

National Cancer Incidence for the Year 2002 in Korea

Hai-Rim Shin, M.D.^{1,2}, Kyu-Won Jung, M.S.¹, Young-Joo Won, M.R.A.¹, Hyun-Joo Kong, M.S.¹, Seon-Hee Yim, M.D.¹, Joonhoo Sung, M.D.¹, Sun-Won Seo, M.R.A.³, Ki-Young Kim, B.S.⁴, Sang-Yi Lee, M.D.⁴, In-Sik Kong, M.D.⁵, In Kyoung Hwang, M.D.⁶, Choong Won Lee, M.D.⁷, Ze-Hong Woo, M.D.⁸, Tae-Yong Lee, M.D.⁹, Jin-Su Choi, M.D.¹⁰, Cheol-In Yoo, M.D.¹¹, Jong-Myon Bae, M.D.¹² and Keun-Young Yoo, M.D.¹

¹Korea Central Cancer Registry, National Cancer Center, Goyang, ²International Agency for Research on Cancer, Lyon, France, ³Korean Medical Record Association, ⁴National Health Insurance Corporation, Seoul, ⁵Cancer Control Policy Team, Bureau of Health Policy, Ministry of Health & Welfare, Gwacheon, ⁶Busan Cancer Registry, Busan, ⁷Daegu Cancer Registry, Daegu, ⁸Incheon Cancer Registry, Incheon, ⁹Daejeon Cancer Registry, Daejeon, ¹⁰Gwangju Cancer Registry, Gwangju, ¹¹Ulsan Cancer Registry, Ulsan, ¹²Jeju-do Cancer Registry, Jeju, Korea

Purpose: Since the revised Cancer Act of October 2006, cancer registration was reactivated, based on the Statistics Law.

Materials and Methods: The incidence of cancer during 2002 was calculated on the basis of the information available from the National Cancer Incidence Database. Crude and age-standardized rates were calculated by gender for 18 age groups (0~4, 5~9, 10~14, every five years, 85 years and over).

Results: The overall crude incidence rates (CRs) were 269.2 and 212.8 per 100,000 for males and females, and the overall age-standardized incidence rates (ASRs) were 287.8 and 172.9 per 100,000, respectively. Among males, the five leading primary cancer sites were stomach (CR 62.4, ASR 65.7), lung (CR 45.4, ASR 51.0), liver (CR 43.2, ASR 43.7), colon and rectum (CR 30.7, ASR 32.7), and prostate (CR 8.0, ASR 9.6). Among females, the most common cancer sites were breast (CR 33.1, ASR 26.9), followed by stomach (CR 32.8, ASR 26.0), colon and rectum (CR 23.1, ASR 18.5), thyroid (CR 19.1, ASR 15.7), and uterine cervix (CR 18.2, ASR 14.7). In

the 0~14 age group, leukemia was the most common cancer for both genders. For males, stomach cancer was the most common cancer in the 15~64 age-group, but lung cancer was more frequent in men 65 or older. For females, thyroid cancer among the 15~34 age-group, breast cancer among 35~64 age-group and stomach cancer in women 65 years or older were the most common forms of cancer for each age group. The quality indices for the percentage of deaths, by death certificate only, were 4.7% for males and 4.5% for females.

Conclusions: Since the National Cancer Incidence Database was started, the annual percent change of cancer cases increased by 4.8% (4.1% for males, 5.7% for females) during 1999~2002. This value reflects the increase in prostate cancer for males and breast and thyroid cancer in females during 2002. The timely reporting of improved quality of cancer registration is needed for evidence-based decisions regarding cancer control in Korea. (*Cancer Res Treat.* 2007;39:139-149)

Key Words: Cancer, Incidence, Korea

INTRODUCTION

Originally, cancer registries were primarily concerned with the description of cancer patterns. In the last 20 years, cancer registries provided not only information on the incidence and

characteristics of specific cancers but also supplied the source of cancer control planning and evaluation and the care of individual cancer patients with survival (1).

In Korea, since 1980, a nationwide hospital-based cancer registry (Korea Central Cancer Registry: KCCR) has been active in collaborating with training hospitals. The annual report of the KCCR for 2002 was published in December 2003 (2) and showed the trends of cancer occurrence in Korea. In November 2004, the Ministry of Health and Welfare designated the KCCR and eight population-based regional cancer registries (PB-RCR) to facilitate nationwide cancer registration and to obtain regional and national cancer statistics. However, privacy protection laws limited cancer registration between 2004 and 2006. The National Cancer Incidence Database (NCIDB) was constructed with the KCCR original DB and 8 PB-RCR databases, and the site-specific cancer registry databases (such

Correspondence to: Hai-Rim Shin, National Cancer Center (Korea Central Cancer Registry), 111, Jungbalsan-ro, Ilsandong-gu, Goyang 410-769, Korea. (Tel) 82-31-920-2175, (Fax) 82-31-920-2179, (E-mail) hrshin@ncc.re.kr and IARC (shinhr@iarc.fr)

Received December 2, 2007, Accepted December 20, 2007

This work was supported by a grant 0710040-1 from the National Cancer Center and the 2007 National Health Promotion Program grant 0760100-1 from the Ministry of Health & Welfare, Republic of Korea.

as breast, ovary, uterus, and liver cancer databases), as well as the data from the *ad-hoc* medical record review surveys and the cancer mortality database from the National Statistical Office (NSO) (3). The national cancer incidence during 1999~2001 was first reported in 2005 (4).

The revised law of the Cancer Act (October 2006) encouraged the collection of information on cancer cases with personal identification, with the introduction of the Statistics law. Hence, the national cancer registration was reactivated to collect newly diagnosed cancer cases by active and passive registration.

