

Survival of Korean Cancer Patients Diagnosed in 1995

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Purpose: To produce the nationwide 5-year survival rates of Korean cancer patients by primary cancer site.

Materials and Methods: The study subjects were cancer patients diagnosed in 1995, as documented by the Korea Central Cancer Registry (KCCR) Program. This data was collected in 120 (93%) of 129 nationwide intern- and resident-training hospitals and 75 (94%) of the 80 Korean university hospitals. Follow-up was performed by obtaining information upon vital status (i.e., whether living or dead) from the government administered whole population files. Cumulative observed survival rate (OSR) was calculated by using the life table method and the relative survival rate (RSR) was computed using the life-time table for the years 1995, 1997, and 1999.

Results: Of the 55,042 study subjects, the OSR for all Korean cancer patients was 61.4% at 1 year and 38.1% at 5 years. The RSR for all cancers was 62.5% at 1 year and 41.4% at 5 years, and the 5-year RSRs for all cancers in men and women were 32.6% and 53.2%, respectively.

Conclusion: This is the first nationwide report upon 5-year cancer survival by primary site in Korea. Men showed a lower survival rate than women in most malignancies. Pancreatic and thyroid cancer had the lowest and highest 5-year survival rates, respectively. (*Cancer Research and Treatment 2002;34:319-325*)

Key Words: Neoplasm, Survival, Population, Korea

INTRODUCTION

Cancer has been the most frequent cause of death in Korea since 1983 (1). The Korea Central Cancer Registry (KCCR) Program began in 1980 at 47 resident-training general hospitals in Korea. The number of KCCR-affiliated hospitals increased to 170 in 2001, and then participated included 75 (94%) of the 80 Korean university hospitals and 120 (96%) of the 125 nationwide intern- & resident-training hospitals (Appendix). These hospital-based reports have been estimated to cover about 80 percent of the newly diagnosed malignancies in Korea (2).

A nationwide cancer screening program for stomach, breast, and cervix started in 2002, even the target population is only for medicaid and beneficiaries with lower 20% of premium (3).

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MATERIALS AND METHODS

1) Study subjects

A total of 59,785 incident cases between 1 January 1995 and 31 December 1995, registered in KCCR, formed the basis for the survival analysis.

Complete individual information - especially personal identification number (PIN), the date of birth, date of diagnosis, age at diagnosis, gender, address, primary site of cancer by International Classification of Disease - Oncology/2 (ICD-O/2) code (5), histological verification, and morphology were available for each patient. Age at diagnosis was calculated based on the recorded date of diagnosis and this was classified

Table 1. Cases of cancer registered and data quality indices, Korea Central Cancer Registry, 1995

Site	ICD-10	No. of cases registered	%HV	Cases excluded from analysis		Cases included for survival analysis	
				PIN* mismatched	Other errors [†] in data	No.	%
Oral cavity	C00-C08	636	94.5	40	1	595	93.6
Nasopharynx	C11	219	90.0	14	1	204	93.2
Other pharynx	C09-C10;C12-C14	366	89.3	22	1	343	93.7
Oesophagus	C15	1,183	89.9	86	1	1,096	92.6
Stomach	C16	13,353	91.7	965	44	12,344	92.4
Colon and rectum	C18-C21	5,044	90.8	382	12	4,650	92.2
Liver etc.	C22	7,318	33.0	587	30	6,701	91.6
Pancreas	C25	1,264	52.1	97	6	1,161	91.9
Larynx	C32	757	91.0	38	1	718	94.8
Lung etc.	C33-C34	7,001	84.9	544	36	6,421	91.7
Skin melanoma	C43	135	96.3	10	1	124	91.9
Breast	C50	3,149	94.2	221	5	2,923	92.8
Cervix uteri	C53	3,846	90.9	297	6	3,543	92.1
Corpus uteri	C54	319	97.2	25	1	293	91.8
Ovary etc.	C56-C57	909	89.8	79	3	827	91.0
Prostate	C61	606	89.3	34	0	572	94.4
Testis	C62	81	90.1	4	0	77	95.1
Bladder	C67	1,348	94.4	104	2	1,242	92.1
Kidney etc.	C64-C66;C68	979	84.7	57	1	921	94.1
Brain and CNS	C70-C72	881	80.5	80	4	797	90.5
Thyroid	C73	1,685	95.2	108	1	1,576	93.5
Non-Hodgkin lymphoma	C82-C85;C96	1,259	96.7	109	5	1,145	90.9
Hodgkin disease	C81	107	99.1	9	0	98	91.6
Multiple myeloma	C88;C90	292	90.8	27	1	264	90.4
Leukemia	C91-C95	1,419	95.2	126	4	1,289	90.8
Total	C00-C97	59,785	82.0	4,561	182	55,042	92.1

*PIN: Personal Identification Number

[†] incomplete information

into 15 age groups of five years up to and including age 74, those aged 75 or over were placed in a 16th group. In cases involving multiple tumors, the initially diagnosed tumor was used for the classification.

