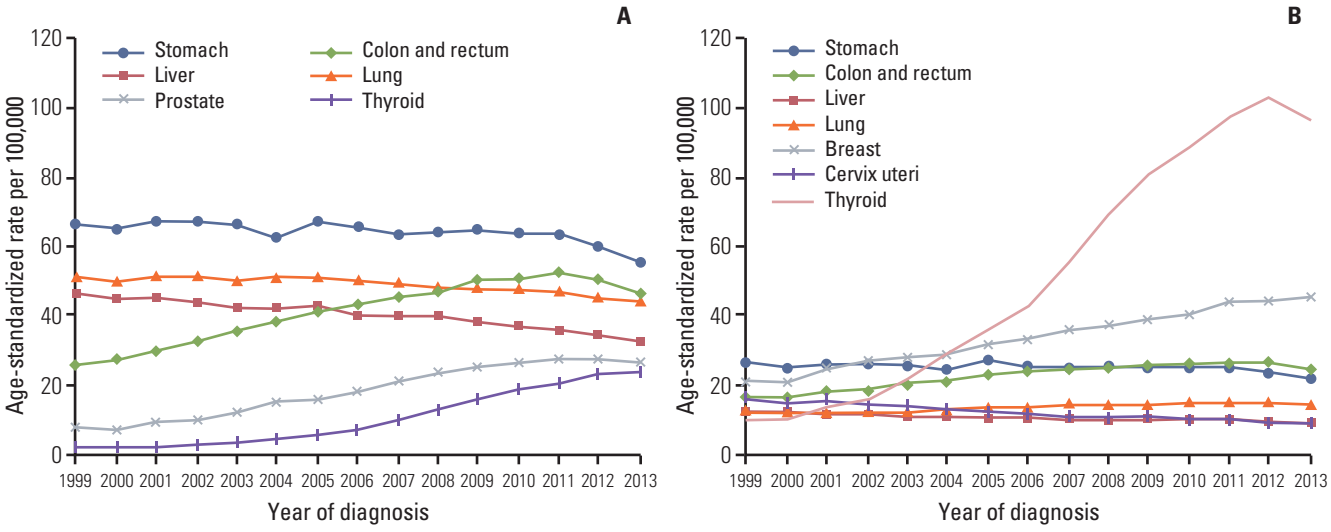


Fig. 2. Trends in age-standardized incidences of selected cancers by sex from 1999 to 2013 in Korea. (A) Men. (B) Women. Age standardization was based on the Segi's world standard population.

Table 5. Trends in cancer incidence rates for both sexes from 1999 to 2013 in Korea

Site/Type	Year															APC
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	
All sites	210.5	205.1	216.7	220.1	227.9	235.1	247.9	252.2	263.5	276.1	286.9	293.5	303.8	301.7	290.5	3.1[a]
Lip, oral cavity, and pharynx	3.6	4.4	3.6	3.7	3.8	3.8	3.8	3.8	3.9	4.0	3.8	4.0	4.1	4.0	4.0	0.4
Esophagus	4.1	3.7	3.9	3.8	3.6	3.6	3.5	3.4	3.3	3.3	3.1	3.1	3.0	3.0	2.9	–2.2[a]
Stomach	43.6	42.3	44.0	43.6	43.3	41.2	44.4	42.8	41.8	42.6	43.4	42.5	42.8	40.1	37.4	-0.6
Colon and rectum	20.4	21.0	22.9	24.7	26.9	28.6	31.0	32.5	33.8	34.9	36.9	36.9	38.3	37.7	34.0	4.6[a]
Liver	27.9	26.7	27.3	26.5	25.7	25.6	25.8	24.6	24.4	24.1	23.5	22.8	22.5	21.2	20.2	–2.0[a]
Gallbladder[b]	6.5	6.4	6.7	6.7	6.7	6.9	7.1	6.6	6.6	6.4	6.8	6.6	6.4	6.3	6.1	–0.3
Pancreas	5.6	5.5	5.5	5.8	5.9	6.0	6.3	6.2	6.3	6.4	6.3	6.4	6.7	6.8	6.6	1.5[a]
Larynx	2.3	2.2	2.4	2.2	2.1	1.9	2.0	1.8	1.8	1.7	1.7	1.6	1.5	1.4	1.5	–3.5[a]
Lung	28.5	27.7	28.3	28.5	27.9	28.8	29.0	28.7	28.4	28.2	28.3	28.6	28.7	27.7	27.4	–0.1
Breast	10.7	10.8	12.7	13.9	14.3	15.0	16.3	17.0	18.1	18.9	19.7	20.7	22.3	22.7	23.0	5.8[a]
Cervix uteri	8.5	7.9	8.3	7.7	7.4	6.9	6.5	6.4	5.7	5.9	5.5	5.6	5.2	4.9	4.8	–4.1[a]
Corpus uteri	1.4	1.3	1.5	1.7	1.9	1.9	2.0	2.1	2.2	2.4	2.6	2.6	2.7	2.7	2.9	5.6[a]
Ovary	2.7	2.5	2.5	2.6	2.7	2.7	2.8	2.8	3.1	2.9	2.8	3.0	3.0	3.1	3.1	1.4[a]
Prostate	3.1	2.7	3.6	3.9	4.8	6.0	6.3	7.3	8.6	9.8	10.6	11.0	11.9	11.7	11.4	12.0[a]
Testis	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	4.6[a]
Kidney	3.0	2.9	3.3	3.4	3.5	3.7	4.1	4.4	4.8	5.1	5.2	5.3	5.6	5.6	5.7	5.5[a]
Bladder	4.6	4.6	4.9	4.7	5.1	5.1	5.1	4.9	5.0	4.8	4.6	4.7	4.7	4.4	4.4	–0.5
Brain and CNS	2.9	2.8	2.8	2.6	2.9	2.9	3.0	2.9	3.1	3.1	3.0	3.1	2.7	2.9	2.9	0.4
Thyroid	6.3	6.1	7.9	9.5	12.8	17.3	20.7	25.5	32.9	41.4	48.2	53.7	59.2	63.2	60.1	20.8[a]
Hodgkin lymphoma	0.2	0.3	0.3	0.3	0.3	0.4	0.3	0.3	0.4	0.4	0.4	0.4	0.5	0.5	0.4	4.7[a]
Non-Hodgkin lymphoma	4.5	4.2	4.5	4.6	5.0	5.3	5.3	5.5	5.6	5.7	6.2	6.2	6.6	6.7	6.7	3.5[a]
Multiple myeloma	1.0	1.0	1.1	1.1	1.1	1.2	1.3	1.3	1.4	1.4	1.5	1.5	1.4	1.6	1.6	3.6[a]
Leukemia	4.7	4.3	4.7	4.8	4.8	4.8	4.7	4.9	4.9	5.0	5.1	5.0	5.2	5.0	5.0	0.9[a]
Other and ill-defined	14.3	13.5	13.9	13.5	15.2	15.3	16.2	16.2	17.3	17.1	17.2	17.6	18.3	17.9	17.8	2.3[a]