In this report, cancer incidence for the year 2002 is reported, using the Korea-NCIDB.

MATERIALS AND METHODS

1) Sources of data

The NCIDB, for the year 2002, was constructed using the same process as the NCIDB for the period 1999~2001 published in 2005 (2,5). In detail, the KCCR identified incident form of cancer cases in Korea through the nationwide hospital-based cancer registration. All malignant neoplasms and *in situ* cases by international classification of diseases for oncology (ICD-O) were reported by training hospitals. The collection of information was largely passive.

The list of KCCR-registered cases and a list of cancer cases of the billing claims made by the National Health Insurance Corporation (NHIC) for each region were sent to the regional cancer registries to identify unregistered cancer cases. The data collection methods of regional cancer registries were both passive and active.

From 2002 to 2006, we conducted an *ad hoc* nation-wide medical record review survey of patients who were newly diagnosed during 1999~2003, and were not registered through both registration systems (hospital-based cancer registration and regional population-based cancer registration).

In 2002, the KCCR constructed the Korea National Cancer Incidence DataBases (KNCIDB) by merging the KCCR mother DB, all 8 PB-RCR databases, and the site-specific cancer registry databases (breast, ovary, cervix, liver cancer etc) as well as the data from the *ad-hoc* medical record review surveys and the cancer mortality database from the National Statistical Office (NSO). The KNCIDB was further refined by confirming multiple primary cancers according to the rules provided by the International Agency for Research on Cancer (IARC); only one tumor per organ or pair of organs per person per lifetime is reportable. Duplicates were removed with the help of experts from a variety of fields such as clinicians, pathologists and medical record administrators.

All newly diagnosed cancer cases in 2002 according to ICD-O-3 were included in this study. They were 116,034 cases analyzed during 2002. Among them, 110,699 (95.4%) cases were included, from 593 hospitals-including 164 KCCR-affiliated hospitals. In 2002, there were 40,029 hospitals and clinics including 284 general hospitals, and 691 hospitals in Korea (6). Approximately 87.1% (96,392 cases out of 110,699 cases) were registered through the KCCR program and 12.9% of the cases were collected through the PB-RCR, site-specific cancer registry, and other *ad-hoc* medical record review

surveys. There were 5,335 cancer deaths not identified by the medical records and included as death certificate reports only, in the final data set of the incidence database for the year of 2002. Table 1 shows the number of incident cases by year of registration and the final data set for the calculation of incidence in the year 2002.

2) Data control and quality indices

We calculated several quality indices. For the mortality: incidence ratio (M : I), an indicator of data completeness, the mortality data on cancer by gender, age group and cancer site, for the same period as the mortality from the NSO, were compared to the incidence data from the registry, which is presented as a percent. The microscopic verification percentage (MV%), an indicator of the validity of the diagnostic information, is the percentage of cases for which the diagnosis was based on morphological verification by a tissue specimen. The Death Certificate Only percentage (DCO%), is the percentage of cases registered on the basis of death certificates only, and was one of the indices for the validity of the diagnosis. Primary site unknown percentage (PSU%) and age unknown percentage (Age UNK%) are the percentage of cases registered with unknown primary cancer sites or unknown age.

3) Statistical analysis

The crude incidence rates (CRs) per 100,000 by gender were calculated for 18 age groups (0~4, 5~9, 10~14, every five year, 85 years and over) and standardized to the World Standard Population of the World Health Organization (WHO). The population used as the denominator to calculate the cancer incidence was a mid-year population (the population as of July 1st). In this report, we modified the registered population that was released annually from NSO, to obtain the mid-year population value (7).

The cumulative risk is the proportion of initially susceptible individuals in a population who become incident cases during a specified time, in the absence of other competing causes of

Table 1. Number of cancer cases first diagnosed in the year 2002

Year of registration	Source of cancer cases diagnosed in 2002		
	KCCR n (row %)	Other sources n (row %)	Total n (column %)
2002	88,015 (99.9)	45 (0.1)	88,060 (75.9)
2003	7,337 (45.0)	8,955 (55.0)	16,292 (14.0)
2004	658 (11.7)	4,965 (88.3)	5,623 (4.8)
2005	382 (53.0)	342 (47.0)	724 (0.6)
Number of registered cases	96,392 (87.1)	14,307 (12.9)	110,699 (95.4)
Death certificate only			5,335 (4.6)
Total number of incident cases in 2002			116,034 (100.0)

death. The cumulative risk could be derived from the cumulative rate, which is the summation of each age-specific rate over each year of age, from birth to a defined upper age limit. In this report, we used 74 as the upper age limit.

and females and the overall ASRs were 287.8 and 172.9 per 100,000, respectively. The overall cumulative risk for developing cancer before the age of 74 was 29.5% for males and 17.3% for females (Table 2). For males, the five leading primary cancer sites were stomach (CR 62.4, ASR 65.7), lung (CR 45.4, ASR 51.0), liver (CR 43.2, ASR 43.7), colon and rectum (CR 30.7, ASR 32.7), and prostate (CR 8.0, ASR 9.6). In females, the most common cancer sites were breast (CR 33.1, ASR 26.9), followed by stomach (CR 32.8, ASR 26.0), colon and

RESULTS

The overall CRs were 269.2 and 212.8 per 100,000 for males

Table 2. Number of cancer cases for crude and age standardized incidence rates by gender in Korea during 2002

