

Cancer Incidence of Korean Veterans

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Objectives: The purpose of this study is to understand the rate of cancer incidence in veterans hospitals, which is in charge of care and treatment of Korean veterans, as Korea is accelerating its entry into the aging society. **Methods:** Cancer incidence data from January 1st 2013 to June 30th 2016 were obtained from Veterans hospitals in 5 different regions, nationwide. The incidence was defined by the number of cancer patients diagnosed in 2013. We investigated the sociodemographic and clinical characteristics of subjects. CR rates and ASR were calculated. **Results:** In 2013, 2,070 Korea veterans out of 672,532 were newly diagnosed with cancer which was 0.3% of the total. Vietnam War veterans showed the highest rate of cancer incidence. Prostate cancer was the most commonly diagnosed cancer and followed by stomach, lung, colorectal and liver cancer. The total CR for overall cancer incidence of veterans was 307.8 and the CR for prostate cancer was the highest (59.2) followed by stomach (51.0), lung (50.6), colorectal (48.2), and liver (22.9). Furthermore, the total ASR rates were 51.1 followed by lung (8.9), prostate cancer (8.8). **Conclusions:** In 2013, there were 2,070 veterans who were newly diagnosed cancer and over 97.9% of them were over the age of 60. Compared to IR for overall cancer incidence of the non-veteran Koreans (52.8%), the rate of IR of veterans (97.9%) were 1.8 times higher. Like that, at considering the characteristic of war veterans that elderly population rate is much higher comparing to the whole population in Korea, it is expected that the cancer incidence of war veterans will be continually increased.

Key words: Cancer, Veterans, Incidence rate, Crude rate, Age standardized rates

INTRODUCTION

The patriots and veterans affairs exists for supporting veterans, patriots and their families who sacrificed for Korea. Therefore, veteran hospitals provide medical and welfare services for patriots, veterans, and their families as public agency.

The Korean Veteran Almanac [1] in 2011 showed the rates of veterans who were above the age 65 was 66.6%. Compared to the standard of aging society defined by United Nations, aging of veterans is serious. The ratio of veterans diagnosed chronic diseases like cancer, diabetes mellitus, hypertension was 28.6% higher than the 18.4% for other patients who diagnosed chronic diseases in hospitals for common people.

The number of veterans who were diagnosed with severe diseases like cancer, were keep growing and it took 60% of care trusts [2]. Both the

aging and the number of cases diagnosed chronic diseases and cancer of veterans were higher than common people.

The national cancer registration program was launched in 1980 followed by constructing national medical center. Since 2000, after the national cancer center was founded, the national cancer control administration team is in charge. Also, the cancer control act, enacted in 2003, enabled national and regional cancer control administration teams take part in important role in research of national cancer registration and statistics. Cancer incidence of Korea is calculated by data of over 200 hospitals in Korea and data of National Health Insurance Service (NHIS). The ministry of health and welfare collects data of cancer cases, makes DB and publishes annual report of national cancer registration and statistics in Korea.

Recently, aging of veterans is rapidly increasing and we expect cancer

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incidence will also increase. So, in this report, we will figure out annual cancer incidence of veterans. As the cancer incidence in Korea is increased annually, it is expected that super-elderly war veterans' cancer incidence will be increased, so the purpose of this study was to recognize the cancer incidence by identifying the characteristics of veteran cancer patients by age, primary site and veteran type.

We analyzed veterans who diagnosed cancer as follows: Identifying cancer incidence of veterans and figuring out veteran sociodemographic feature and clinical characteristics. Analyzing and comparing common cancer sites, CR, ASR, and SIR among different types of veterans.

METHODS

Data sources

The objects of this research are veterans who diagnosed cancer at veteran's hospitals, who diagnosed cancer at common hospitals and re-registered to veteran's hospital for saving costs and who request trusts to other hospitals.