The distribution of incident cases, the proportion of histologically verified cases and the number of cases ultimately included in the survival analysis for individual cancer sites are shown in Table 1. The figure for histological verification ranged between 33% in liver cancer (C22) and 96.7% in Non-Hodgkin lymphoma (C82-85;C96). Of the incidence cases, 4,561 cases were not followed up due to the mismatched PIN and 182 cases with incomplete information on date of diagnosis or death etc. The proportion of cases included varied from 90.4% in multiple myeloma (C88;C90) and 95.1% in testicular cancer (C62). During the follow-up period 35,460 of study subjects were confirmed as having died (not shown).

2) Follow-up methods

Follow-up was done by merging computer to obtain information upon the individual's status from government administered population files. The vital status of each case was verified up to December 31, 2001. In the computerized

record-linkage procedure, matching was achieved by using an individual's personal identification number (PIN: total 13 digits) and name. This follow-up method may be regarded as relatively complete for the cancer registry records, because the vital status of patients is updated from the governmental files, such as the population registry of the Ministry of Government Administration and Home Affairs (6), and the death certificated data files of the Korea National Statistical Office (1).

3) Statistical methods

The survival time for each case was the time between the incidence date and the date of death, cut-off date, 31 December, 2001. Cumulative observed and relative survival rates were calculated using Hakulinen's method (7).

Relative survival is defined as "the observed survival for subjects with a particular cancer" divided by "the expected survival of a group of individuals with the same demographic characteristics who are at risk of death only from causes of death other than the cancer under study" (8). The method used in this paper was that of Hakulinen, both for overall and for age-specific and sex-specific estimates of relative survival.

RESULTS

1) Overall survivals

The overall one-year, up to five-year cumulative observed and relative survival rates are given in Table 2.

The observed survival of total subjects was 61.4% at 1 year and 38.1% at 5 years after diagnosis (Fig. 1). The 5-year observed survival in males and females were 28.9% and 50.9%, respectively. Women showed a higher observed survival than men throughout the study period. The 1- to 5-year observed survival by sex are given in Table 2.

The 5-year observed survival curves by sex and age group are depicted in Fig. 2. Survival rates generally decreased with age after 35 years old. OSRs by sex and primary sites are shown in Table 3. For men & women pancreatic cancer showed the lowest 5-year OSR of 7.7%, these were followed by patients with cancer of the, liver (9.6%), lung (10.0%), or esophagus (11.2%). On the other hand, thyroid cancer had the highest 5-year OSR of 90.6%, followed by testis (85.7%), breast (75.6%), and uterine cervix (73.9%). Testicular cancer and thyroid cancer had the highest 5-year OSRs in men and women, respectively.

2) Relative survivals

For all cancers combined, the 5-year RSR in Korea was

41.4% (Table 2, Fig. 3). The 5-year RSRs of men and women were 32.6% and 53.2%, respectively. Table 4 shows the 5-year RSRs estimated by cancer site. The 5-year RSR of pancreatic cancer carried the poorest prognosis of 8.4%.

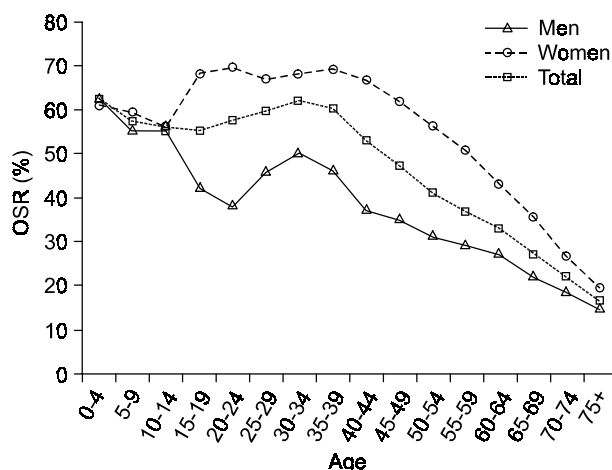


Fig. 2. The 5-year observed survival rates (OSR, %) by age in diagnosis and sex.