Site	ICD-10	Male					Female				
		Cases*	% [†]	CR [‡]	ASR [§]	Cum risk	Cases*	% [†]	CR [‡]	ASR [§]	Cum risk
Lip, mouth and pharynx	C00-C14	1,477	2.3	6.1	6.4	0.8	482	0.9	2.0	1.7	0.2
Esophagus	C15	1,789	2.8	7.4	8.2	1.1	163	0.3	0.7	0.5	0.1
Stomach	C16	15,063	23.2	62.4	65.7	7.9	7,857	15.4	32.8	26.0	3.0
Colon and rectum	C18-C20	7,420	11.4	30.7	32.7	3.9	5,532	10.8	23.1	18.5	2.2
Liver	C22	10,437	16.1	43.2	43.7	5.1	3,440	6.7	14.3	11.7	1.4
Gallbladder etc.	C23-C24	1,737	2.7	7.2	8.1	1.0	1,778	3.5	7.4	5.8	0.7
Pancreas	C25	1,757	2.7	7.3	7.9	1.0	1,306	2.6	5.4	4.2	0.5
Larynx	C32	1,028	1.6	4.3	4.7	0.6	91	0.2	0.4	0.3	0.0
Lung etc	C33-C34	10,967	16.9	45.4	51.0	6.3	3,918	7.7	16.3	12.7	1.4
Breast	C50	56	0.1	0.2	0.3	0.0	7,928	15.5	33.1	26.9	2.7
Cervix uteri	C53	-	-	-	-	-	4,368	8.6	18.2	14.7	1.6
Corpus uteri	C54	-	-	-	-	-	923	1.8	3.8	3.2	0.4
Ovary	C56	-	-	-	-	-	1,412	2.8	5.9	5.0	0.5
Prostate	C61	1,938	3.0	8.0	9.6	1.0	-	-	-	-	-
Testis	C62	155	0.2	0.6	0.6	0.0	-	-	-	-	-
Kidney	C64	1,188	1.8	4.9	5.0	0.6	559	1.1	2.3	2.0	0.2
Bladder	C67	1,928	3.0	8.0	8.9	1.1	523	1.0	2.2	1.7	0.2
Brain and CNS	C70-C72	666	1.0	2.8	2.8	0.3	602	1.2	2.5	2.3	0.2
Thyroid	C73	713	1.1	3.0	2.7	0.3	4,586	9.0	19.1	15.7	1.5
Hodgkin disease	C81	80	0.1	0.3	0.3	0.6	61	0.1	0.3	0.2	0.4
Non-Hodgkin lymphoma	C82-C85, C96	1,332	2.0	5.5	5.6	0.0	957	1.9	4.0	3.4	0.0
Multiple myeloma	C90	310	0.5	1.3	1.4	0.2	232	0.5	1.0	0.8	0.1
Leukemia	C91-C95	1,257	1.9	5.2	5.5	0.5	913	1.8	3.8	3.8	0.3
Others	Re.C00-C97	3,722	5.7	15.4	16.7	1.8	3,383	6.6	14.1	11.8	1.2
All cancer	C00-C97	65,020	100	269.2	287.8	29.5	51,014	100	212.8	172.9	17.3

*the Total number of cases by site, [†]proportional frequency to the total of all cancer, [‡]crude rate per 100,000 population, [§]the World age-standardized rate per 100,000 population, ^{||}cumulative risk up to age 74. Note: the sum of each %, CR, ASR, Cum risk may differ from the total of each value due to rounding-off error.

Table 3. Number of cancer cases by gender, age and primary site in Korea during 2002

Site	ICD-10	Unknown age																			
		All age	0~	5~	10~	15~	20~	25~	30~	35~	40~	45~	50~	55~	60~	65~	70	75~	80~	85+	
Male																					
Lip, mouth and pharynx	C00-C14	1,477	0	5	2	7	4	10	21	31	43	82	122	151	202	245	268	149	81	38	16
Esophagus	C15	1,789	0	0	0	0	0	0	1	1	6	22	71	132	222	386	401	244	185	91	27
Stomach	C16	15,063	0	1	0	1	7	25	71	221	409	869	1,168	1,450	1,894	2,563	2,521	1,896	1,170	579	218
Colon and rectum	C18-C20	7,420	0	0	0	3	5	11	47	105	204	361	514	706	946	1,312	1,271	893	599	303	140
Liver	C22	10,437	0	14	3	2	4	15	34	101	254	795	1,275	1,551	1,588	1,676	1,347	868	549	276	85
Gallbladder etc.	C23-C24	1,737	0	0	0	0	0	0	2	6	17	47	74	130	197	301	323	272	193	119	56
Pancreas	C25	1,757	0	0	0	1	1	3	5	17	30	68	111	154	211	293	315	230	179	100	39
Larynx	C32	1,028	0	0	0	0	0	1	0	2	8	24	40	108	148	201	231	139	71	40	15
Lung etc	C33-C34	10,967	1	1	0	2	2	2	14	44	84	222	404	709	1,117	1,900	2,292	1,940	1,352	665	216
Breast	C50	56	0	0	0	0	0	0	0	0	2	4	4	5	7	11	9	6	6	0	2
Prostate	C61	1,938	0	0	0	0	2	1	0	3	3	7	25	52	120	288	379	366	349	238	105
Testis	C62	155	0	15	1	2	12	9	25	33	20	14	6	5	3	0	3	4	1	2	0
Kidney	C64	1,188	0	18	2	0	1	8	7	20	65	87	127	138	169	187	165	108	56	22	8
Bladder	C67	1,928	0	1	0	0	0	2	7	16	22	60	94	146	188	316	353	311	227	130	55
Brain and CNS	C70-C72	666	0	32	39	25	29	41	24	44	48	61	44	49	53	51	49	38	25	10	4
Thyroid	C73	713	0	0	0	5	9	21	38	62	71	91	97	67	63	70	60	27	14	13	5
Hodgkin disease	C81	80	0	0	2	4	7	5	6	5	5	5	5	7	7	8	5	4	4	0	1
Non-Hodgkin lymphoma	C82-C85, C96	1,332	0	23	29	36	23	30	41	59	67	99	126	122	129	154	164	119	66	40	5
Multiple myeloma	C90	310	0	0	0	0	0	1	0	3	9	16	20	28	39	55	61	43	25	8	2
Leukemia	C91-C95	1,257	0	101	65	64	54	56	57	70	87	104	77	66	83	107	103	82	48	26	7
Others	Re. C00-C97	3,722	0	84	34	55	72	63	72	94	113	206	248	286	355	505	548	407	329	174	77
All Cancer	C00-C97	65,020	1	295	177	207	232	304	472	937	1,567	3,244	4,652	6,062	7,741	10,629	10,868	8,146	5,529	2,874	1,083

