

Statistics of hematologic malignancies in Korea: incidence, prevalence and survival rates from 1999 to 2008

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Background

The nationwide statistical analysis of hematologic malignancies in Korea has not been reported yet.

Methods

The Korea Central Cancer Registry and the Korean Society of Hematology jointly investigated domestic incidence rates and prevalence of hematologic malignancies occurred between 1999 and 2008, and analyzed survival rates of patients who were diagnosed between 1993 and 2008. Data of hematologic malignancies from 1993 to 2008 were obtained from the Korean National Cancer Incidence Data base. The crude incidence rates, age-specific incidence rates, age-standardized incidence rates, annual percentage change of incidence, and prevalence from 1999-2008 were calculated. Survival rates for patients diagnosed in 1993-2008 were estimated.

Results

In 2008, a total of 8,006 cases of hematologic malignancies were occurred, which comprised 4.5% of all malignancies. In all genders, non-Hodgkin lymphoma, myeloid leukemia, and multiple myeloma were most frequent diseases. In terms of age, ages between 60 and 69 were most prevalent. From 1999 to 2008, the age-standardized incidence rates increased from 10.2 to 13.7, and the annual percentage change was 3.9%. The 5-year survival rate increased from 38.2% during 1993-1995 to 55.2% during 2004-2008. As of January 2009, number of patients with 10-year prevalence was 33,130, and with 5- to 10-year prevalence was 10,515.

Conclusion

This is the first nationwide statistical report of hematologic malignancies in Korea. It could be used as the basic information to help investigate epidemiologic characteristics, evaluate progress during the past years, and establish future strategies for hematologic malignancies. Periodic statistical analysis of hematologic malignancies in Korea should be continued.

Key Words Hematologic malignancy, Incidence, Survival, Prevalence, Korea

INTRODUCTION

The field of hematologic malignancies has continuously advanced for past 50 years in Korea. However, much less attention was paid for its cancer statistical analysis. There has not been a report that analyzed the incidence rate, prevalence rate, and survival rate of the whole nationwide hematologic malignancies and this is also comparable to other devel-

oped countries [1, 2]. There are several reasons for the difficulty of analysis. The classification of hematologic malignancies is constantly changing, and cancer registry in each country has different definitions for the subtypes of hematologic malignancies, which jeopardizes the quality of patient data and all these reasons make it difficult to compare hematologic statistics according to time and region. Since 2005, USA and Europe integrated recent International Classification of Diseases-Oncology (ICD-O) and World Health Organiza-

tion (WHO) classification and with agreements of experts, they classified statistics on hematologic malignancies that fit the objectives of epidemiology and public health care, and published the statistical reports [3-5].

In an effort to determine the characteristics of domestic hematologic malignancies and analyze past survival rates to establish the barometer for creating strategies for the advancement of domestic hematologic malignancies field, the Korea Central Cancer Registry and the Korean Society of Hematology jointly investigated the domestic prevalence rate and incidence rate of hematologic malignancies occurred between 1999 and 2008, and analyzed survival rate of patients who were diagnosed as hematologic malignancies between 1993 and 2008.

MATERIALS AND METHODS

Data of hematologic malignancies from 1993 to 2008 were obtained from the Korean National Cancer Incidence Data base (KNCIDB) [6]. Hematologic malignancies were classified according to the International Classification of Diseases for Oncology 3rd edition (ICD-O-3) and converted to the International Classification of Diseases 10th edition (ICD-10) (Table 1) [7, 8]. For myeloproliferative disorders (MPD) and myelodysplastic syndromes (MDS), official registration employing ICD-O-3 began in 2003 at Korea Central Cancer Registry (KCCR).

Crude incidence rates (CRs) and age-specific incidence rates of each hematologic malignancy were calculated. The CRs per 100,000, an incidence rate based on the frequency of cancer in the entire population, were calculated by dividing the total number of events (N) by the total number of person-year of observation (P) and multiplying the result by 100,000. The age-specific incidence rates per 100,000 within age group i , were calculated by dividing the number of incidence observed in the age group (N_i) by the number of corresponding person-year of observation (P_i) and multiplying the result by 100,000. Age-standardized incidence rates (ASRs), a weighted average of crude age-specific rates, were determined by using the mid-year population in Korea in 2000 as standard population. Changes in the annual ASRs

were examined by calculating the annual percentage change (APC) over a time period as $(\exp(b)-1) \times 100$, where b is the slope of the regression of $\log(\text{ASR})$ on a calendar year as the following linear regression equation [9]:

$$E(\log(\text{ASR})|year) = a + b \text{ year.}$$

The survival analysis used cases of hematologic malignancies first diagnosed during 1993-2008 from KNCIDB, and the vital status of these patients were followed through December 31, 2010. The survival duration of each case was determined as the time difference between the date of initial diagnosis and the date of death, date of loss to follow up, or closing date for follow-up. Observed survival rates were calculated using a life table method, in which survival times are grouped into intervals [10]. Limited-duration prevalent cases are the number of cancer patients alive on a certain day who had been diagnosed with the disease within the past specified years. For example, 10-year prevalent cases in this report were the patients that were diagnosed between 1999 and 2008 and were alive on January 1, 2009. The limited-duration prevalence, such as 1, 5, and 10-year prevalence was calculated using SEER*Stat software [11].

RESULTS

1. Incidence

A total national cancer incident cases in 2008 were 178,816 cases. Stomach cancer (15.7%) was most prevalent, followed by thyroid cancer (15.1%), colorectal cancer (12.7%), lung cancer (10.5%), liver cancer (8.8%), and breast cancer (7.1%). Hematologic malignancies occurred in 8,006 patients, which was 4.5% of all cancers next to breast cancer. It occurred in 4,486 men and 3,520 women, and this relates to 4.8% of all cancers occurred in men, and 4.1% of all cancers occurred in women (Fig. 1). Among all hematologic malignancies, non-Hodgkin lymphoma (NHL) was most frequent, followed by myeloid leukemia, and multiple myeloma regardless of gender. Ages between 60 and 69 were most prevalent followed by ages 70 to 79, and ages 50 to 59 (Fig. 2). Lymphoid leukemia was most prevalent in ages below 15 years in both genders while NHL was most prevalent in ages above 15 years (Table 2).