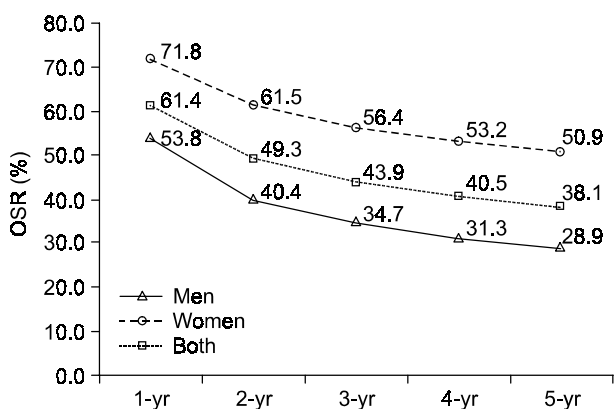


Fig. 1. The 1- to 5-year observed survival rates (OSR, %) by sex.

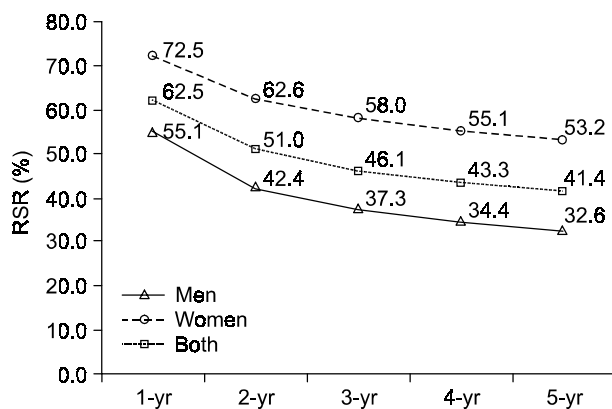


Fig. 3. The 1- to 5-year relative survival rates (RSR, %) by sex.

Table 2. Observed survival rates (OSR, %) and relative survival rates (RSR, %) of the subject

	Sex	1-year	2-year	3-year	4-year	5-year
OSR	Both	61.4	49.3	43.9	40.5	38.1
	Men	53.8	40.4	34.7	31.3	28.9
	Women	71.8	61.5	56.4	53.2	50.9
RSR	Both	62.5	51.0	46.1	43.3	41.4
	Men	55.1	42.4	37.3	34.4	32.6
	Women	72.5	62.6	58.0	55.1	53.2

Table 3. The 5-year observed survival rates (OSR, %) by primary sites and sex

Site	ICD-10	Men		Women		Both	
		1-yr	5-yr	1-yr	5-yr	1-yr	5-yr
Total	C00-C97	53.9	28.9	71.8	50.8	61.5	38.1
All cancer*	C00-C97	53.8	28.9	71.8	50.9	61.4	38.1
Oral cavity	C00-C08	66.4	36.2	81.5	57.3	70.9	42.5
Nasopharynx	C11	79.3	42.7	81.5	55.6	79.9	46.1
Other pharynx	C09-C10;C12-C14	54.7	22.3	52.9	17.6	54.5	21.9
Esophagus	C15	37.6	10.7	47.9	19.2	38.3	11.2
Stomach	C16	63.7	39.3	64.8	41.2	64.0	39.9
Colon and rectum	C18-C21	78.8	48.6	78.6	50.3	78.7	49.4
Liver	C22	31.7	9.3	31.8	10.7	31.8	9.6
Pancreas	C25	19.2	6.7	21.8	9.1	20.2	7.7
Larynx	C32	82.1	51.8	77.3	54.5	81.6	52.1
Lung.	C33-C34	34.2	9.4	39.1	11.8	35.2	10.0
Skin melanoma	C43	58.5	29.2	72.9	37.3	65.3	33.1
Breast	C50	-	-	94.3	75.7	94.3	75.6
Cervix uteri	C53	-	-	91.9	73.9	91.9	73.9
Corpus uteri	C54	-	-	89.8	71.7	89.8	71.7
Ovary etc.	C56-C57	-	-	85.1	62.3	85.1	62.3
Prostate	C61	85.8	43.5	-	-	85.8	43.5
Testis	C62	93.5	85.7	-	-	93.5	85.7
Bladder	C67	84.1	57.8	80.8	59.4	83.5	58.1
Kidney etc.	C64-C66;C68	79.3	56.1	80.5	57.6	79.7	56.6
Brain and CNS	C70-C72	59.7	36.6	63.9	41.7	61.5	38.8
Thyroid	C7391.0	-	78.8	96.3	92.9	95.4	90.6
Non-Hodgkin lymphoma	C82-C85;C96	66.3	40.4	70.4	48.6	67.9	43.6
Hodgkin disease	C81	83.3	68.2	87.5	71.9	84.7	69.4
Multiple myeloma	C88;C90	51.1	17.7	56.1	20.3	53.4	18.9
Leukemia	C91-C95	54.0	25.8	55.8	30.4	54.8	27.9