Table 3. Continued

Site	ICD-10	All age	Unknown age	0~	5~	10~	15~	20~	25~	30~	35~	40~	45~	60~	55~	60~	65~	70~	75~	80~	85+
Female																					
Lip, mouth and pharynx	C00-C14	482	0	1	3	1	5	16	16	28	32	32	42	46	49	50	51	40	44	17	9
Esophagus	C15	163	0	0	0	1	0	0	0	0	1	2	5	10	13	19	26	28	30	18	10
Stomach	C16	7,857	1	0	2	0	5	32	120	240	354	553	513	556	737	947	1,137	1,050	818	511	281
Colon and rectum	C18-C20	5,532	0	0	0	1	3	15	25	72	151	331	409	482	526	768	856	752	584	362	195
Liver	C22	3,440	0	10	1	0	2	9	14	28	63	122	226	303	414	513	559	492	381	190	113
Gallbladder etc.	C23-C24	1,778	0	0	0	0	0	0	1	8	15	47	65	87	138	234	280	334	270	168	131
Pancreas	C25	1,306	0	2	0	0	1	1	0	11	12	32	54	57	105	152	222	242	212	136	67
Larynx	C32	91	0	0	0	0	1	1	1	2	2	3	2	1	4	11	12	23	17	4	7
Lung etc	C33-C34	3,918	0	0	1	2	3	9	14	31	42	121	177	240	307	461	575	650	610	413	262
Breast	C50	7,928	0	0	0	0	3	25	161	492	925	1,525	1,539	1,080	776	615	369	216	114	48	40
Cervix uteri	C53	4,368	0	0	0	0	0	16	101	266	472	636	616	471	427	419	364	294	188	66	32
Corpus uteri	C54	923	0	0	0	0	0	3	15	37	51	128	160	157	133	100	72	35	21	9	2
Ovary	C56	1,412	0	1	7	23	34	39	58	62	87	149	169	124	137	150	133	98	72	46	23
Kidney	C64	559	0	22	4	0	0	5	10	17	22	30	43	58	61	78	73	50	48	29	9
Bladder	C67	523	0	0	0	0	0	2	3	8	10	18	18	18	32	65	68	96	91	58	36
Brain and CNS	C70-C72	602	0	31	26	25	15	18	24	32	41	34	54	26	49	56	58	43	38	23	9
Thyroid	C73	4,586	0	0	2	8	56	154	297	436	486	732	645	521	434	309	233	142	78	33	20
Hodgkin disease	C81	61	0	0	1	5	8	10	5	6	4	2	0	1	4	7	5	1	1	0	1
Non-Hodgkin lymphoma	C82-C85, C96	957	0	10	12	17	15	23	27	34	58	73	83	81	102	122	87	106	68	30	9
Multiple myeloma	C90	232	0	0	0	1	0	0	1	6	12	12	12	26	25	42	38	39	14	11	5
Leukemia	C91-C95	913	0	84	40	33	35	40	50	60	69	69	69	48	62	66	70	54	35	23	6
Others	Re. C00-C97	3,383	0	73	25	28	43	48	61	95	117	177	228	238	273	370	451	401	319	259	176
All cancer	C00-C97	51,014	2	234	124	144	230	466	1,003	1,966	3,020	4,828	5,129	4,631	4,808	5,554	5,739	5,186	4,053	2,454	1,443

Table 4. Age-specific incidence rates per 100,000 population by gender and primary site in Korea during 2002