APC was calculated using age-standardized incidence data based on the world standard population. APC, annual percentage change; CNS, central nervous system.
[a]Significantly different from zero ($p < 0.05$), [b]Includes the gallbladder and other/unspecified parts of the biliary tract.

Table 6. Trends in cancer incidence rates in men from 1999 to 2013 in Korea

Site/Type	Year															APC
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	
All sites	285.0	276.7	288.3	290.0	295.1	299.6	311.4	310.3	317.1	324.2	330.9	332.0	337.2	329.1	316.5	1.3[a]
Lip, oral cavity, and pharynx	6.1	7.1	6.0	6.2	6.5	6.2	6.1	6.2	6.3	6.5	6.1	6.1	6.4	6.2	6.0	–0.2
Esophagus	8.8	8.0	8.3	8.2	7.7	7.7	7.6	7.2	7.0	7.0	6.6	6.5	6.3	6.1	6.0	–2.6[a]
Stomach	66.2	65.0	67.2	66.6	66.0	62.3	66.9	65.3	63.1	64.5	65.0	63.4	63.8	59.6	55.3	–0.8[a]
Colon and rectum	26.2	27.2	29.6	32.9	35.3	38.0	41.2	43.3	45.3	47.0	50.0	50.1	52.0	50.4	45.6	5.0[a]
Liver	46.8	44.7	45.1	43.9	42.3	42.1	42.6	40.3	39.8	39.5	38.2	36.9	36.1	34.5	32.8	–2.2[a]
Gallbladder[b]	8.1	7.8	8.2	8.1	7.8	8.4	8.7	8.1	7.9	7.6	8.1	8.2	7.7	7.6	7.4	–0.4
Pancreas	7.8	7.6	7.6	7.9	7.7	8.0	8.3	8.0	8.2	8.4	8.1	8.1	8.6	8.5	8.2	0.7[a]
Larynx	4.9	4.5	5.1	4.7	4.5	4.1	4.3	3.8	3.8	3.5	3.6	3.4	3.2	3.0	3.1	–3.6[a]
Lung	51.4	49.8	51.1	51.0	50.0	50.8	50.9	49.2	48.8	47.7	47.5	47.5	46.7	44.7	44.2	–1.0[a]
Breast	0.2	0.3	0.2	0.3	0.2	0.2	0.2	0.2	0.1	0.3	0.2	0.2	0.2	0.2	0.2	–1.4
Prostate	8.4	7.2	9.5	10.1	12.5	15.2	15.8	18.0	20.9	23.5	25.3	26.1	27.7	27.3	26.2	10.7[a]
Testis	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.9	0.9	1.0	4.5[a]
Kidney	4.5	4.4	4.9	5.0	5.2	5.5	6.0	6.5	7.1	7.5	7.6	8.0	8.1	8.3	8.3	5.2[a]
Bladder	9.0	9.0	9.4	9.0	9.7	9.8	9.8	9.6	9.5	9.2	8.7	8.9	8.9	8.3	8.3	–0.7[a]
Brain and CNS	3.2	3.1	3.1	2.9	3.3	3.3	3.3	3.2	3.4	3.4	3.5	3.5	3.0	3.3	3.2	0.5
Thyroid	2.1	1.9	2.4	2.7	3.7	4.8	5.9	7.5	10.0	13.3	15.6	18.6	20.4	23.3	24.0	22.7[a]
Hodgkin lymphoma	0.4	0.4	0.4	0.3	0.4	0.5	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.6	0.6	3.9[a]
Non-Hodgkin lymphoma	5.8	5.5	5.8	5.8	6.2	6.6	6.5	6.9	7.0	6.8	7.5	7.4	7.7	7.9	8.0	2.7[a]
Multiple myeloma	1.2	1.3	1.4	1.4	1.4	1.4	1.6	1.5	1.6	1.7	1.9	1.8	1.8	2.0	1.9	3.3[a]
Leukemia	5.5	5.0	5.4	5.8	5.5	5.7	5.6	5.6	5.7	5.8	5.9	6.0	6.1	5.9	6.0	1.0[a]
Other and ill-defined	17.9	16.5	16.8	16.5	18.5	18.3	19.3	18.9	20.4	19.8	20.0	19.9	20.9	20.3	20.5	1.6[a]