*Only the initially diagnosed tumor was included in the cases of multiple tumors

DISCUSSION

The overall 5-year observed survival (38.1%) and relative survival (41.4%) are the first report as a nationwide 5-year survival of Korean cancer patients by primary cancer site.

Monitoring the survival trends of cancer patients is an essential part of our evaluation of progress against cancers (9). Survival analysis reports are scarcely issued by developing countries due to difficulties associated with patient follow-up (10). However, Korean patients can be followed up systematically using their national personal identification numbers (PINs).

We should interpret the results of the present study carefully, because there are some limitations imposed by the KCCR database, as gathered by the nationwide hospital-based cancer registry program (2,11).

In addition, patients with an invalid identification number could not be merged with death certification, and therefore, a patient might be incorrectly regarded as living. For this reason, only cases with valid information, especially a valid personal

identification number, were included in this study before merging computer records.

On combining all cancers, women were found to have a much better prognosis than men. Part of this female advantage is explained by the high frequency of female cancers (e.g., thyroid, breast and uterine cervix), which have a good prognosis. In addition, it is possible that behavioral, environmental, and genetic factors and their complex interrelations, may influence the cancer prognosis, and play a role in determining the survival differences between men and women found, as found in the present study (12).

Overall, survival rate tended to decrease with increasing age, which is consistent with other population-based studies (13). In addition, the risk of death is likely to depend on the stage distribution of cases at diagnosis; moreover, it has also been shown that the proportion of advanced cancers increases with age (14).

Comparing the survival curves in men and women, survival rates in women were found to slowly increase from around age 25 until age 42, and then started to decrease. This pattern might be due to the fact that the distribution of primary cancer sites, which have different prognostic variations, changes with age.

Table 4. The 5-year relative survival rates (RSR, %) by primary sites and sex

Site	ICD-10	Men		Women		Both	
		1-yr	5-yr	1-yr	5-yr	1-yr	5-yr
Total	C00-C97	55.2	32.5	72.6	53.1	62.6	41.3
All cancer*	C00-C97	55.1	32.6	72.5	53.2	62.5	41.4
Oral cavity	C00-C08	68.0	40.9	82.5	60.6	72.4	46.8
Nasopharynx	C11	80.3	45.1	82.0	57.4	80.8	48.4
Other pharynx	C09-C10;C12-C14	55.9	24.9	53.6	18.6	55.7	24.2
Esophagus	C15	38.7	12.1	48.7	20.7	39.3	12.7
Stomach	C16	65.1	44.0	65.5	43.7	65.3	43.9
Colon and rectum	C18-C21	80.7	55.2	79.7	54.2	80.3	54.8
Liver etc	C22	32.3	10.2	32.2	11.4	32.3	10.5
Pancreas	C25	19.7	7.5	22.2	9.7	20.7	8.4
Larynx	C32	84.2	59.9	78.8	60.6	83.7	59.9
Lung etc.	C33-C34	35.2	10.9	39.7	12.8	36.2	11.4
Skin melanoma	C43	59.7	33.0	73.7	39.9	66.4	36.3
Breast	C50	-	-	94.7	77.5	94.7	77.5
Cervix uteri	C53	-	-	92.5	76.4	92.5	76.4
Corpus uteri	C54	-	-	90.3	73.9	90.3	73.9
Ovary etc.	C56-C57	-	-	85.6	64.2	85.6	64.2
Prostate	C61	90.2	58.9	-	-	90.2	58.9
Testis	C62	94.0	87.8	-	-	94.0	87.8
Bladder	C67	86.7	67.9	82.6	66.1	86.0	67.6
Kidney etc.	C64-C66;C68	81.2	63.1	81.4	61.2	81.2	62.5
Brain and CNS	C70-C72	60.3	37.8	64.2	42.2	61.9	39.7
Thyroid	C73	92.2	84.0	96.7	95.1	96.0	93.3
Non-Hodgkin lymphoma	C82-C85;C96	67.4	43.7	71.0	50.8	68.8	46.5
Hodgkin disease	C81	84.1	70.7	88.2	74.6	85.5	71.9
Multiple myeloma	C88;C90	52.5	20.0	56.8	21.5	54.5	20.7
Leukemia	C91-C95	54.6	26.8	56.0	31.1	55.2	28.7

*Only the initially diagnosed tumor was included in the cases of multiple tumors

This pattern also suggests a correlation between female sex hormones and survival from cancer. It has been proposed that female sex hormones might be able to prevent the establishment of distant metastases in certain malignant diseases (12).