Site	ICD-10	All age	0~	5~	10~	15~	20~	25~	30~	35~	40~	45~	50~	55~	60~	65~	70~	75~	80~	85+	
Male																					
Lip, mouth and pharynx	C00-C14	6.1	0.3	0.1	0.4	0.2	0.5	1.0	1.3	2.0	3.7	7.2	12.2	20.4	26.9	42.1	40.6	37.5	34.8	32.5	
Esophagus	C15	7.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.0	4.2	10.6	22.4	42.4	62.9	66.6	85.6	83.2	54.8	
Stomach	C16	62.4	0.1	0.0	0.1	0.4	1.2	3.3	9.4	18.8	38.7	68.4	116.8	190.8	281.5	395.7	517.1	541.3	529.5	442.3	
Colon and rectum	C18-C20	30.7	0.0	0.0	0.2	0.3	0.5	2.2	4.5	9.4	16.1	30.1	56.9	95.3	144.1	199.5	243.6	277.1	277.1	284.0	
Liver	C22	43.2	0.9	0.2	0.1	0.2	0.7	1.6	4.3	11.7	35.4	74.7	125.0	160.0	184.1	211.4	236.7	254.0	252.4	172.5	
Gallbladder etc.	C23-C24	7.2	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.8	2.1	4.3	10.5	19.9	33.1	50.7	74.2	89.3	108.8	113.6	
Pancreas	C25	7.3	0.0	0.0	0.1	0.1	0.1	0.2	0.7	1.4	3.0	6.5	12.4	21.3	32.2	49.4	62.7	82.8	91.4	79.1	
Larynx	C32	4.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	1.1	2.3	8.7	14.9	22.1	36.3	37.9	32.8	36.6	30.4	
Lung etc	C33-C34	45.4	0.1	0.0	0.1	0.1	0.1	0.7	1.9	3.9	9.9	23.7	57.1	112.5	208.7	359.7	529.1	625.4	608.1	438.2	
Breast	C50	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.4	0.7	1.2	1.4	1.6	2.8	0.0	4.1	
Prostate	C61	8.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.3	1.5	4.2	12.1	31.6	59.5	99.8	161.5	217.6	213.0	
Testis	C62	0.6	1.0	0.1	0.1	0.7	0.4	1.2	1.4	0.9	0.6	0.4	0.4	0.3	0.0	0.5	1.1	0.5	1.8	0.0	
Kidney	C64	4.9	1.1	0.1	0.0	0.1	0.4	0.3	0.8	3.0	3.9	7.4	11.1	17.0	20.5	25.9	29.5	25.9	20.1	16.2	
Bladder	C67	8.0	0.1	0.0	0.0	0.0	0.1	0.3	0.7	1.0	2.7	5.5	11.8	18.9	34.7	55.4	84.8	105.0	118.9	111.6	
Brain and CNS	C70-C72	2.8	2.0	2.1	1.4	1.6	2.0	1.1	1.9	2.2	2.7	2.6	4.0	5.3	5.6	7.7	10.4	11.6	9.1	8.1	
Thyroid	C73	3.0	0.0	0.0	0.3	0.5	1.0	1.8	2.6	3.3	4.1	5.7	5.4	6.4	7.7	9.4	7.4	6.5	11.9	10.1	
Hodgkin disease	C81	0.3	0.0	0.1	0.2	0.4	0.2	0.3	0.2	0.2	0.2	0.3	0.6	0.7	0.9	0.8	1.1	1.9	0.0	2.0	
Non-Hodgkin lymphoma	C82-C85, C96	5.5	1.5	1.5	2.1	1.3	1.5	1.9	2.5	3.1	4.4	7.4	9.8	13.0	16.9	25.7	32.5	30.5	36.6	10.1	
Multiple myeloma	C90	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.7	1.2	2.3	3.9	6.0	9.6	11.7	11.6	7.3	4.1	
Leukemia	C91-C95	5.2	6.4	3.5	3.7	3.1	2.7	2.7	3.0	4.0	4.6	4.5	5.3	8.4	11.8	16.2	22.4	22.2	23.8	14.2	
Others	Re. C00-C97	15.4	5.3	1.8	3.2	4.1	3.0	3.4	4.0	5.2	9.2	14.5	23.0	35.8	55.5	86.0	111.0	152.2	159.1	156.2	
All Cancer	C00-C97	269.2	18.7	9.4	11.9	13.1	14.7	22.2	39.7	72.0	144.5	272.5	488.4	779.9	1,167.5	1,705.7	2,221.7	2,557.7	2,628.1	2,197.2	