In most cases, if a veteran diagnosed cancer, he would like to visit veterans' hospital for having cost reduction and grading. Veteran hospital managed clients by providing immediate treatments who diagnosed cancer and connecting clients to care trusts who live in long distance from veteran hospitals.

Data of cancer incidence of veterans as follows:

- (1) Newly diagnosed cancer statistics in 2013 gained at 5 veterans hospitals.
- (2) Incomplete data of cancer suspected cases obtained by national cancer control administration (Statistics of severe disease-cancer cases, nonregistered cancer cases calculated by NHIS).
- (3) Nonregistered data of cancer mortality rates in 2013 provided by Statistics Korea.
- (4) The data registered in veterans hospitals' program. There are 9 variables-types, ages, regions, first medical examination date, sites, differentiation, diagnosis method, treatment method and SEER code used for analyzing veterans' cancer cases. The cohort of this research is veterans who firstly diagnosed cancer and registered in 2013.

Statistical analysis

The study subjects are veterans who were newly diagnosed with can-

cers in 2013 and also including late-registered cases from January 1st, 2013 to June 30th, 2013. The investigation period is 6 months from July 1st to December 31st, 2016.

When there is a case that has multiple primary cancers, it contained respectively as registered in national cancer registration and statistics. The total number of veterans diagnosed cancer were obtained from 5 veterans hospitals' electrical medical records, data bases and programs that contained veterans' personal information like names, resident registration number, disease information.

Rates were expressed as crude ratio (CR) per 100,000 individuals. The crude rate was calculated as the total number of incidence cases divided by the total number of veterans of the specified year. The age standardized rate (ASR) was weighted average calculated by rates of standard population of each age groups.

Moreover, the standardized incidence rates were calculated as the sums of the previous SIR divided by the sum of the expected SIR. Confidence interval (CI) above 1.0 were considered statistically significant. SPSS 23.0 (IBM Co., Armonk, NY, USA) were used to calculate the incidence and to perform the statistical analyses.

RESULTS

The cancer incidence by types and diagnosis methods

In 2013, a total of 2,070 veterans were newly diagnosed with cancer during the investigation period (Table 1). The Vietnam War veterans took the largest part (56.3%) followed by the Korean War (30.7%), Disabled Veterans (9.3%), National Merit guardian (3.0%), Public officials (0.5%) and Discharged veterans (0.2%). In 2013, 2,070 Korea veterans out of 672,532 were newly diagnosed with cancer which was 0.3% of the total. Vietnam War veterans showed the highest rate of cancer incidence.

There are 4 variables when analyzed by ages. The average age of veterans who diagnosed with cancer was 72.5, age between 60 and 69 was 47%, between 70 and 79 was 19.9% and age above 80 was 31% of total. Age above 60 accounted for 97.9%.

Considered region, veterans who live in Seoul and Gyeong-gi were 48.1%, followed by Gwangju/Jeolla Namdo/Bukdo (13.8%), and Busan (13.0%). Prostate cancer (19.2%) was the most common cancer in veterans, followed by stomach (16.6%), lung (16.4%), colorectal (15.7%), and liver (7.4%).