The trends in number of patients, CRs, and ASRs for each hematologic malignancy between 1999 and 2008 are described in Table 3. The overall ASRs of hematologic malignancies increased from 10.2 in 1999 to 13.7 in 2008. The APC was 3.9% between 1999 and 2008 which was higher than 3.3% in all cancers, and APCs were statistically significant in all hematologic malignancies. For age-specific incidence rates in 2008, lymphoid leukemia was the highest in age under 15 years regardless of gender. In both genders, age-specific incidence rates of all hematologic malignancies, except for lymphoid leukemia, increased as age increased; however, age-specific incidence rate decreased after age of 80 in women (Fig. 3).

Table 1. Classification of hematologic malignancies according to ICD-10.

Cancer type	ICD-10 code (ICD-O-3 code)
Hodgkin lymphoma	C81
Non-Hodgkin lymphoma	C82-C85, C96
Multiple myeloma	C90
Lymphoid leukemia	C91
Myeloid leukemia	C92-C94
MPD	(M9950/3, 996_/3, 9975/3)
MDS	(M998_/3)

Abbreviations: MPD, myeloproliferative disorders; MDS, myelodysplastic syndromes.

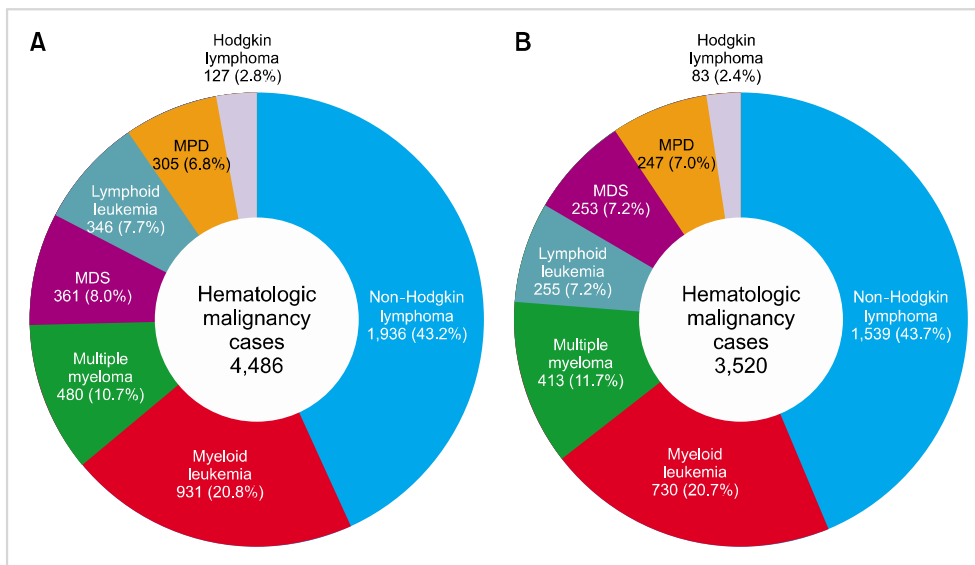


Fig. 1. Relative frequency of hematologic malignancies in Korea, 2008. (A) Men. (B) Women.

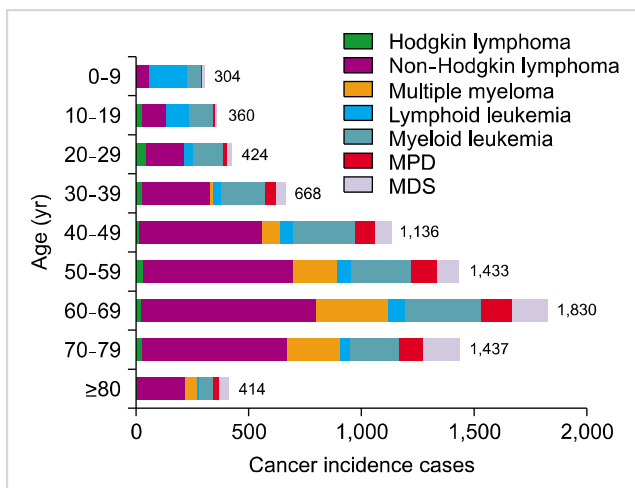


Fig. 2. Incident cases of hematologic malignancies by age group in Korea, 2008.

2. Survival rates

The survival of all hematologic malignancies continually increased from 1993 to 2008 with 5-year survival rate of 38.2% between 1993 and 1995 to 55.2% between 2004 and 2008, an increase of 17% (Fig. 4). The survival rates increased from 68.5% to 80.9% in Hodgkin lymphoma (HL), from 47.6% to 62.8% in NHL, from 22.9% to 33.2% in multiple myeloma, from 38.9% to 52.4% in lymphoid leukemia, and from 21.9% to 44% in myeloid leukemia. Survival rate of women were slightly higher or similar to men, but in MDS, men had 36.4% of survival rate while women had 50.3%, showing differences.

Survival rate decreased as age increased in most of the hematologic malignancies, and when the age of diagnosis was above 50 years old, the survival rate was even more decreased (Table 4). However, there is a marked difference of survival rate in lymphoid leukemia between groups of diagnostic age of 0-14 years and above 15 years. Five year

survival rates according to hematologic malignancies, year, gender and age are described in Table 4.

3. Prevalence

As of January 2009, the total number of patients with 10 year-prevalence who were diagnosed as hematologic malignancies was 33,130, which comprised 4.6% of total 10 year-prevalence in all cancers. In terms of prevalent cases, the number of patients less than 1 year was 6,548, 1-2 years 5,024, 2-5 years 11,043, and 5-10 years 10,515 (Fig. 5). Patients with more than 5 year-prevalence comprised 32%. NHL was most frequent with 16,142 patients, followed by myeloid leukemia and lymphoid leukemia with 6,068 and 3,066 patients, respectively.