Table 4. Continued

Site	ICD-10	All age	0~	5~	10~	15~	20~	25~	30~	35~	40~	45~	50~	55~	60~	65~	70~	75~	80~	85+	
Female																					
Lip, mouth and pharynx	C00-C14	2.0	0.1	0.2	0.1	0.3	0.8	0.8	1.2	1.6	1.5	2.5	3.8	4.7	4.8	6.1	6.6	10.8	7.2	5.7	
Esophagus	C15	0.7	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.3	0.8	1.3	1.8	3.1	4.6	7.4	7.6	6.3	
Stomach	C16	32.8	0.0	0.1	0.0	0.3	1.6	5.9	10.6	17.3	25.6	30.9	45.4	70.8	91.5	136.3	172.5	201.6	215.5	177.5	
Colon and rectum	C18-C20	23.1	0.0	0.0	0.1	0.2	0.8	1.2	3.2	7.4	15.3	24.6	39.4	50.5	74.2	102.6	123.5	143.9	152.7	123.2	
Liver	C22	14.3	0.7	0.1	0.0	0.1	0.5	0.7	1.2	3.1	5.7	13.6	24.7	39.8	49.6	67.0	80.8	93.9	80.1	71.4	
Gallbladder etc.	C23-C24	7.4	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.7	2.2	3.9	7.1	13.3	22.6	33.6	54.9	66.5	70.9	82.7	
Pancreas	C25	5.4	0.1	0.0	0.0	0.1	0.1	0.0	0.5	0.6	1.5	3.3	4.7	10.1	14.7	26.6	39.8	52.2	57.4	42.3	
Larynx	C32	0.4	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4	1.1	1.4	3.8	4.2	1.7	4.4	
Lung etc	C33-C34	16.3	0.0	0.1	0.1	0.2	0.5	0.7	1.4	2.1	5.6	10.7	19.6	29.5	44.6	68.9	106.8	150.3	174.2	165.5	
Breast	C50	33.1	0.0	0.0	0.0	0.2	1.3	7.9	21.6	45.1	70.7	92.7	88.2	74.6	59.4	44.2	35.5	28.1	20.3	25.3	
Cervix uteri	C53	18.2	0.0	0.0	0.0	0.0	0.8	5.0	11.7	23.0	29.5	37.1	38.5	41.0	40.5	43.6	48.3	46.3	27.8	20.2	
Corpus uteri	C54	3.8	0.0	0.0	0.0	0.0	0.2	0.7	1.6	2.5	5.9	9.6	12.8	12.8	9.7	8.6	5.8	5.2	3.8	1.3	
Ovary	C56	5.9	0.1	0.4	1.5	2.1	2.0	2.8	2.7	4.2	6.9	10.2	10.1	13.2	14.5	15.9	16.1	17.7	19.4	14.5	
Kidney	C64	2.3	1.5	0.2	0.0	0.0	0.3	0.5	0.8	1.1	1.4	2.6	4.7	5.9	7.5	8.8	8.2	11.8	12.2	5.7	
Bladder	C67	2.2	0.0	0.0	0.0	0.0	0.1	0.2	0.4	0.5	0.8	1.1	1.5	3.1	6.3	8.2	15.8	22.4	24.5	22.7	
Brain and CNS	C70-C72	2.5	2.2	1.6	1.6	0.9	0.9	1.2	1.4	2.0	1.6	3.3	2.1	4.7	5.4	7.0	7.1	9.4	9.7	5.7	
Thyroid	C73	19.1	0.0	0.1	0.5	3.4	7.8	14.6	19.2	23.7	33.9	38.9	42.5	41.7	29.9	27.9	23.3	19.2	13.9	12.6	
Hodgkin disease	C81	0.3	0.0	0.1	0.3	0.5	0.5	0.2	0.3	0.2	0.1	0.0	0.1	0.4	0.7	0.6	0.2	0.3	0.0	0.6	
Non-Hodgkin lymphoma	C82-C85, C96	4.0	0.7	0.7	1.1	0.9	1.2	1.3	1.5	2.8	3.4	5.0	6.6	9.8	11.8	10.4	17.4	16.8	12.7	5.7	
Multiple myeloma	C90	1.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3	0.6	0.7	2.1	2.4	4.1	4.6	6.4	3.5	4.6	3.2	
Leukemia	C91-C95	3.8	5.8	2.4	2.1	2.1	2.0	2.5	2.6	3.4	3.2	4.2	3.9	6.0	6.4	8.4	8.9	8.6	9.7	3.8	
Others	Re. C00-C97	14.1	5.1	1.5	1.8	2.6	2.4	3.0	4.2	5.7	8.2	13.7	19.4	26.2	35.8	54.1	65.9	78.6	109.3	111.2	
All Cancer	C00-C97	212.8	16.3	7.5	9.3	14.0	23.7	49.1	86.5	147.3	223.7	309.0	378.1	461.9	536.7	687.8	851.9	998.8	1,035.1	911.5	

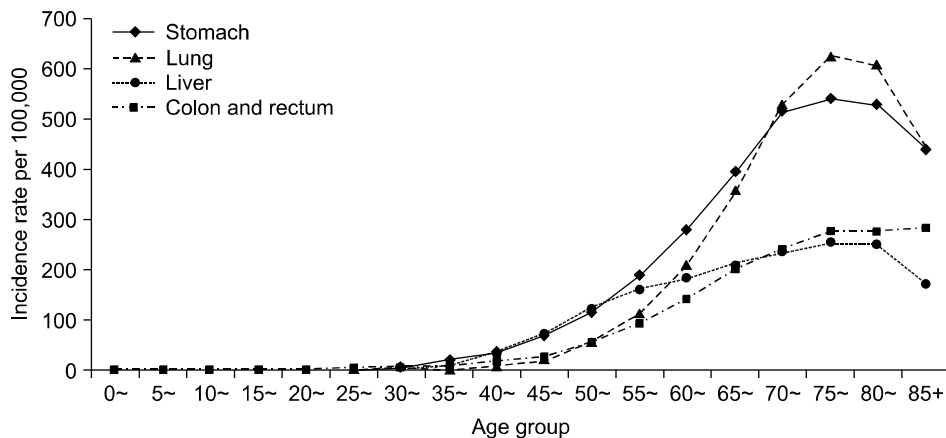


Fig. 1. Age specific incidence rates of the four major cancers in males.

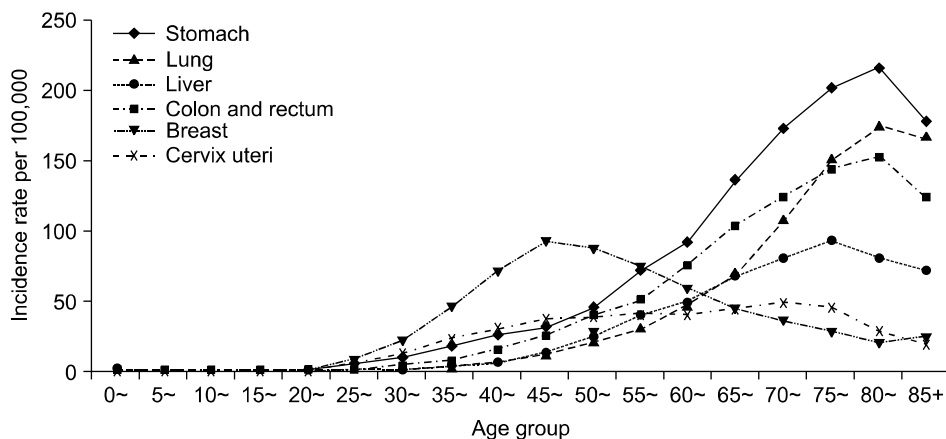


Fig. 2. Age specific incidence rates of the six major cancers in females.

rectum (CR 23.1, ASR 18.5), thyroid (CR 19.1, ASR 15.7), and the uterine cervix (CR 18.2, ASR 14.7).