Table 1. The cancer incidence by veterans and methods of cancer treatments

Characteristics	n (%)	Characteristics	n (%)
Veterans types		Veterans types (cancer)	
Disabled veterans	192 (9.3)	Disabled veterans	118,076 (192)
Vietnam veterans	1,165 (56.3)	Vietnam veterans	260,494 (1,165)
Public officials	11 (0.5)	Public officials	4,787 (11)
6-25 War veterans	637 (30.7)	6-25 War veterans	167,857 (637)
National Merit guardian	64 (3.0)	National Merit guardian	64,480 (64)
Long-term veterans	4 (0.2)	Long-term veterans	56,838 (4)
		Total	672,532 (2,070)
Age (y)		Diagnosis method	
<60	44 (2.1)	Clinical only	120 (5.9)
60-69	973 (47.0)	Clinical investigations	249 (12.1)
70-79	412 (19.9)	Histology of primary	1,627 (79.7)
≥80	641 (31.0)	Histology of metastasis	47 (2.3)
		Cytology or hematology etc.	27 (1.3)
Primary site		By region	
1. Prostate	398 (19.2)	Seoul·Gyeonggi	995 (48.1)
2. Stomach	343 (16.6)	Incheon	65 (3.1)
3. Lung	340 (16.4)	Gangwon	42 (2.0)
4. Colon·rectum	324 (15.7)	Busan·Gyeongnam	269 (13.0)
5. Liver	154 (7.4)	Daegu·Gyeongbuk	251 (12.2)
6. Bladder	107 (5.2)	Gwangju·Jeolla	286 (13.8)
7. Pancreas	57 (2.7)	Daejeon·Chungcheong	162 (7.8)
8. Thyroid	42 (2.0)	Total	2,070 (100.0)
9. Esophagus	40 (1.9)		
10. Myeloma	33 (1.6)		
Total	2,070 (100.0)		

Number of cancer cases and cancer incidence rate among veterans

This table shows incidence rates by cancer sites and number of cases Table 2. The most common cancer site was prostate (19.2%) followed by stomach cancer (16.6%), lung (16.4%), and colorectal (15.7%). The incidence rate of veterans calculated by standard population was 51.1 per 100,000, followed by stomach (8.9%), prostate (8.8%), colorectal (7.8%), and lung cancer (6.0%).

The crude and standardized cancer incidences by cancer sites

Considering types and sites, the Vietnam War veterans (56.3%) ranked the highest and the most commonly diagnosed cancer type was prostate cancer (20.9%, CR 36.1), followed by colorectal (17.2%, CR 29.7), stomach (16.5% CR 28.6), lung (13.4%, CR 23.2), and liver (6.9%, CR 12.0).

The Korean War veterans (637, 30.7%) hold the second rank, the most common cancer site was lung (22.1%, CR 30.0), followed by prostate (16.6%), stomach (14.7%), colorectal (13.2%), and liver (8.3%). Disabled Veterans were 9.3% of total, the most common cancer was stomach (22.4%), followed by prostate (16.2%), lung (15.1%), colorectal (13.5%), and liver (8.3%). Next, National Merit Veterans were 3.0% of total, lung cancer (20.3%) was the most common cancer, followed by colorectal (20.3%), prostate (18.8%), stomach (17.2%), and bladder (6.7%) (Table 3). Among types of veterans, public officials and discharged soldiers were not considered because of low number of cases.

Table 2. Number of cancer cases and cancer incidence rate among veterans, 2013 (per 100,000 persons, per year)

Characteristics	Number of cases by age group				Total (%)	Incidence rate crude	ASR ¹
	<60	60-69	70-79	≥80			
All site	44	973	412	641	2,070 (100.0)	307.8	51.1
Prostate	3	190	108	97	398 (19.2)	59.2	8.8
Stomach	12	174	57	100	343 (16.6)	51.0	8.9
Lung	5	131	62	142	340 (16.4)	50.6	6.0
Colon & rectum	8	160	67	89	324 (15.7)	48.2	7.8
Liver	2	78	21	53	154 (7.4)	22.9	3.1
Bladder	1	48	23	35	107 (5.2)	15.9	2.6
Pancreas		27	8	22	57 (2.7)	8.5	1.0
Thyroid	3	28	9	2	42 (2.0)	6.2	2.1
Esophagus	1	18	6	15	40 (1.9)	5.9	0.9
Myeloma	3	12	7	11	33 (1.6)	5.8	1.9

¹ASR, age standardized rate (Korea; 2000 mid-year population).