The 5-year RSR of all sites in Koreans (1995) was 41.4%. This rate is lower than observed in the United States (1992), as determined by the Surveillance, Epidemiology, and End Results (SEER) Program of the National Cancer Institute (15). However, the interpretation of survival differences between countries must be performed carefully, because, for example, survival is dependent upon early diagnosis, advances in surgical technology and the adoption of effective adjuvant therapies (16). In addition, the interpretation of geographical survival differences should also be considered in terms of data quality, diagnostic procedures, and clinical treatment factors (8,17).

CONCLUSIONS

According to this first report upon nationwide 5-year cancer survival by primary site in Korea, the 5-year observed and

relative survival rates were 38.1% and 41.4%, respectively. Men showed a lower survival rate than women in most malignancies. The lowest and highest 5-year survival rates were shown by pancreatic and thyroid cancer, respectively.

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[Appendix] List of the hospitals participating the KCCR program

Ajou University Hospital	Andong General Hospital
Andong Presbyterian Hospital	Asan Foundation Kangnung Hospital
Asan Medical Center	Bag Ae Hospital
Benedict Hospital	Bupyeong Serim General Hospital
Busan Veterans Hospital	Capital Armed Forces General Hospital
Carollo Hospital	Catholic GEN Hospital
Changwon General Hospital	ChonBuk National University Hospital
Chongju St. Mary's Hospital	Chonnam University Hospital
Choon Hae Hospital	Chosun University Hospital
Chung-Ang University Hospital	ChungAng University Medical Center
Chungbuk National University Hospital	Chungnam National University Hospital
College of Medicine, Pochon CHA University CHA General Hospital	Dae Dong Hospital
Dae Rim St. Mary's Hospital	Daegu Medical Center
DanKook University Hospital	Dong Kang General Hospital
Dong Rae Bong Seng Hospital	Dong-A University Hospital
Dongeuil Medical Center	Dongguk University Kyong Ju Hospital
Dong-In Hospital	Dong-Kuk University Po-Hang Hospital
Dongsan Sacred Heart Hospital, Hallym University	Eulji Medical Center
Ewha Womans University Mokdong Hospital	Ewha Womans University Tongdaemun Hospital
Gachon Medical College Gil Medical Center	Gangneung Medical Center
Gyeongsang University Hospital	Hae Dong Hospital
Hallym Sacred Heart Hospital	Hallym University Hang Gang Sacred Heart Hospital
Hallym University Medical Center ChunCheon Sacred Heart Hospital	Hangdong University Sunlin Presbyterian Hospital
Hanil Hospital	Hanyang University Hospital
Hanyang University Kuri Hospital	Il Sin Christian Hospital
In Je University, Pusan Paik hospital	Inchon Christian Hospital
Inchon Severance hospital	Inchun Choongang General Hospital
Inha University Hospital	Inha University Medical Center Inha Hospital
Inje University Sanggye Paik Hospital	Inje University, Seoul Paik Hospital
Kaejong Hospital, The Korean Institution for Rural Health	Kang Dong Sacred Heart Hospital
Kangbuk Samsung Hospital	Kangnam General Hospital Public Corporation
KangNam Sacred Heart Hospital Hallym University	Keimyung University Medical Center
Koje Hospital	Kon Kuk University Medical Center Seoul Hospital
Korea Cancer Center Hospital	Korea University Ansan Hospital
Korea University College of Medicine, Guro Hospital	Korea University Hospital
Korea Veterans Hospital	Kosin University Gospel Hospital
Kwak's Hospital	Kwang Ju Christian Hospital
Kwang Ju Veterans Hospital	Kwang Myung Sung Ae General Hospital
Kwanghye General Hospital	Kyung Hee Medical Center
Kyungpook National University Hospital	Local Public Corp. Inchun Medical Center
Local Public Corp. Chung Cheong Nam-Do Hong Sung Medical Center	Maryknoll General Hospital