DISCUSSION

This is the first study to analyze hematologic malignancies, providing a statistical information on all hematologic malignancies in Korea. As with all other cancers, the incidence of hematologic malignancies has been increasing. In comparison with other countries, almost no differences can be seen with Japan and China in the incidences of hematologic malignancies, however, in comparison with western countries including United Kingdom, France, Germany, and Canada, our incidences of HL, NHL, and multiple myeloma were lower, showing distinct differences (Table 5) [12]. This could be regarded as the reflection of differences in race; however, we observed the recent increase of HL, NHL, and multiple myeloma in our country.

MDS and MPD have been officially registered in Korea cancer registry since 2003. USA also began their registration of MDS and MPD in central registry in 2001. According to the analysis of MDS registered in the Surveillance, Epidemiology, and End Results (SEER) and North American Association of Cancer Registry between 2001 and 2004, the

Table 2. Ranks of age-specific incidence rates of hematologic malignancies by gender and age group in Korea, 2008.

Rank	Age (yr)					
	0-14	15-34	35-49	50-64	65-79	≥ 80
Men						
1	LL (2.8)	NHL (2.4)	NHL (6.3)	NHL (14.8)	NHL (32.4)	NHL (46.3)
2	NHL (1.4)	ML (2.1)	ML (3.1)	ML (6.1)	ML (12.6)	ML (15.0)
3	ML (1.4)	LL (0.8)	MPD (1.0)	MM (4.8)	MM (11.6)	MM (14.5)
4	HL (0.2)	HL (0.6)	MM (0.7)	MDS (2.6)	MDS (8.9)	MDS (10.1)
5	MDS (0.1)	MPD (0.4)	MDS (0.7)	MPD (2.4)	MPD (5.7)	MPD (5.7)
6	MPD (0.02)	MDS (0.3)	LL (0.7)	LL (1.5)	LL (2.6)	LL (2.2)
7	MM (0)	MM (0.1)	HL (0.3)	HL (0.6)	HL (1.4)	HL (1.8)
Women						
1	LL (2.5)	NHL (2.3)	NHL (4.7)	NHL (10.8)	NHL (20.4)	NHL (19.4)
2	ML (1.0)	ML (1.8)	ML (2.7)	ML (4.1)	MM (8.2)	ML (5.7)
3	NHL (0.9)	HL (0.5)	MDS (0.8)	MM (3.9)	ML (7.9)	MM (3.8)
4	MDS (0.1)	LL (0.5)	MPD (0.7)	MPD (1.9)	MDS (3.9)	MDS (3.2)
5	HL (0.1)	MDS (0.3)	LL (0.6)	MDS (1.5)	MPD (3.7)	MPD (2.3)
6	MPD (0.1)	MPD (0.3)	MM (0.6)	LL (1.1)	LL (1.3)	LL (0.5)
7	MM (0)	MM (0.03)	HL (0.1)	HL (0.4)	HL (0.7)	HL (0.4)

Incidence rates per 100,000 are in parenthesis.

Abbreviations: LL, lymphoid leukemia; NHL, non-Hodgkin lymphoma; ML, myeloid leukemia; HL, Hodgkin lymphoma; MM, multiple myeloma; MPD, myeloproliferative disorders; MDS, myelodysplastic syndromes.

Table 3. Number of hematologic malignancies and trend in crude incidence rates and age-standardized incidence rates in Korea from 1999 to 2008.

Cancer type	Gender		Year										APC
			1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Hematologic malignancies (Total)	Total	Cases	4,735	4,620	5,215	5,466	6,087	6,484	6,837	7,131	7,623	8,006	
		CR	10.0	9.7	10.9	11.4	12.6	13.4	14.0	14.6	15.5	16.2	
		ASR	10.2	9.7	10.7	11.0	12.0	12.4	12.7	13.0	13.4	13.7	3.9 ^{b)}
	Men	Cases	2,747	2,640	2,987	3,201	3,439	3,719	3,831	3,994	4,325	4,486	
		CR	11.6	11.1	12.4	13.3	14.2	15.3	15.7	16.3	17.6	18.1	
		ASR	12.7	11.9	13.2	13.8	14.5	15.3	15.3	15.5	16.3	16.3	3.4 ^{b)}
	Women	Cases	1,988	1,980	2,228	2,265	2,648	2,765	3,006	3,137	3,298	3,520	
		CR	8.5	8.4	9.3	9.4	11.0	11.4	12.4	12.9	13.5	14.3	
		ASR	8.1	7.9	8.7	8.8	9.9	10.1	10.6	10.9	11.0	11.6	4.5 ^{b)}
Hodgkin lymphoma	Total	Cases	121	135	148	144	158	204	157	172	200	210	
		CR	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.4	0.4	0.4	
		ASR	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.3	0.4	0.4	4.5 ^{b)}
	Men	Cases	85	89	100	83	112	145	105	106	127	127	
		CR	0.4	0.4	0.4	0.3	0.5	0.6	0.4	0.4	0.5	0.5	
		ASR	0.4	0.4	0.4	0.4	0.5	0.6	0.4	0.4	0.5	0.5	2.8
	Women	Cases	36	46	48	61	46	59	52	66	73	83	
		CR	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.3	0.3	0.3	
		ASR	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.3	0.3	0.3	7.2 ^{b)}
Non-Hodgkin lymphoma	Total	Cases	2,176	2,093	2,303	2,400	2,666	2,892	3,013	3,210	3,353	3,475	
		CR	4.6	4.4	4.8	5.0	5.5	6.0	6.2	6.6	6.8	7.0	
		ASR	4.7	4.4	4.7	4.8	5.2	5.5	5.6	5.8	5.8	5.8	3.3 ^{b)}
	Men	Cases	1,281	1,246	1,356	1,397	1,522	1,667	1,680	1,830	1,931	1,936	
		CR	5.4	5.2	5.6	5.8	6.3	6.9	6.9	7.5	7.8	7.8	
		ASR	6.1	5.7	6.1	6.1	6.4	6.8	6.7	7.0	7.2	7.0	2.4 ^{b)}
	Women	Cases	895	847	947	1,003	1,144	1,225	1,333	1,380	1,422	1,539	
		CR	3.8	3.6	4.0	4.2	4.8	5.1	5.5	5.7	5.8	6.2	
		ASR	3.6	3.3	3.6	3.8	4.2	4.4	4.6	4.7	4.6	4.9	4.4 ^{b)}
Multiple myeloma	Total	Cases	466	487	561	563	615	671	785	765	882	893	
		CR	1.0	1.0	1.2	1.2	1.3	1.4	1.6	1.6	1.8	1.8	
		ASR	1.0	1.0	1.1	1.1	1.2	1.2	1.4	1.3	1.4	1.4	3.8 ^{b)}
	Men	Cases	254	271	314	326	331	359	403	382	455	480	
		CR	1.1	1.1	1.3	1.3	1.4	1.5	1.7	1.6	1.8	1.9	
		ASR	1.3	1.3	1.5	1.4	1.4	1.5	1.6	1.4	1.6	1.6	2.7 ^{b)}