APC was calculated using age-standardized incidence data based on the world standard population. APC, annual percentage change; CNS, central nervous system.
[a]Significantly different from zero ($p < 0.05$), [b]Includes the gallbladder and other/unspecified parts of the biliary tract.

Table 7. Trends in cancer incidence rates in women from 1999 to 2013 in Korea

Site/Type	Year															APC[a]
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	
All sites	161.1	157.4	169.0	174.6	184.6	193.9	208.1	216.7	232.5	249.9	263.9	275.5	290.3	292.9	281.8	5.1[a]
Lip, oral cavity, and pharynx	1.6	2.4	1.7	1.7	1.7	1.9	1.9	1.8	1.9	1.9	1.8	2.2	2.1	2.0	2.2	1.3
Esophagus	0.6	0.6	0.6	0.5	0.6	0.5	0.4	0.5	0.5	0.5	0.4	0.4	0.4	0.5	0.4	–2.2[a]
Stomach	26.7	25.2	26.2	26.3	25.9	24.7	26.8	25.1	24.8	25.1	25.8	25.4	25.3	23.7	22.4	–0.7[a]
Colon and rectum	16.4	16.4	17.9	18.8	20.5	21.5	23.0	24.1	24.6	25.2	26.3	26.1	26.8	27.1	24.4	3.7[a]
Liver	12.3	11.8	12.2	11.8	11.5	11.3	11.4	11.1	11.1	10.7	10.6	10.4	10.5	9.6	9.0	–1.8[a]
Gallbladder[b]	5.3	5.5	5.7	5.8	5.8	5.9	6.0	5.5	5.6	5.5	5.8	5.4	5.5	5.3	5.0	–0.5
Pancreas	4.0	4.0	4.0	4.2	4.4	4.5	4.7	4.7	4.8	4.9	4.9	5.0	5.1	5.4	5.2	2.2[a]
Larynx	0.4	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	–7.0[a]
Lung	12.4	12.5	12.3	12.6	12.4	13.0	13.5	14.0	14.0	14.2	14.2	14.8	15.4	15.1	14.9	1.7[a]
Breast	20.9	20.9	24.7	27.2	27.9	29.4	32.1	33.3	35.7	37.3	38.8	40.8	44.1	44.9	45.7	5.9[a]
Cervix uteri	16.3	15.1	15.8	14.8	14.2	13.2	12.4	12.2	11.1	11.5	10.7	10.9	10.2	9.6	9.5	–3.9[a]
Corpus uteri	2.8	2.6	3.0	3.3	3.8	3.7	3.9	4.0	4.2	4.7	5.1	5.1	5.3	5.4	5.8	5.8[a]
Ovary	5.0	4.8	4.8	5.0	5.2	5.2	5.5	5.4	5.9	5.6	5.4	5.9	5.8	6.1	6.0	1.7[a]
Kidney	1.7	1.8	1.9	2.0	2.1	2.2	2.5	2.7	2.8	3.0	3.2	3.0	3.4	3.2	3.4	5.4[a]
Bladder	1.6	1.6	1.7	1.7	1.8	1.7	1.7	1.6	1.7	1.6	1.6	1.5	1.5	1.4	1.4	–1.1[a]
Brain and CNS	2.6	2.5	2.5	2.4	2.6	2.6	2.8	2.7	2.8	2.7	2.6	2.7	2.5	2.4	2.7	0.2
Thyroid	10.4	10.1	13.2	16.2	21.9	29.6	35.4	43.4	55.7	69.6	80.8	89.0	98.3	103.5	96.6	20.6[a]
Hodgkin lymphoma	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.3	5.7[a]
Non-Hodgkin lymphoma	3.4	3.2	3.4	3.5	4.0	4.1	4.4	4.4	4.4	4.8	5.2	5.2	5.6	5.7	5.6	4.4[a]
Multiple myeloma	0.8	0.8	0.9	0.8	1.0	1.0	1.2	1.1	1.2	1.2	1.2	1.3	1.1	1.4	1.4	4.1[a]
Leukemia	3.9	3.8	4.1	4.0	4.1	4.1	4.0	4.4	4.2	4.3	4.3	4.1	4.5	4.1	4.2	0.7[a]
Other and ill-defined	11.8	11.5	11.8	11.5	12.9	13.2	13.9	14.2	14.9	15.0	14.9	15.8	16.2	15.9	15.6	2.7[a]