Table 3. The crude and standardized cancer incidences by cancer sites

Ranking	Disabled veterans		Vietnam veterans		Korean War veterans		National Merit veterans	
	n (%)	CR	n (%)	CR	n (%)	CR	n (%)	CR
1st	Stomach 43 (22.4)	6.4	Prostate 243 (20.9)	36.1	Lung 141 (22.1)	30.0	Lung 13 (20.3)	1.9
2nd	Prostate 31 (16.2)	4.6	Colon·Rectum 200 (17.2)	29.7	Prostate 106 (16.6)	15.8	Colon·Rectum 13 (20.3)	1.9
3rd	Lung 29 (15.1)	4.3	Stomach 192 (16.5)	28.6	Stomach 93 (14.7)	13.8	Prostate 12 (18.8)	1.8
4th	Colon·Rectum 26 (13.5)	3.9	Lung 156 (13.4)	23.2	Colon·Rectum 84 (13.2)	12.5	Stomach 11 (17.2)	1.7
5th	Liver 16 (8.3)	2.4	Liver 81 (6.9)	12.0	Liver 53 (8.3)	7.9	Bladder 4 (6.7)	0.6
6th	Myeloma 7 (0.3)	1.0	Bladder 62 (5.3)	9.2	Bladder 35 (1.7)	5.2	Liver 3 (0.1)	0.5
7th	Bladder 6 (0.3)	1.0	Pancreas 34 (1.6)	5.1	Pancreas 19 (0.9)	2.8	Pancreas 1 (0.0)	0.2
8th	Thyroid 6 (0.3)	1.0	Thyroid 33 (1.6)	5.0	Gallbladder 18 (0.9)	2.7	Kidney 1 (0.0)	0.2
9th	Esophagus 3 (0.1)	0.5	Kidney 17 (0.8)	2.5	Esophagus 17 (0.8)	2.5	Skin 1 (0.0)	0.2
10th	Pancreas 3 (0.1)	0.5	Skin 16 (0.7)	2.5	Kidney 11 (0.5)	1.7	Ureter 1 (0.0)	0.2
Etc	Kidney etc. 22 (11.5)	-	Myeloma etc. 131 (11.3)	-	Myeloma etc. 60 (9.4)	-	Myeloma etc. 4 (6.7)	-
Sum	192 (100.0)	28.6	1,165 (100.0)	173.2	637 (100.0)	94.7	64 (100.0)	9.5

CR, crude ratio.

Crude rates were expressed as crude ratio (CR) per 100,000 individuals.

Comparison the crude rates and standardized incidence rates between veterans and ordinary Korean by primary cancer site

CR of veterans' primary cancer site was 307.8, lower than 445.7 of CR of common Koreans in 2013 (Table 4). Prostate cancer (59.2) was the most common primary site, followed by stomach (51.0), lung (50.6), colorectal (48.2), and liver (22.9). Compared to CR of common Korean male, stomach cancer (59.7) was the highest, followed by colon & rectum (54.6), lung (45.8), liver (32.0), prostate (18.8), the CR of veterans were lower. The SIR of veterans was 0.7 (95% CI, 0.6-0.8) and it also showed lower than SIR of the ordinary Koreans.

Especially, veterans' cancer incidence of stomach, colon & rectum, liver, pancreas, thyroid and gallbladder cancer showed lower than common subjects. However, prostate cancer (3.2), followed by bladder (2.1), esophagus (1.3), and lung (1.1) were statistically higher in veterans.

DISCUSSION

There are many factors that affect to cancer incidence like environ-

Table 4. Comparison the crude and standardized cancer incidences by cancer sites between veterans and ordinary Koreans

Characteristics	Veterans CR	Ordinary people CR ¹	SIR	95% CI
All site	307.8	445.7	0.7	0.6-0.8
Prostate	59.2	18.8	3.2	3.0-3.4
Stomach	51.0	59.7	0.9	0.7-1.0
Lung	50.6	45.8	1.1	1.0-1.3
Colon & rectum	48.2	54.6	0.9	0.8-1.0
Liver	22.9	32.0	0.7	0.5-0.8
Bladder	15.9	7.4	2.1	1.9-2.2
Pancreas	8.5	10.9	0.8	0.7-0.9
Thyroid	6.2	84.1	0.1	0.0-0.3
Esophagus	5.9	4.7	1.3	1.1-1.4
Myeloma	5.8	10.4	0.6	0.5-0.8

CR, crude rate; SIR, standardized incidence ratio; CI, confidence interval.