Table 3. Continued.

Cancer type	Gender		Year										APC	
			1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		
Lymphoid leukemia	Women	Cases	212	216	247	237	284	312	382	383	427	413	5.1 ^{b)}	
		CR	0.9	0.9	1.0	1.0	1.2	1.3	1.6	1.6	1.7	1.7		
		ASR	0.8	0.8	0.9	0.8	1.0	1.0	1.2	1.1	1.2	1.2		
	Total	Cases	549	497	541	557	550	534	554	595	598	601		1.2 ^{b)}
		CR	1.2	1.0	1.1	1.2	1.1	1.1	1.1	1.2	1.2	1.2		
		ASR	1.2	1.0	1.1	1.2	1.1	1.1	1.1	1.2	1.2	1.2		
	Men	Cases	314	281	315	336	302	304	328	327	339	346		1.1
		CR	1.3	1.2	1.3	1.4	1.2	1.3	1.3	1.3	1.4	1.4		
		ASR	1.3	1.2	1.3	1.4	1.3	1.3	1.4	1.4	1.4	1.4		
Women	Cases	235	216	226	221	248	230	226	268	259	255	1.5 ^{b)}		
	CR	1.0	0.9	0.9	0.9	1.0	1.0	0.9	1.1	1.1	1.0			
	ASR	1.0	0.9	1.0	0.9	1.0	1.0	0.9	1.1	1.1	1.1			
Myeloid leukemia	Total	Cases	1,216	1,156	1,325	1,380	1,394	1,495	1,450	1,500	1,535	1,661	1.4 ^{b)}	
		CR	2.6	2.4	2.8	2.9	2.9	3.1	3.0	3.1	3.1	3.4		
		ASR	2.6	2.4	2.7	2.8	2.8	2.9	2.8	2.8	2.8	3.0		
	Men	Cases	691	619	718	796	757	846	804	832	869	931		1.6 ^{b)}
		CR	2.9	2.6	3.0	3.3	3.1	3.5	3.3	3.4	3.5	3.8		
		ASR	3.1	2.7	3.1	3.4	3.2	3.5	3.2	3.3	3.3	3.5		
	Women	Cases	525	537	607	584	637	649	646	668	666	730		1.3 ^{b)}
		CR	2.2	2.3	2.5	2.4	2.6	2.7	2.7	2.7	2.7	3.0		
		ASR	2.2	2.2	2.4	2.3	2.4	2.5	2.4	2.4	2.4	2.5		
MPD ^{a)}	Total	Cases					307	290	414	420	523	552	10.9 ^{b)}	
		CR					0.6	0.6	0.9	0.9	1.1	1.1		
		ASR					0.6	0.5	0.8	0.7	0.9	0.9		
	Men	Cases					182	152	231	225	302	305		10.3 ^{b)}
		CR					0.8	0.6	0.9	0.9	1.2	1.2		
		ASR					0.8	0.6	0.9	0.9	1.1	1.1		
	Women	Cases					125	138	183	195	221	247		11.7 ^{b)}
		CR					0.5	0.6	0.8	0.8	0.9	1.0		
		ASR					0.4	0.5	0.6	0.6	0.7	0.8		
MDS ^{a)}	Total	Cases					397	398	464	469	532	614	5.2 ^{b)}	
		CR					0.8	0.8	1.0	1.0	1.1	1.2		
		ASR					0.8	0.7	0.8	0.8	0.9	1.0		
	Men	Cases					233	246	280	292	302	361		4.1 ^{b)}
		CR					1.0	1.0	1.1	1.2	1.2	1.5		
		ASR					1.0	1.0	1.1	1.1	1.1	1.3		
	Women	Cases					164	152	184	177	230	253		6.5
		CR					0.7	0.6	0.8	0.7	0.9	1.0		
		ASR					0.6	0.5	0.6	0.6	0.7	0.8		

^{a)}Official registration employing ICD-O-3 began in 2003 at KCCR, ^{b)}The annual percent change is statistically significantly different from zero ($P < 0.05$).

Abbreviations: CR, crude incidence rate; ASR, age-standardized incidence rate; APC, annual percentage change; MPD, myeloproliferative disorders; MDS, myelodysplastic syndromes.

incidence rate of MDS was reported to have increased during those times, but the active engagement of registration during those times could have played a role behind the increase [13]. The APC for domestic MDS, MPD were also high between 2003 and 2008, but longer observation of changes in incidence should be implemented.

Multiple factors were thought to have played role in the increase of hematologic malignancies in Korea. Age, infection, genetics, and other environmental factors were suggested as causes of hematologic malignancies, but the exact cause would be difficult to explain [14-17]. According to Europe's HAEMACARE project, the incidence of hemato-

logic malignancies in Europe also increased as age increased [3]. The aging of Korean population structure could be one factor for the increase of hematologic malignancies; however, our study showed significant increase of age-adjusted APC in most of the hematologic malignancies, and it cannot be explained solely by aging. Incidences of all hematologic diseases were lower in women than men, similar with results of Europe's HAEMACARE project. For the explanation of this phenomenon, there had been many interpretation including environmental and occupational risk factor, smoking, alcohol consumption, susceptibility to cancer, and hormonal and genetic differences between men and women [18-20].