APC was calculated using age-standardized incidence data based on the world standard population. APC, annual percentage change; CNS, central nervous system.
[a]Significantly different from zero ($p < 0.05$), [b]Includes the gallbladder and other/unspecified parts of the biliary tract.

Table 8. The five common sites of cancer incidence by age group and sex in Korea, 2013

Rank	Age (yr)			
	0-14	15-34	35-64	≥ 65
Male				
1	Leukemia (4.3)	Thyroid (17.7)	Stomach (88.3)	Lung (449.4)
2	Non-Hodgkin lymphoma (2.4)	Leukemia (3.5)	Colon and rectum (69.5)	Stomach (396.3)
3	Brain and CNS (2.0)	Colon and rectum (3.2)	Liver (62.4)	Colon and rectum (333.4)
4	Liver (0.4)	Non-Hodgkin lymphoma (3.0)	Thyroid (54.6)	Prostate (289.3)
5	Testis (0.4)	Stomach (2.3)	Lung (42.4)	Liver (192.1)
Female				
1	Leukemia (3.4)	Thyroid (71.7)	Thyroid (228.2)	Colon and rectum (176.5)
2	Brain and CNS (1.9)	Breast (10.6)	Breast (123.9)	Stomach (149.3)
3	Non-Hodgkin lymphoma (1.1)	Cervix uteri (5.5)	Colon and rectum (40.8)	Lung (126.6)
4	Thyroid (0.6)	Stomach (3.4)	Stomach (38.8)	Thyroid (92.7)
5	Ovary (0.6)	Ovary (3.1)	Lung (21.7)	Liver (72.5)

CNS, central nervous system.

5. Age-specific incidence rates

According to age group, leukemia was the most commonly diagnosed cancer among children between 0-14 years of age, while thyroid cancer was the most common cancer among adolescents and young adults between 15 and 34 years of age (Table 8). For men, the incidence rate of cancer increased with age (Fig. 4A). Stomach cancer was the most commonly diagnosed cancer among men aged 35 and 64 years old, while lung cancer was the most common among elderly men aged ≥ 65 years. In contrast, thyroid cancer was most commonly diagnosed among women aged 35 and 64 years, while colorectal cancer was most common among elderly women aged ≥ 65 years. Thyroid and breast cancer showed inverted U-shaped incidence rates by age (Fig. 4B).

6. Survival rates

The 5-year relative survival rates for all cancer combined improved remarkably in both sexes, from 41.2% in 1993-1995 to 69.4% in 2009-2013 (Table 9, Fig. 5A). After excluding thyroid cancer, the 5-year relative survival rates for all cancer still increased from 1993-1995 to 2009-2013 (Fig. 5B).

The 5-year relative survival rate in 2009-2013 for all cancer combined was 61.0% in men and 77.7% in women, respectively. The 5-year relative survival rate for thyroid cancer was over 100%, while the 5-year relative survival rates for testis, prostate, and breast cancer were over 90% in 2009-2013 for both sexes, respectively. However, the 5-year relative survival rate for pancreatic cancer was only 9.4% in both sexes in 2009-2013.

When compared to the 5-year relative survival rate for 1993-1995, prostate cancer diagnosed from 2009 to 2013 showed the most outstanding improvement, followed by stomach cancer, leukemia, 'lip, oral cavity, and pharynx' and colorectal cancer in men. Among women, stomach cancer diagnosed during 2009-2013 showed the greatest improvement in 5-year relative survival rates compared to those between 1993 and 1995, followed by leukemia, non-Hodgkin's lymphoma, colorectal cancer, and kidney cancer.

7. Prevalence rates

A total of 1,370,049 cancer prevalent cases were identified on January 1, 2014 (Table 1). Of these cases, 603,524 (44.1%) were men and 766,525 (55.9%) were women. The crude and age-standardized prevalence rates for cancer overall were 2,709.8 per 100,000 individuals and 1,772.4 per 100,000 individuals for both sexes, respectively, in 2013 (Table 10). Among men, the crude and age-standardized prevalence rates for cancer overall were 2,387.1 and 1,683.6 per 100,000 individuals, respectively. Among women the rates for cancer overall were 3,032.6 and 1,944.3 per 100,000 individuals, respectively.