In the 0~14 age group, leukemia was the most common cancer in both genders. For males, stomach cancer was the most common cancer in the 15~64 age group, but lung cancer was more frequent in the over 65 age group. For females, thyroid cancer for the 15~34 age group, breast cancer for the 35~64 age group and stomach cancer among the over 65 group were the most common forms of cancer for each age group (Table 3, 4). Fig. 1 shows an age-specific incidence graph for the four major cancers in males. Fig. 2 shows an age-specific incidence graph for the six major cancers in females. The data shows that cancer incidence gradually increased with age, but there was some decline after 80.

To assess the quality of the data in terms of completeness and validity, we examined several indices of quality (Table 5). The M : I ratios were 62.1% and 44.8% for males and females. We also evaluated the validity of the KNCIDB data using indices such as the percentages for the MV, DCO, PSU, and Age UNK. The MV% for the diagnosis was 74.2% for males and 81.0% for females. The DCO% was 4.7% for males and 4.5% for females. The PSU% was 1.9% for males and 1.9% for females. The Age UNK was one case for males and two cases for females.

DISCUSSION

Since the revision of the Cancer Act in October 2006, the annual cancer incidence rates have been available, based on the Statistics law. As shown in Table 1, three years are needed to report the annual rates with more complete data. The annual percent change of cancer cases increased by 4.8% (4.1% for males, 5.7% for females) during 1999~2002 (data not shown). We observed a pattern of cancer incidence for the most common cancer sites similar to the incidence from 1999~2001 published in 2005. Two-thirds of the cancer burden in males was from stomach, lung, liver, and colorectal cancers and two-thirds of the female cancer burden from stomach, breast, colorectal, cervix, lung, and liver cancers. However, in 2002, there was a significant increase of prostate cancer and of breast and thyroid cancers. Moreover, breast cancer was the most common cancer in women during 2002, and was the second most common cancer after stomach cancer in 2002.

Compared to the cancer incidence estimates (all cancers except skin) reported in the Globocan 2002 (8), the overall ASR (excluding skin) was 285.1 per 100,000 males; similar to the estimates for Korean men (285.7 per 100,000) and the estimates for Northern European men (283.1 per 100,000).

Table 5. Indices of data quality for the cancer incidence database in 2002 by gender

Unit: %

Site	ICD-10	Male			Female		
		MV*	DCO [†]	M/I [‡]	MV	DCO	M/I
Lip, mouth and pharynx	C00-C14	90.0	3.0	47.7	86.7	4.8	38.0
Esophagus	C15	86.4	5.1	78.2	70.6	11.7	82.2
Stomach	C16	91.1	3.6	51.1	86.7	6.2	52.6
Colon and rectum	C18-C20	91.7	2.5	37.6	88.2	3.3	41.4
Liver	C22	23.2	6.7	81.1	23.8	7.2	78.9
Gallbladder etc.	C23-C24	53.1	5.4	84.2	51.3	5.5	80.0
Pancreas	C25	40.0	7.2	96.4	35.2	7.2	91.6
Larynx	C32	86.5	5.2	59.6	59.3	28.6	103.3
Lung etc	C33-C34	76.3	6.5	84.7	65.2	10.9	85.8
Breast	C50	85.7	12.5	32.1	97.0	1.1	17.2
Cervix uteri	C53	–	–	–	94.5	0.9	23.2
Corpus uteri	C54	–	–	–	97.5	0.3	13.0
Ovary	C56	–	–	–	85.7	3.0	44.5
Prostate	C61	88.9	2.5	38.5	–	–	–
Testis	C62	93.6	1.3	16.1	–	–	–
Kidney	C64	83.3	2.4	32.2	81.0	2.9	34.5
Bladder	C67	92.0	2.2	37.9	82.8	5.7	39.2
Brain and CNS	C70-C72	68.5	10.2	95.6	59.1	14.0	88.2
Thyroid	C73	96.6	0.3	12.8	97.7	0.4	5.1
Hodgkin disease	C81	95.5	2.8	46.3	95.6	2.9	43.7
Non-Hodgkin lymphoma	C82-C85, C96	100.0	0.0	20.0	98.4	1.6	18.0
Multiple myeloma	C90	91.6	5.5	79.7	93.5	4.7	84.5
Leukemia	C91-C95	93.5	5.9	67.4	93.5	5.5	67.3
Others	Re. C00-C97	78.1	5.0	50.4	76.7	7.8	53.0
All Cancer	C00-C97	74.2	4.7	62.1	81.0	4.5	44.8

*microscopically verified, [†]death certificate only, [‡]mortality/incidence ratio.

However, the estimates were higher than the world average (209.6 per 100,000) males. In contrast, Korean females had an overall ASR higher than the world average (170.8 vs. 161.5 per 100,000 females) but lower than the Northern European average (252.3). In addition, it was slightly higher than that of Japan (167.4) and higher than the estimates for Korean women (155.3 per 100,000 females). The reported data in this paper is from the national population-based cancer registry and included in the publication “*Cancer Incidence in Five continents, Volume IX*” (9), therefore we should be cautious in comparing or in interpreting between the magnitude of cancer incidences among different countries and estimates, in terms of the completeness

of cancer registration and quality indices.

For both genders, the ASRs of stomach, colon and rectum, liver, lung, and thyroid cancers were higher than the world average ASR.

For most cancers, the incidence increases with age. This trend begins to increase after the age of 30. However, there is some decline after the age of 80. This trend has been observed in the oldest age groups of other cancer registries. It is partly due to less efficient case ascertainment, some of which is a consequence of competing causes of mortality in the elderly, as well as a decrease in the proportion of the population predisposed to cancer (10).