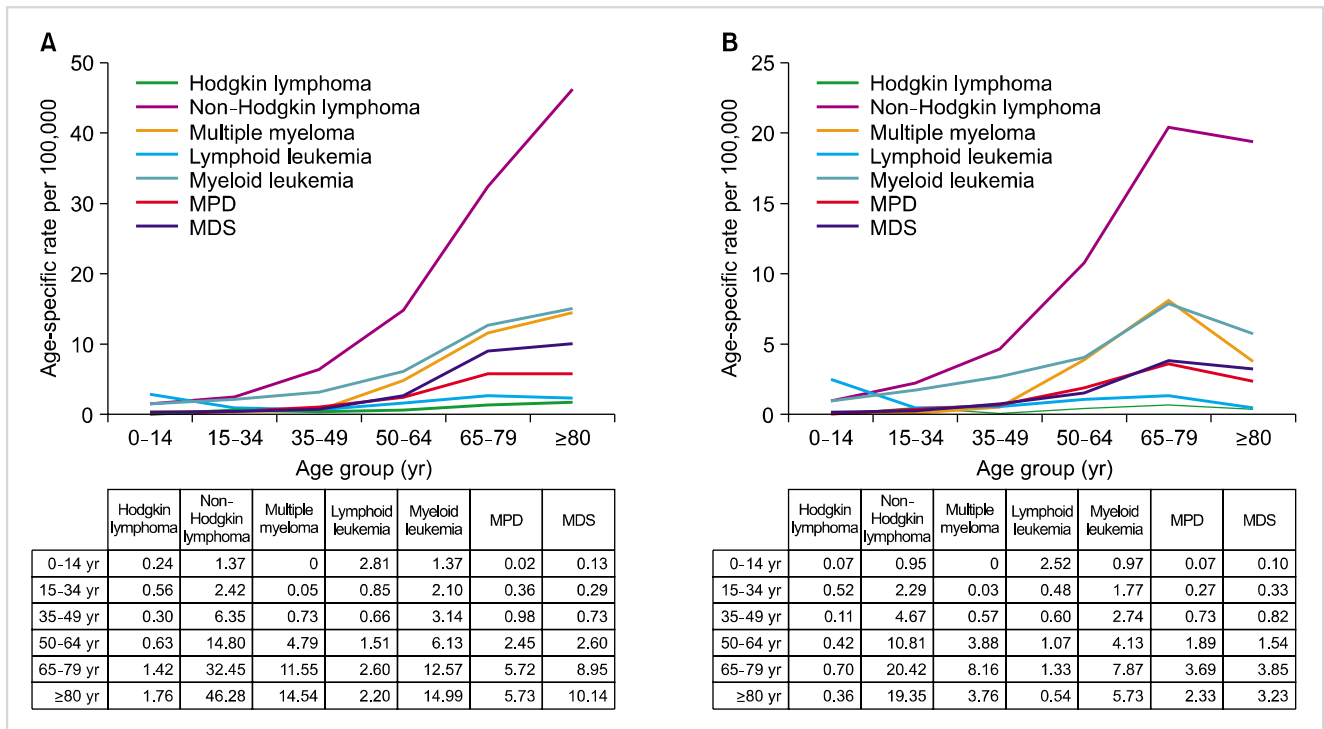


Fig. 3. Age-specific incidence rates of hematologic malignancies in Korea, 2008. (A) Men. (B) Women.

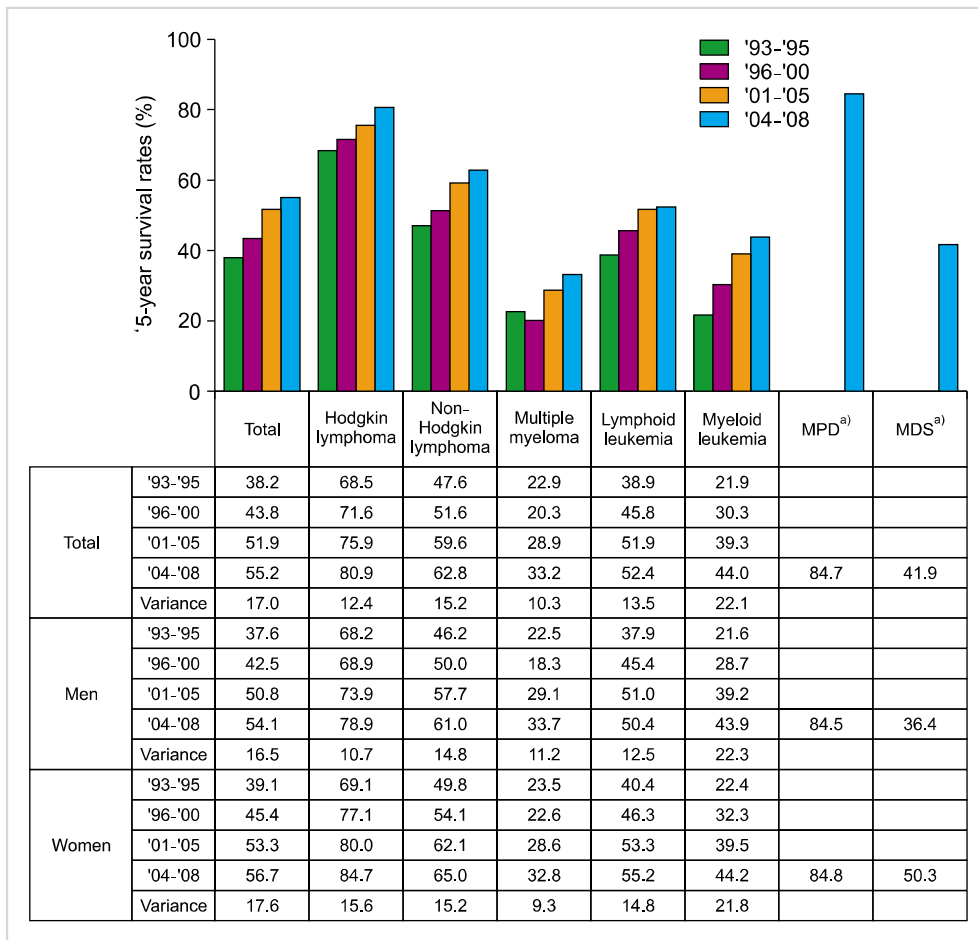


Fig. 4. Five-year survival rate of hematologic malignancies from 1993 to 2008 in Korea. ^{a)}Official registration employing ICD-O-3 began in 2003 at KCCR.