The five most common cancers for men were stomach (CR, 589.0 per 100,000), colorectal (CR, 449.1 per 100,000), prostate (CR, 220.5 per 100,000), thyroid (CR, 194.3 per 100,000), and liver cancer (CR, 163.0 per 100,000). In contrast, thyroid cancer was most common in women (CR, 995.9 per 100,000), followed by breast (CR, 579.3 per 100,000), colorectal (CR, 302.8 per 100,000), stomach (CR, 298.4 per 100,000), and cervix uteri cancer (CR, 181.9 per 100,000).

Analysis of the time period after cancer diagnosis revealed that thyroid cancer (23.2%) was the most prevalent cancer

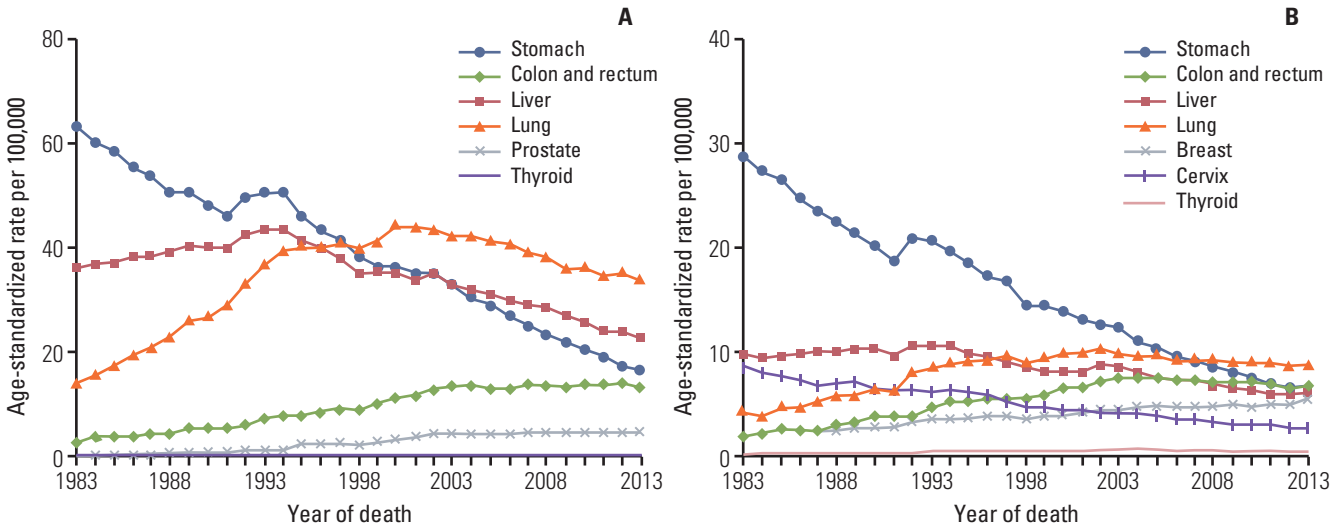


Fig. 3. Annual age-standardized cancer mortalities of selected cancers by sex from 1983 to 2013 in Korea. (A) Men. (B) Women. Age standardization was based on the Segi's world standard population.