Masan Samsung Hospital	Masan Sungmo General Hospital
Metro Hospital	Missionary Benedictine Sisters Fatima Hospital
Mokpo Catholic Hospital	Nam Kwang Hospital
National Health Insurance Corporation Ilsan Hospital	National Medical Center
National Police Hospital	Pohang St. Mary's Hospital
Presbyterian Medical Center	Pundang Je-Saeng Hospital
Pusan Adventist Hospital	Pusan Medical Center
Pusan National University Hospital	Saehan Hospital
Samsung Medical Center	Samsung Cheil Hospital & Women's Health Care Center
Sejong General Hospital	Seo San Medical Center
Seoul Adventist Hospital	Seoul Christian Hospital
Seoul Municipal Boramae Hospital	Seoul National University Hospital
Seoul Red Cross Hospital	Severance Hospital Yonsei University Medical College
Soonchunhyang GuMi Hospital	Soonchunhyang University Chonan Hospital
Soonchunyang Univ. Hospital	St. Francisco General Hospital
Sun General Hospital	Sung Ae Hospital
Taeback Choongang General Hospital	Taegu Catholic University Hospital
Taegu Fatima Hospital	Taegu Verterans Hospital
Tae-jeon Eul-ji College Hospital	The Catholic University of Korea, Holy Family Hospital
The Catholic University of Korea, Kangnam St. Mary's Hospital	
The Catholic University of Korea, Our Lady of Mercy Hospital	
The Catholic University of Korea, St. Mary's Hospital	
The Catholic University of Korea, St. Vincent's Hospital	
The Catholic University of Korea, Uijongbu St. Mary's Hospital	
Wallace Memorial Baptist Hospital	
WonJu Christian Hospital, Won Ju College of Medicine, Yonsei University	
WonKwang University Hospital	
Yonsei Medical Center, Yong-Dong Severance Hospital	
	Andong General Hospital
	Asan Foundation Kangnung Hospital
	Bag Ae Hospital
	Bupyeong Serim General Hospital
	Capital Armed Forces General Hospital
	Catholic GEN Hospital
	ChonBuk National University Hospital
	Chonnam University Hospital
	Chosun University Hospital
	ChungAng University Medical Center
	Chungnam National University Hospital
	Dae Dong Hospital
	Daegu Medical Center
	Dong Kang General Hospital
	Dong-A University Hospital
	Dongguk University Kyong Ju Hospital
	Dong-Kuk University Po-Hang Hospital
	Eulji Medical Center
	Ewha Womans University Tongdaemun Hospital
	Gangneung Medical Center
	Hae Dong Hospital
	Hallym University Hang Gang Sacred Heart Hospital
	Hangdong University Sunlin Presbyterian Hospital
	Hanyang University Hospital
	Il Sin Christian Hospital
	Inchon Christian Hospital
	Inchun Choongang General Hospital
	Inha University Medical Center Inha Hospital
	Inje University, Seoul Paik Hospital
	Kang Dong Sacred Heart Hospital
	Kangnam General Hospital Public Corporation
	Keimyung University Medical Center
	Kon Kuk University Medical Center Seoul Hospital
	Korea University Ansan Hospital
	Korea University Hospital
	Kosin University Gospel Hospital
	Kwang Ju Christian Hospital
	Kwang Myung Sung Ae General Hospital
	Kyung Hee Medical Center
	Local Public Corp. Inchun Medical Center
	Maryknoll General Hospital
	Masan Sungmo General Hospital
	Missionary Benedictine Sisters Fatima Hospital
	Nam Kwang Hospital
	National Medical Center
	Pohang St. Mary's Hospital
	Pundang Je-Saeng Hospital
	Pusan Medical Center
	Saehan Hospital
	Samsung Cheil Hospital & Women's Health Care Center
	Seo San Medical Center
	Seoul Christian Hospital
	Seoul National University Hospital
	Severance Hospital Yonsei University Medical College
	Soonchunhyang University Chonan Hospital
	St. Francisco General Hospital
	Sung Ae Hospital
	Taegu Catholic University Hospital
	Taegu Verterans Hospital
	The Catholic University of Korea, Holy Family Hospital
	The Catholic University of Korea, St. Paul's Hospital
	The Catholic University of Korea, Taejon St. Mary's Hospital
	Ulsan University Hospital
	Yeungnam University Medical Center
	Young Dong Hospital