It is essential to assess the quality of the data for completeness and validity. We evaluated the completeness and the validity of the data from the KNCIDB using indices such as the DCO%, the M : I ratio, the MV%, the PSU% and the Age UNK%. All values for these indices of our data were within the inclusion criteria of the *Cancer Incidence in Five Continents, Volume IX*, which was published on the IARC website in November 2007 (9). The standards for the DCO% from the North American Association of Central Cancer Registries (11) was less than 5% for the silver standard; that of the Canadian Cancer Registry (12) was less than 5% for the acceptable standard. For a DCO% higher than 15%, probable under-reporting was considered as the cause of this value (13). Conversely, a very low DCO% (under 1%) might indicate that not all death certificates, with a diagnosis of cancer, were ascertained. According to these rules, the DCO% in this report (4.7% for males and 4.5 % for females) was acceptable. The PSU% from the KNCIDB (1.9% for males and 1.9% for females) was acceptable by the standards of the Canadian Cancer Registry (0~8%) and relatively low compared to those of most other countries (9, 12). For the Age UNK%, which rarely exceeds 1% in developed countries, there were a few cases with unknown age in our data (males: 1 case, females: 2 cases).

Even though the completeness of incidence data was not calculated for this report, the medical record review for the unregistered cancer cases of the billing claims from NHIC since 1999 enhanced the completeness of cancer registration in Korea and improved the quality. The assessment of completeness of NCIDB is underway, with more than 5 years of incidence database.

Considering the magnitude of the incident cancer cases in this report and cancer mortality in 2002 (7), cancer is currently the most important public health problem in Korea. These numbers will continue to increase with the aging Korean population, even if age-specific rates remain constant. Further efforts to improve the quality of the data for cancer registration should be made by all registry staff, clinicians, pathologists, and policy makers to collect more accurate and timely information that can be used for evaluation and planning of cancer control activities in Korea.

CONCLUSIONS

Since the National Cancer Incidence Database was started, the annual percent change of cancer cases increased by 4.8% (4.1% for males, 5.7% for females) during 1999~2002. This value reflects the increase in prostate cancer for males and breast and thyroid cancer in females during 2002.

Further efforts to improve the quality of the data for cancer

registration should be made by all registry staff, clinicians, pathologists, and policy makers to collect more accurate and timely information that can be used for evaluation and planning of cancer control activities in Korea.

ACKNOWLEDGEMENT

The authors are deeply grateful to KCCR-affiliated Hospitals, non KCCR-affiliated Hospitals and staff members of the Busan, Daegu, Incheon, Gwangju, Daejeon, Ulsan, and Jeju-do Cancer Registries.

REFERENCES

1. Parkin DM. The evolution of the population-based cancer registry. *Nat Rev Cancer*. 2006;6:603-12.
2. Shin HR, Jung KW, Won WJ, Park JG. 139 KCCR-affiliated hospitals. 2002 Annual Report of the Korea Central Cancer Registry: based on registered data from 139 hospitals. *Cancer Res Treat*. 2004;36:103-14.
3. National Statistical Office in Korea. Annual report on the cause of death statistics (based on vital registration). Daejeon: National Statistical Office in Korea; 2007.
4. Shin HR, Won YJ, Jung KW, Kong HK, Yim SY, Lee J, et al. Nationwide cancer incidence in Korea, 1999-2001; first result using the National Cancer Incidence Database. *Cancer Res Treat*. 2005;37:325-31.
5. National Statistical Office. Annual report on the cause of death statistics (based on vital registration); 2003.
6. Ministry of Health and Welfare. Yearbook of health & welfare statistics. Korea; 2007.
7. Korean Statistical Information Service. 2007 [cited 2007/12/11]; Available from: <http://www.kosis.kr/>
8. Ferlay J, Bray F, Pisani P, Parkin DM. GLOBOCAN 2002 Cancer Incidence, Mortality and Prevalence Worldwide. 2.0 ed. Lyon; 2004.
9. Curado MP, Edwards B, Shin HR, Storm H, Ferlay J, Heanue M, eds. Cancer incidence in five continents, Vol. IX IARC Scientific PublicationsNo. 160, Lyon, IARC; 2007.
10. Parkin DM. Comparability and quality control in cancer registration: International Agency for Research on Cancer; 1994.
11. Seiffert J, North American Association of Central Cancer R, Registry Operations C. Standards for Completeness, Quality, Analysis, and Management of Data: North American Association of Central Cancer Registries; 2000.
12. Cormier M. User guide to data quality reports for provincial/ Territorial Cancer Registries. 2005.
13. Jensen OM, Parkin DM, MacLennan R, Muir CS, Skeet RG, eds. Cancer Registration Principles and Methods Lyon: IARC Scientific Publication; 1991.

Appendix 1. The mean number of the mid-year population during the year 2002 in Korea and the world standard population

Age group	Male	Female	World*
0~4	1,575,963	1,439,748	12,000
5~9	1,873,896	1,658,968	10,000
10~14	1,732,800	1,546,140	9,000
15~19	1,767,491	1,640,097	9,000
20~24	2,068,955	1,962,200	8,000
25~29	2,121,750	2,040,949	8,000
30~34	2,358,846	2,273,266	6,000
35~39	2,176,204	2,049,912	6,000
40~44	2,245,145	2,158,372	6,000
45~49	1,707,414	1,659,723	6,000
50~54	1,241,331	1,224,792	5,000
55~59	992,521	1,040,931	4,000
60~64	910,380	1,034,907	4,000
65~69	637,169	834,422	3,000
70~74	366,650	608,795	2,000
75~79	216,167	405,801	1,000
80~84	109,358	237,078	500
85+	49,291	158,319	500
Total	24,151,331	23,974,420	100,000

*World standard population: it is a theoretical proportion of world populations to use for standardization.