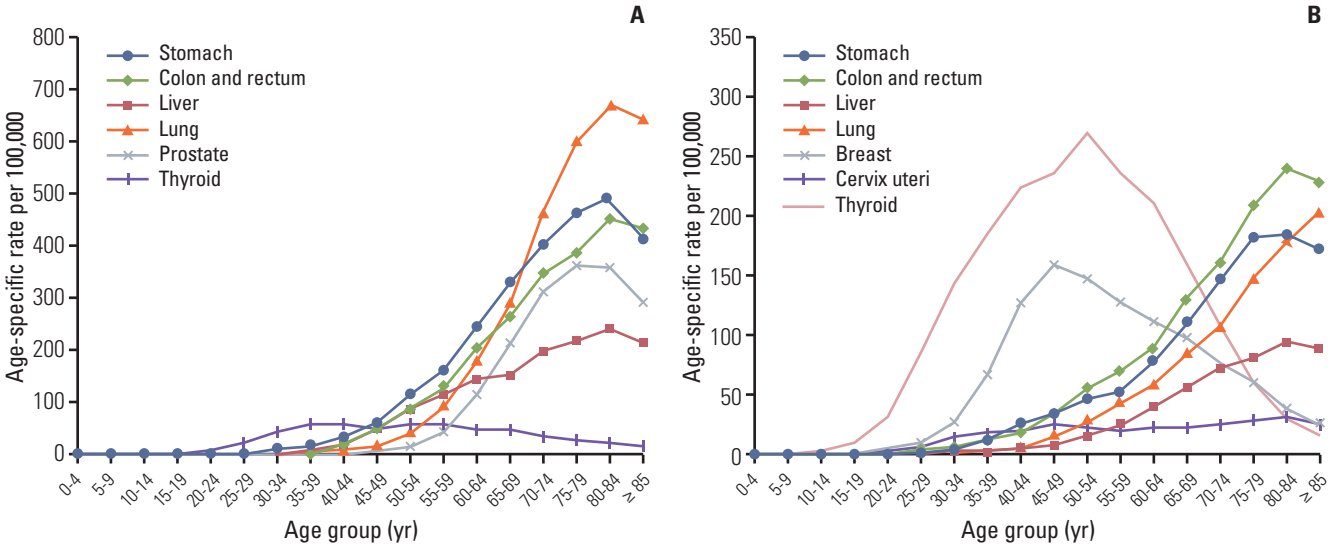


Fig. 4. Age-specific incidence rates of common cancers for 2013 in Korea. (A) Men. (B) Women.

within 2 years after cancer diagnosis, followed by stomach (13.9%) and colorectal cancer (13.3%) (Fig. 6). Thyroid cancer (26.2%) was most prevalent for 2-5 years, followed by stomach (15.4%) and colorectal cancer (14.0%). After 5 years, stomach cancer (18.6%) was the most prevalent cancer, followed by thyroid (18.1%) and colorectal cancer (14.1%).

Table 9. Trends in the 5-year relative survival rates (%) by year of diagnosis from 1993 to 2013 in Korea

Site/Type	Both sexes					Male					Female				
	1993-1995	1996-2000	2001-2005	2008-2013	Change[a]	1993-1995	1996-2000	2001-2005	2008-2013	Change[a]	1993-1995	1996-2000	2001-2005	2009-2013	Change[a]
All sites	41.2	44.0	53.8	69.4	28.2	31.7	35.3	45.3	61.0	29.3	53.4	55.3	64.0	77.7	24.3
Lip, oral cavity, and pharynx	41.1	46.7	54.2	63.1	22.0	35.8	41.1	49.4	59.3	23.5	58.1	63.8	67.7	73.0	14.9
Esophagus	12.7	15.2	21.2	33.4	20.7	11.8	14.3	20.5	33.1	21.3	23.7	24.2	29.6	36.1	12.4
Stomach	42.8	46.6	57.7	73.1	30.3	43.0	46.9	58.4	73.9	30.9	42.6	46.0	56.4	71.5	28.9
Colon and rectum	54.8	58.0	66.6	75.6	20.8	55.3	59.0	68.5	77.5	22.2	54.2	56.8	64.2	72.6	18.4
Liver	10.7	13.2	20.2	31.4	20.7	9.9	12.9	20.2	31.6	21.7	13.6	14.2	20.4	30.8	17.2
Gallbladder[b]	17.3	19.7	22.8	29.0	11.7	16.6	20.3	23.3	30.2	13.6	18.0	19.1	22.3	27.9	9.9
Pancreas	9.4	7.6	8.2	9.4	-	8.8	7.3	8.2	9.2	0.4	10.1	8.1	8.1	9.7	–0.4
Larynx	59.7	62.3	66.2	73.1	13.4	60.2	62.8	66.8	73.5	13.3	55.4	57.8	58.2	66.9	11.5
Lung	11.3	12.7	16.2	23.5	12.2	10.4	11.6	15.0	20.5	10.1	14.2	16.2	19.7	30.6	16.4
Breast	77.9	83.2	88.5	91.5	13.6	75.1	85.6	87.0	91.6	16.5	78.0	83.2	88.5	91.5	13.5
Cervix uteri	77.5	80.0	81.3	80.1	2.6	-	-	-	-	-	77.5	80.0	81.3	80.1	2.6
Corpus uteri	81.5	81.8	84.6	87.9	6.4	-	-	-	-	-	81.5	81.8	84.6	87.9	6.4
Ovary	58.7	58.9	61.4	62.0	3.3	-	-	-	-	-	58.7	58.9	61.4	62.0	3.3
Prostate	55.9	67.2	80.2	92.5	36.6	55.9	67.2	80.2	92.5	36.6	-	-	-	-	-
Testis	85.4	90.4	90.6	94.9	9.5	85.4	90.4	90.6	94.9	9.5	-	-	-	-	-
Kidney	62.0	66.1	73.4	80.8	18.8	60.8	64.4	72.8	80.5	19.7	64.5	69.7	74.5	81.6	17.1
Bladder	69.1	73.1	75.6	75.3	6.2	70.0	74.8	77.4	77.4	7.4	65.5	66.3	68.5	67.0	1.5
Brain and CNS	38.5	39.0	40.7	41.8	3.3	37.2	37.5	40.1	40.1	2.9	40.2	40.7	41.4	43.9	3.7
Thyroid	94.2	94.9	98.3	100.2	6.0	87.2	89.5	95.8	100.6	13.4	95.4	95.9	98.7	100.1	4.7
Hodgkin lymphoma	68.0	71.2	76.6	78.2	10.2	67.6	68.1	74.6	78.6	11.0	68.6	77.4	80.7	77.5	8.9
Non-Hodgkin lymphoma	46.6	50.8	60.0	68.4	21.8	45.3	48.9	58.1	66.6	21.3	48.7	53.5	62.4	70.5	21.8
Multiple myeloma	22.1	19.8	29.3	38.9	16.8	21.1	17.8	29.6	37.6	16.5	23.3	22.1	29.0	40.5	17.2
Leukemia	26.5	33.3	41.8	49.7	23.2	26.2	32.3	41.7	49.7	23.5	26.8	34.6	42.0	49.6	22.8
Other and ill-defined	42.1	45.9	55.9	68.1	26.0	37.4	42.4	52.2	64.6	27.2	47.4	50.0	60.0	71.7	24.3