¹Ordinary people CR: Annual report of cancer statistics in Korea in 2013, Ministry of Health and Welfare, 2015.

ment, region, sex, etc. In 2013, the most common cancers in Korean men were stomach, followed by colorectal, lung, liver, and prostate. In case of Korean women, thyroid cancer was the most, and then breast, colorectal, stomach, and lung cancer was common [3].

In 2013, 5,280 veterans out of 672,532 (the total number of veterans) were diagnosed with cancer. Moreover, veterans newly diagnosed with cancer are 2,070 and it took 0.3% of total. Among the veterans who diagnosed with cancer (5,280), the newly diagnosed cases were 39.2%.

This report chiefly managing about cancer in male veterans because male veterans were 99.9% of total. There are only 2 women veterans (0.01%).

The most common type of veterans who diagnosed with cancer was Vietnam War veterans (56.3%). The average age of veterans who diagnosed with cancer is 72.5 and Vietnam War veterans are between 60 and 80 so that's why they showed the highest rate of cancer incidence. Furthermore, considering average age of Korean male is 78 [4], high portion of Vietnam War veterans makes sense.

When it comes to age, in 2013 among Korean who diagnosed with cancer, 52.8% was age over 60 and 8.9% was age over 80 [5]. In case of veterans who diagnosed with cancer, age over 60 (97.9%) and age over 80 (31.0%). It shows aging in veterans are more rapidly increasing.

The most reported cancer site in veterans is prostate (19.2%), and also it is the most common cancer in Vietnam War veterans. The reason why prostate cancer is mainly showed in Vietnam War veterans is the herbicide used in Vietnam War. According to Veterans and Agent Orange [6], herbicides like Agent Green and Agent Orange are closely related to incidence of prostate, lung cancer and non-Hodgkin lymphomas.

The most common diagnosed cancer in Korean men 2013, was stomach cancer (17.8%) followed by colorectal cancer (14.6%), lung (14.2%), liver (10.6%) and prostate (8.4%). There is little difference in common cancer between whole Korean men and Korean veterans. According to annual report of national cancer registration and statistics in Korea, the most common cancers in OECD were prostate, colorectal and lung cancer. The result was similar with Korea, except stomach cancer was the most common in Korean.

According to cohort research in 2011, reported by Korea Occupational Safety and Health Agency [7], the most common cancer in workers was stomach (24.2%), followed by liver (17.0%), lung (10.6%), thyroid (4.4%), and non-Hodgkin lymphoma (2.8%). There is some difference in sites and ranks in case of veterans.

In analysis of CR of veterans, in 2013 [5], CR of Korean veterans who were diagnosed with cancer was 307.8. It was lower than CR of cancer case in annual report of national cancer registration and statistics (445.7) and in report of Yi [8] (431.6). However, CR of Korean veterans' cancer

incidence was higher than Korean workers (187.4) reported by Korea Occupational Safety and Health Agency. Prostate cancer, the most common in veterans, CR of veterans was 59.2 per 10, and it is higher than CR of prostate cancer in common Korean (18.8) and of Yi's [8] report (6.0).

The ASR of veterans in 2013 considering standard population was 51.1 per 100,000. The most common cancer was stomach (8.9) followed by prostate (8.8). When it comes to comparing the ASR of Koreans in 2013, the ASR was 311.6 per 100,000, followed by thyroid (71.3) and lung (38.9).