Table 4. Five-year relative survival rates of hematologic malignancies by gender and age group in Korea.

Cancer type	Gender	Age (yr)	Year								Change ^{a)}
			1993-1995		1996-2000		2001-2005		2004-2008		
			Cases	Relative survival	Cases	Relative survival	Cases	Relative survival	Cases	Relative survival	
Hematologic malignancies (Total)	Total	0-14	1,217	51.7	2,305	61.8	2,462	71.9	2,377	73.3	21.6
		15-34	1,809	39.5	3,402	49.6	3,871	62.3	4,159	70.3	30.8
		35-49	1,671	42.4	4,085	49.7	5,948	62.1	6,790	66.8	24.4
		50-64	2,243	34.2	5,610	40.4	7,888	51.5	9,516	56.7	22.5
		65-79	1,261	25.2	3,738	26.5	6,906	33.1	9,396	36.9	11.7
	Men	≥80	92	18.0	390	24.4	905	19.8	1,382	22.3	4.3
		0-14	755	50.4	1,369	60.9	1,518	71.4	1,416	73.9	23.5
		15-34	1,042	38.5	1,968	45.7	2,228	59.3	2,388	68.5	30.0
		35-49	1,015	43.2	2,450	48.4	3,481	60.4	3,924	64.9	21.7
		50-64	1,327	33.1	3,253	38.6	4,547	48.5	5,508	53.6	20.5
	Women	65-79	711	21.9	1,990	26.1	3,726	33.1	5,022	35.5	13.6
		≥80	42	24.5	176	19.5	456	17.9	681	20.7	-3.8
		0-14	462	53.8	936	63.0	944	72.7	961	72.5	18.7
		15-34	767	40.9	1,434	55.0	1,643	66.3	1,771	72.7	31.8
		35-49	656	41.1	1,635	51.6	2,467	64.4	2,866	69.5	28.4
		50-64	916	35.8	2,357	42.8	3,341	55.5	4,008	60.8	25.0
		65-79	550	29.2	1,748	27.0	3,180	33.0	4,374	38.4	9.2
≥80	50	13.2	214	28.0	449	21.4	701	23.9	10.7		
Hodgkin lymphoma	Total	0-14	26	84.8	37	94.7	60	95.1	67	95.6	10.8
		15-34	102	79.9	186	88	288	88	318	91.1	11.2
		35-49	57	75.4	131	73.1	161	83.8	178	89.1	13.7
		50-64	51	50.4	129	56.7	161	63.6	182	75	24.6
		65-79	29	39.5	75	43.6	99	40.6	134	49.3	9.8
	Men	≥80	4	0	5	0	14	22.3	20	21.8	21.8
		0-14	20	85.3	24	96	38	94.8	43	95.4	10.1
		15-34	54	78.4	102	86.8	159	85.2	168	88.3	9.9
		35-49	41	82.8	101	73.9	128	84.2	134	88.1	5.3
		50-64	37	47.1	105	51	122	62.9	140	74.2	27.1
	Women	65-79	17	31.1	43	44.2	72	40.7	92	45.9	14.8
		≥80	2	0	3	0	6	0	6	0	0
		0-14	6	83.5	13	92.4	22	95.5	24	95.9	12.4
		15-34	48	81.5	84	89.5	129	91.5	150	94.5	13
		35-49	16	56.7	30	70.5	33	82.3	44	92.9	36.2
		50-64	14	59.1	24	81.3	39	65.7	42	77.9	18.8
		65-79	12	51.1	32	42.8	27	40.3	42	55.2	4.1
≥80	2	0	2	0	8	37.6	14	33	33		
Non-Hodgkin lymphoma	Total	0-14	226	61.7	452	69.6	525	80.8	534	78.6	16.9
		15-34	638	51.1	1,274	60.2	1,482	71	1,617	78.9	27.8
		35-49	811	57	2,023	62.2	2,830	70.9	3,242	74.7	17.7
		50-64	1,166	45.5	2,935	50.3	3,833	62.5	4,521	66.7	21.2
		65-79	706	33.3	2,013	34.8	3,261	41.6	4,205	45.6	12.3
	Men	≥80	57	22.2	254	30	505	24.4	707	26.9	4.7
		0-14	161	60.4	298	67.3	365	80.9	364	80.6	20.2
		15-34	383	48.7	775	55.6	847	66.6	918	75.6	26.9
		35-49	540	56.4	1,284	60.3	1,669	67.7	1,877	70.6	14.2
		50-64	715	42.8	1,722	48	2,245	58.4	2,634	63.3	20.5
	Women	65-79	402	29.5	1,125	33.6	1,766	41.9	2,253	44.8	15.3
		≥80	23	35.4	108	22.3	259	19.8	336	23.9	-11.5
		0-14	65	64.7	154	74.2	160	80.6	170	73.9	9.2
		15-34	255	54.7	499	67.3	635	76.8	699	83.2	28.5
		35-49	271	58.1	739	65.5	1,161	75.5	1,365	80.3	22.2
		50-64	451	49.7	1,213	53.6	1,588	68.2	1,887	71.5	21.8
		65-79	304	38.1	888	36.3	1,495	41.2	1,952	46.5	8.4
≥80	34	14.5	146	35.2	246	28.8	371	30.3	15.8		
Multiple myeloma	Total	0-14	1	101.2	1	100.1	3	33.4	3	66.7	-34.5
		15-34	25	60.4	30	53.6	32	72.2	38	73.1	12.7
		35-49	99	32	281	30.8	390	44.7	419	49.5	17.5
		50-64	334	22.5	856	21.3	1,146	33.8	1,353	41.4	18.9
		65-79	199	14	695	13	1,254	19.3	1,660	22.9	8.9
		≥80	10	0	43	18.3	131	9	202	12.6	12.6

Table 4. Continued.