CNS, central nervous system. [a]Percentage change in 5-year relative survival from 1993 to 1995 and 2009 to 2013, [b]Includes the gallbladder and other/unspecified parts of the biliary tract.

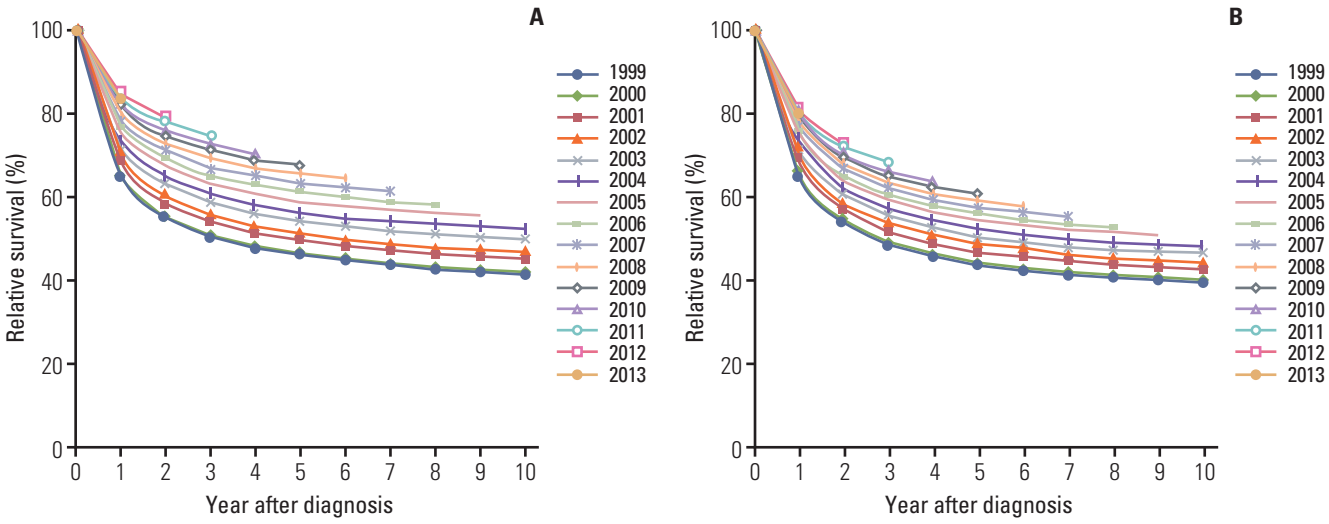
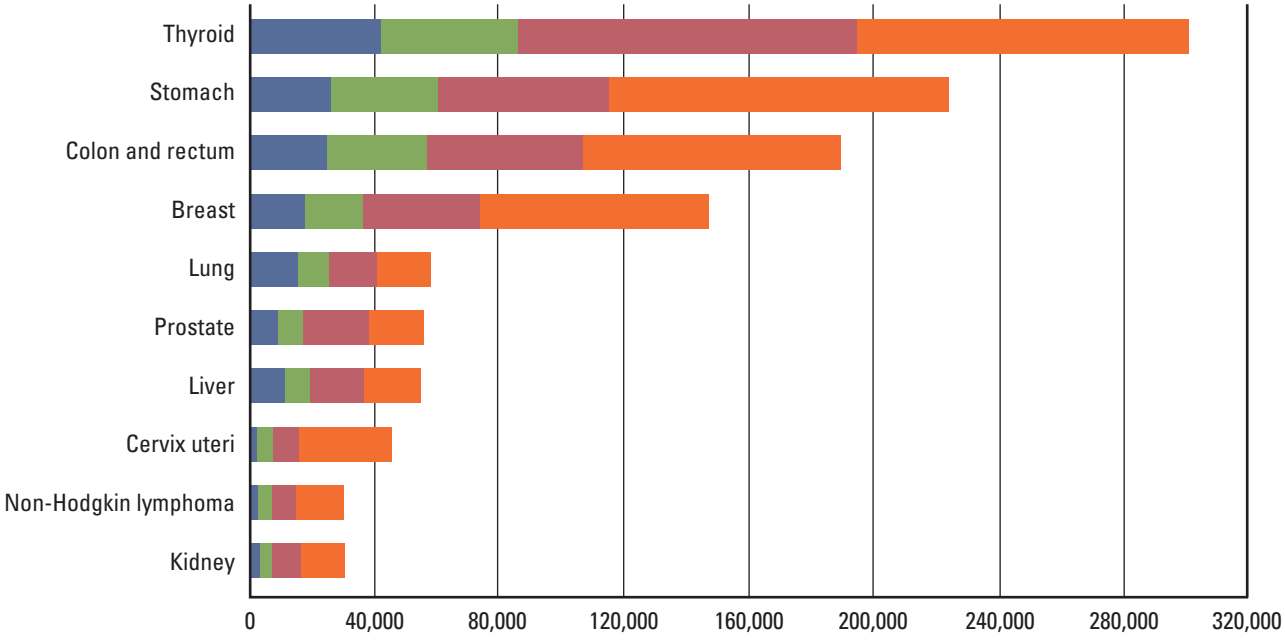