Comparing SIR between veterans diagnosed with cancer and ordinary Korean cancer patients, cancer SIR of veterans were 0.7, lower than ordinary Korean cancer patients. However, prostate cancer was 3.2 times higher in veterans, followed by bladder (2.1), esophagus (1.3), and lung (1.1). In contrast, cancer incidence of veterans were 3.2 times higher than ordinary Korean followed by bladder (2.1), esophagus (1.3), and lung cancer (1.1). SIR of Korean air force officials reported by Lim [9] was 0.2, higher than SIR of veterans and most of incidence rates of cancer sites were higher than air force officials. In case of cancer incidence of Vietnam War veterans reported by Yi [8], the cancer SIR of Vietnam War veterans 0.97 and it is lower than veterans. The SIRs of Vietnam War veterans were prostate (1.2), lung (1.0) and esophagus cancer (0.7) which was lower than veterans'. The report of cancer incidence in Ganghwa region by Lee [10], SIR of the regions were stomach (1.2), lung (1.4), liver (1.3) compared to SIR of veterans-stomach (0.9), lung (1.1), liver (0.7). The result shows SIR of veterans was lower.

CONCLUSION

In conclusion, in 2013, there were newly diagnosed cancer patients were 2,070 out of 672,532 veterans, and the most common type of veterans who diagnosed with cancer was Vietnam War veterans (56.3%). The most common site of cancer was prostate (19.2%) and it is different from the most common cancer in ordinary Koreans-stomach cancer. The veterans, age over 60, was 97.9% of total. The aging of veterans is rapidly increasing and it is one of the major cause of increasing cancer incidence. The cancer incidence rate of most common cancer of veterans per 100,000 was 51.1, the most common cancer was stomach cancer(8.9), followed by prostate cancer (8.8).

This report analyzed the common site of cancer, CR, ASR, of veterans

who were diagnosed with cancer. Therefore, I hope this study helps to encourage early diagnosis and prompt treatment for the elderly veterans and those who have experienced exposure to the local environment, which may have a significant impact on cancer development due to war.

This report is the first report of analyzing about cancer incidence of Korean veterans. The period of this study is about a year and it is the limitation of this study.

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국문초록

한국 보훈대상자의 암발생률

박운제·박소희

목적: 한국의 초고령화 사회로의 진입이 가속화됨에 따라 고령자가 많은 국가 보훈대상자의 진료 및 치료를 담당하는 보훈병원 내의 암 환자 수가 더욱 증가할 것으로 예상되어 우리나라 보훈대상자의 암 발생률을 파악하고자 한다.

방법: 전국 5개의 보훈병원에서 2013년 1월 1일부터 2016년 6월 30일까지의 자료를 바탕으로 2013년도 초진 암발생 환자의 의무기록 자료를 조사하였다. 보훈대상자 암환자의 인구사회학적 특성, 임상적 특성을 규명하고 조발생률 및 연령표준화발생률을 구하였다.

결과: 2013년 우리나라 보훈대상자 672,532명 중에서 초진 암환자는 2,070명으로 전체 보훈대상자 중 0.3%를 차지하였으며, 보훈대상자 유형별로는 베트남참전유공자가 가장 많았다. 호발 암 원발 부위별로는 전립샘암이 가장 많았고, 다음은 위암, 폐암, 대장·직장암, 간암 순으로 발생하였다. 보훈대상자의 암발생률에서 조발생률은 307.8명이었으며, 전립샘암이 59.2명으로 가장 많았고, 위암 51.0명, 폐암 50.6명, 대장·직장암 48.2명, 간암이 22.9명으로 뒤를 이었으며, 연령표준화발생률은 인구 10만 명당 51.1명, 위암 8.9명, 전립샘암 8.8명이었다.

결론: 2013년 보훈대상자 초진 암환자는 2,070명으로 그 중 60세 이상이 97.9%로서 우리나라 일반국민 암환자 60세 이상의 52.8%보다 암 발생률이 약 1.8배 높았다. 이와 같이 우리나라 전체 국민보다 고령 인구의 비율이 훨씬 높은 보훈대상자들의 특성을 고려했을 때 보훈대상자들의 향후 암발생률이 지속적으로 증가할 것으로 예상된다.

주제어: 암, 보훈대상자, 발생률, 조발생률, 연령표준화발생률