Cancer type	Gender	Age (yr)	Year								Change ^{a)}
			1993-1995		1996-2000		2001-2005		2004-2008		
			Cases	Relative survival	Cases	Relative survival	Cases	Relative survival	Cases	Relative survival	
	Men	0-14	-	-	-	-	-	-	-	-	-
		15-34	15	60.6	19	42.4	22	68.5	26	69.4	8.8
		35-49	54	32.5	172	25	249	45.3	255	51.1	18.6
		50-64	193	22.8	479	19	641	30.7	737	38	15.2
		65-79	105	11.1	349	12.1	628	20.7	799	24	12.9
		≥80	9	0	27	22.5	63	5.9	99	6.2	6.2
	Women	0-14	1	101.2	1	100.1	3	33.4	3	66.7	-34.5
		15-34	10	60.2	11	73	10	80.2	12	81.2	21
		35-49	45	31.4	109	39.8	141	43.6	164	46.3	14.9
		50-64	141	22.1	377	24.1	505	37.7	616	45.5	23.4
		65-79	94	17	346	13.8	626	18	861	21.9	4.9
		≥80	1	0	16	11.8	68	11.6	103	16.6	16.6
		≥80	3	0	11	0	13	12	18	24.1	24.1
Lymphoid leukemia	Total	0-14	663	57.2	1,190	67.8	1,211	76.8	1,156	77.4	20.2
		15-34	293	19.2	557	26.5	482	34.2	509	39.6	20.4
		35-49	143	17.8	260	23.4	345	28.5	362	31.1	13.3
		50-64	111	19.1	266	26.3	310	30.3	381	29.5	10.4
		65-79	66	22.8	162	19.4	283	29.5	348	34.3	11.5
		≥80	4	0	17	0	27	12.4	39	31.6	31.6
	Men	0-14	396	55.7	684	66.9	725	75.5	649	76.8	21.1
		15-34	174	20.8	326	24.7	295	31.2	312	40	19.2
		35-49	82	12.5	138	22.2	196	27.8	206	28.7	16.2
		50-64	55	15.8	150	26.7	157	28	222	24.5	8.7
		65-79	37	14	86	21.7	161	27.4	187	27.7	13.7
		≥80	1	0	6	0	14	13.3	21	39.1	39.1
	Women	0-14	267	59.3	506	68.9	486	78.9	507	78.3	19
		15-34	119	16.9	231	29.1	187	38.9	197	39.1	22.2
		35-49	61	24.8	122	24.8	149	29.5	156	34.2	9.4
		50-64	56	22.2	116	25.8	153	32.6	159	35.4	13.2
		65-79	29	33.5	76	16.8	122	31.8	161	43.1	9.6
Myeloid leukemia	Total	0-14	298	28.3	615	41.7	585	51.7	531	56	27.7
		15-34	730	29.5	1,292	41.5	1,356	53.8	1,301	63.4	33.9
		35-49	532	22	1,285	33.1	1,726	50.7	1,778	56.7	34.7
		50-64	548	14.6	1,239	22.7	1,627	31.4	1,803	38.2	23.6
		65-79	252	7.4	721	9.1	1,251	14.4	1,542	18.1	10.7
		≥80	17	22.5	64	5.8	136	5.9	206	14	-8.5
	Men	0-14	176	24.5	356	40.8	341	50.4	309	57.7	33.2
		15-34	408	29.2	715	37.2	774	53.6	738	64.4	35.2
		35-49	288	21.7	708	30.6	960	49.8	986	56.3	34.6
		50-64	314	15.6	713	22.8	921	30	1,034	35.9	20.3
		65-79	147	8.1	350	7	662	14.4	847	17.5	9.4
		≥80	7	32.7	28	0	64	10.5	109	19.2	-13.5
	Women	0-14	122	33.7	259	42.9	244	53.6	222	53.8	20.1
		15-34	322	29.9	577	46.9	582	54	563	62.1	32.2
		35-49	244	22.3	577	36.1	766	51.8	792	57.2	34.9
		50-64	234	13.2	526	22.5	706	33.1	769	41.1	27.9
		65-79	105	6.4	371	11	589	14.3	695	18.7	12.3
		≥80	10	16.5	36	9	72	2.3	97	8.4	-8.1
MPD ^{b)}	Total	0-14							19	100.2	
		15-34							168	96.6	
		35-49							452	93.7	
		50-64							667	90.7	
		65-79							692	72.6	
		≥80							91	48.2	
	Men	0-14							12	100.2	
		15-34							97	97	
		35-49							266	92.7	
		50-64							375	90.9	
		65-79							359	68.1	
		≥80							44	68.1	

Table 4. Continued.

Cancer type	Gender	Age (yr)	Year								Change ^{a)}
			1993-1995		1996-2000		2001-2005		2004-2008		
			Cases	Relative survival	Cases	Relative survival	Cases	Relative survival	Cases	Relative survival	
	Women	0-14							7	100.1	
		15-34							71	96	
		35-49							186	94.5	
		50-64							292	90.3	
		65-79							333	76.7	
		≥80							47	35.7	
MDS ^{b)}	Total	0-14							67	69.7	
		15-34							208	69.1	
		35-49							359	59.1	
		50-64							609	43.6	
		65-79							815	25	
		≥80							117	9.8	
	Men	0-14							39	61.6	
		15-34							129	64.2	
		35-49							200	57.5	
		50-64							366	36	
		65-79							485	18.9	
		≥80							66	3.5	
	Women	0-14							28	84	
		15-34							79	77.5	
		35-49							159	61.7	
		50-64							243	56.6	
		65-79							330	33.7	
		≥80							51	24.4	

^{a)}Change in the 5-year relative survival between 1993-1995 and 2004-2008 as a percentage, ^{b)}Official registration employing ICD-O-3 began in 2003 at KCCR.