Fig. 5. Trends in relative survival by year of diagnosis from 1999 to 2013. (A) All sites for both sexes. (B) All sites except thyroid cancer for both sexes.



Cancer prevalent cases

	Thyroid	Stomach	Colon and rectum	Breast	Lung	Prostate	Liver	Cervix uteri	Non-Hodgkin lymphoma	Kidney	All cancers
Under 1 yr	42,346	27,205	25,285	17,081	16,073	9,257	11,536	3,463	4,131	4,000	197,824
1-2 yr	44,081	24,650	24,305	16,160	9,618	8,563	8,257	3,211	3,441	3,609	174,192
2-5 yr	108,451	63,739	57,954	40,926	16,351	20,307	16,817	9,219	8,192	8,629	413,583
More than 5 yr	105,973	108,758	82,550	72,845	16,611	17,629	18,439	30,096	13,583	12,831	584,450
Total	300,851	224,352	190,094	147,012	58,653	55,756	55,049	45,989	29,347	29,069	1,370,049

Fig. 6. Prevalence of common cancer sites by time period after cancer diagnosis. Prevalent cases were defined as the number of cancer patients alive on January 1, 2014 among all cancer patients diagnosed between 1999 and 2013.

Table 10. Crude and age-standardized rates of cancer prevalence by sex on January 1, 2014 in Korea

Site/Type	Crude prevalence rate per 100,000[a]			Age-standardized prevalence rate per 100,000[b]		
	Both sexes	Male	Female	Both sexes	Male	Female
All sites	2,709.8	2,387.1	3,032.6	1,772.4	1,683.6	1,944.3
Lip, oral cavity, and pharynx	36.7	49.3	24.0	24.3	34.7	15.3
Esophagus	16.0	29.0	3.0	9.9	20.0	1.7
Stomach	443.7	589.0	298.4	276.0	405.3	169.9
Colon and rectum	376.0	449.1	302.8	232.6	311.2	169.7
Liver	108.9	163.0	54.8	71.1	113.2	33.2
Gallbladder[c]	31.7	32.4	31.0	19.0	22.3	16.5
Pancreas	15.3	16.6	14.1	9.7	11.6	8.2
Larynx	18.1	34.0	2.2	11.2	23.6	1.2
Lung	116.0	147.9	84.1	71.8	102.7	48.1
Breast	290.8	2.4	579.3	191.6	1.6	376.3
Cervix uteri	91.0	-	181.9	59.1	-	115.0
Corpus uteri	33.7	-	67.5	22.6	-	44.2
Ovary	30.4	-	60.8	21.6	-	42.7
Prostate	110.3	220.5	-	63.1	152.1	-
Testis	4.8	9.7	-	4.4	8.6	-
Kidney	57.5	77.6	37.4	38.2	54.5	23.9
Bladder	54.3	88.4	20.1	32.2	61.4	10.1
Brain and CNS	18.4	19.1	17.7	15.9	16.9	14.8
Thyroid	595.0	194.3	995.9	409.6	135.5	681.9
Hodgkin lymphoma	4.3	5.5	3.1	3.6	4.6	2.7
Non-Hodgkin lymphoma	58.0	62.5	53.6	41.9	47.7	36.7
Multiple myeloma	8.6	8.9	8.2	5.4	6.1	4.8
Leukemia	32.3	35.6	28.9	30.6	34.2	27.0
Other and ill-defined	158.0	152.3	163.8	107.2	115.8	100.2

CNS, central nervous system. [a]Crude prevalence rate: number of prevalent cases divided by the corresponding person-years of observation. Prevalent cases were defined as patients who were diagnosed between January 1, 1999 and December 31, 2013 and who were alive on January 1, 2014. Multiple primary cancer cases were counted multiple times, [b]Age-adjusted using the world standard population, [c]Includes the gallbladder and other/unspecified parts of the biliary tract.

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Conflicts of Interest

Conflict of interest relevant to this article was not reported.

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