Abbreviations: MPD, myeloproliferative disorders; MDS, myelodysplastic syndromes.

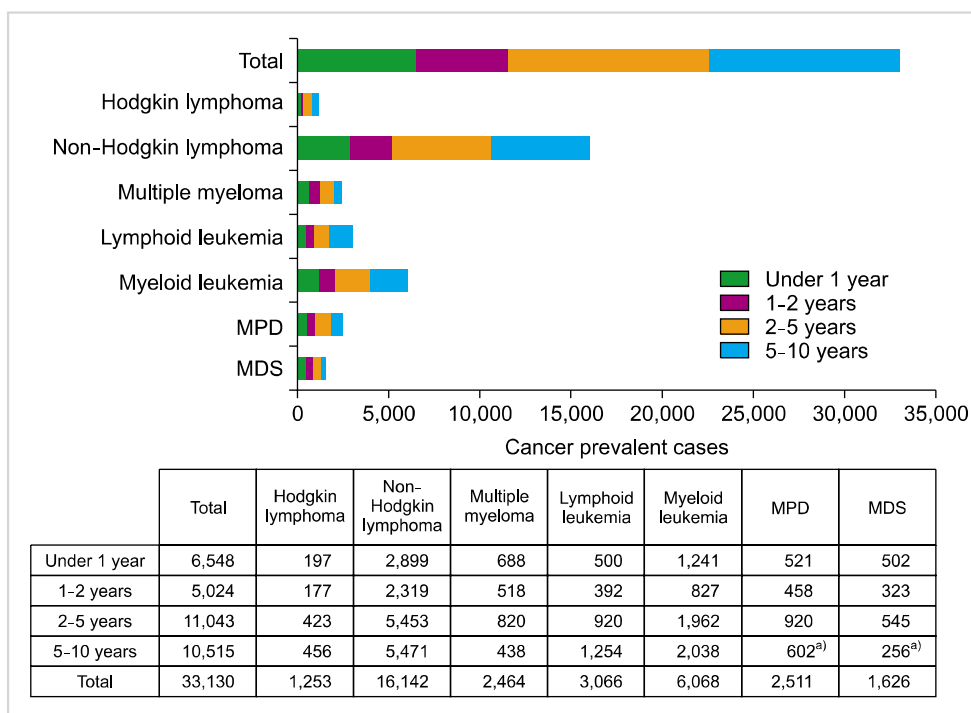


Fig. 5. Number of prevalent cases of hematologic malignancies by time since diagnosis in January 1, 2009 in Korea. ^{a)}Because official registration for MPD and MDS began in 2003, 5-10 year prevalence cases for these cancers are underestimated.

Table 5. International comparison of age-standardized incidence rates of hematologic malignancies.

Gender	Cancer type	ICD-10 code	Korea	Japan	China	France	Germany	UK	Canada	USA
Men	Hodgkin lymphoma	C81	0.5	0.5	0.5	2.3	1.8	2.8	2.7	2.6
	Non-Hodgkin lymphoma	C82-85, C96	6.7	6.3	2.5	11.6	9.3	12.4	15.2	16.3
	Multiple myeloma ^{a)}	C88, C90	1.6	1.6	0.4	4.6	3.4	4.1	4.5	4.8
	Leukemia	C91-95	5.6	5.5	5.3	10.2	8.4	9.0	11.8	12.1
Women	Hodgkin lymphoma	C81	0.3	0.3	0.3	2.7	1.4	2.1	2.2	2.2
	Non-Hodgkin lymphoma	C82-85, C96	4.7	4.0	1.7	7.9	7.0	8.7	11.4	11.5
	Multiple myeloma ^{a)}	C88, C90	1.1	1.1	0.3	2.9	2.3	2.6	3.1	3.0
	Leukemia	C91-95	4.1	3.1	4.7	6.5	5.4	5.7	6.8	7.9

Age-standardized incidence rates using the WHO world standard population, for Korea, data are from Korea National Cancer Incidence Database (KNCI DB), for all other countries, data are from GLOBOCAN 2008.

^{a)}Multiple myeloma in Korea includes C90.

The survival rates have continuously improved in all hematologic malignancies in Korea. According to recent NORDICAN database published by Nordic countries-Denmark, Finland, Norway, and Sweden, the 5-year survival rates of HL, NHL, multiple myeloma, and leukemia in those 4 countries from 1999 to 2003 were similar to our survival rates, and also the 5-year survival rates of hematologic malignancy patients in Hong Kong from 1996 to 2001 were comparable to our levels [1, 21].

However, our survival rates in most of the hematologic malignancies do not reach the levels that of the USA [22], and this difference in survival rates could be due to the different prevalent disease type as well as other complex factors. There were big differences in survival rates in domestic hematologic malignancies before and after year 2000; however, in comparison of years between 2001-2005 and 2004-2008, the increase of survival rates were less distinct with only 3% and 0.5% increase of survival rates in NHL, and lymphoid leukemia, respectively.

Just like other malignancies, there is an increase of long term survivors in hematologic malignancies. As seen in this study, there were more than 30,000 patients with 10-year prevalence treated for hematologic malignancies, and this is comparable to long term survivors of cervical cancer, liver cancer, and lung cancer [23]. Due to the improvements in treatment, more long term survivors of hematologic malignancies will be observed. The increase of long term survivors after treatment for cancers including hematologic malignancies may lead to various physical, psychological, and social problems after the cure of malignancies [24]. While we should try on improving the survival rate of the patients, further study involving the overall quality of life of long term survivors of hematologic malignancies would be needed.

Statistics for hematologic malignancies increases the understanding of overall hematologic malignancies, and it could be used as the basic information to help investigate epidemiologic characteristics, evaluate progress during the past years, and establish future strategies for hematologic malignancies. For more detailed analysis and international comparison, the hematologic malignancies registration program in Korea

should be set up, and continuous effort and feedback between the Korean Society of Hematology and Korea Central Cancer Registry would be needed.

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