RESEARCH COMMUNICATION

The Association between Cancer Incidence and Family Income: Analysis of Korean National Health Insurance Cancer Registration Data

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Abstract

Background: Economic status is known to be directly or indirectly related to cancer incidence since it affects accessibility to health-related social resources, preventive medical checkups, and lifestyle. This study investigates the relationship between cancer incidence and family income in Korea. Methods:Using the Korean National Health Insurance cancer registration data in 2009, the relationship between their family income class and cancer risk was analyzed. The age-standardized incidence rates of the major cancers were calculated for men and women separately. After adjusting for age, residential area, and number of family members, cancer risks for major cancers according to family income class were estimated using a logistic regression model. Results: In men, the risk of stomach cancer for Income Class 5 (lowest) was 1.12 times (95% CI 1.02-1.23) higher than that of Income Class 1 (highest), for lung cancer 1.61 times (95% CI 1.43-1.81) higher, for liver cancer 1.22 times (95% CI 1.08-1.37) higher, and for rectal cancer 1.37 times higher (95% CI 1.18-1.59). In women, the risk of stomach cancer for Income Class 5 was 1.22 times higher (95% CI 1.08-1.37) than that for Income Class 1, while for cervical cancer it was 2.47 times higher (95% CI 2.08-2.94). In contrast, in men, Income Class 1 showed a higher risk of thyroid cancer and prostate cancer than that of Income Class 5, while, in women the same was the case for thyroid cancer. Conclusions: The results show the relationship between family income and cancer risk differs according to type of cancer.

Key words: Income class - cancer incidence - socioeconomic status - Korea

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Introduction

Every year, 10.9 million people in the world become new cancer patients, and 6.7 million people die of cancer, accounting for 12% of deaths. It is estimated that, if the trend continues, there will be 16 million new cancer patients each year with 10.3 million people dying of cancer in 2020 (WHO and UICC, 2005). In Korea, the number of deaths from cancer was 29,384 in 1983, accounting for 11.5% of total death, and 54,757 in 1999, accounting for 22.3% of total death. In 2009, the number of deaths from cancer was 70,779 (28.7%). Since 1983, when the statistical data on causes of death became available, cancer has continuously ranked as the first leading cause of death (Statistics Korea, 2011). The number of new cancer patients has also increased every year, from 101,032 in 1999 to 192,561 in 2009, showing an increase of 90.5% from 1999 (MOHW and NCC, 2011).

It is known that the health status, including life expectancy and mortality, is dependent on economic status. This is the case not only there exists differences in health level between developed and developing countries, but also, in the same country, between lower and higher income groups (Kunst, 2007; Kunst et al., 1995). According to the American Cancer Society, the death rate from cancer increases as the socioeconomic level decreases (Freeman, 1989). Individuals having a lower income and education level showed a higher death rate from cancer. The Institute of Medicine reported that socioeconomic and cultural factors have an influence on the cancer risk such as smoking, malnutrition, lethargy,

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and poverty (IOM, 2003). Income and education level as well as the availability of health insurance affected early cancer detection and treatment. A study conducted on 24 different cancers in 37 population groups in 21 countries showed that the cancer incidence rate was higher in the lower social classes. In men, the only exceptions were, rectal cancer, brain cancer, and melanoma and, in women, rectal cancer, breast cancer, ovarian cancer and melanoma (Faggiano et al., 1997). In men, the incidence of lung cancer, oro-pharyngeal cancer, esophageal cancer, and stomach cancer was higher in the lower social classes. In women, the incidence of esophageal cancer, stomach cancer, and cervical cancer was higher in the lower social classes.

In Korea, the cancer registration and statistics program was established by the Korea Central Cancer Registry to monitor and control cancers. The program has collected statistical data on cancer incidence and mortality (Cho et al., 2007; Jung et al., 2007; Khang and Kim, 2006; Song and Byeon, 2000; Won et al., 2009). However, still the dependency of the cancer incidence and mortality on socioeconomic status has not been sufficiently investigated in Korea. The purpose of this study was to verify the difference in the cancer incidence rate among various income levels in Korea using the cancer registration data from the Korean National Health Insurance.

Materials and Methods

Data sources and Study subjects

The data used in this study were the 2009 Korean National Health Insurance cancer registration data of the self-employed and medical aid beneficiaries. The total number of self-employed and medical aid beneficiaries in 2009 was 18,868,659. The newly diagnosed cancer patients were identified based on the claims data of Korean National Health Insurance between January 1 and December 31, 2009 which were sent by the hospitals having diagnosed and treated the patients and verified by the Health Insurance Review Agency. The number of newly diagnosed cancer patients in 2009 was 65,506.

Income class

The monthly premium of National Health Insurance at the end of December, 2009 was used as a proxy indicator of income class of each subject in this study. The monthly health insurance premium of the self-employed is determined based on earned income, asset income, property (including house and automobile), and the economic activity participation rate. The standardized income was calculated from the monthly health insurance premium data, with adjustments for family size. Income standardization is the method used by the Organization for Economic Cooperation and Development (OECD) to compare and analyze the income of different countries. In this study, the household equivalence scale was used, where the household income is divided by the square root of the family size (OECD, 2009). The subjects were then categorized into five income classes: Income Class 1, the highest intervals (80-100%), Income Class 2 (60-80%), Income Class 3 (40-60%), Income Class 4 (20-40%), and Income Class 5 as the lowest intervals (0%-20%).

Age, number of families, residential area, site of cancer

The age, residence, and family size of each subject were obtained from the database of National Health Insurance Corporation. The age, residence, and family size used were as of the end of December, 2009. Family size data were used to calculate the standardized income. The residence was classified into three groups according to the municipal administrative territory: metropolis, urban, and rural.

Statistical analysis

The age-standardized incidence rates (per 100,000

Table 1. Characteristics of the Study Population

Variables		Men Cancer Cases	CR*	Total	p-Value	Women Cancer Cases	CR*	Total	p-Value
		29,226	311.5	9,381,750		36,280	382.4	9,486,909	
Income Class					<.0001				<.0001
	Class1 (High)	5,846	311.8	1,874,777		7,258	382.5	1,897,369	
	Class2	5,844	311.6	1,875,445		7,258	382.3	1,898,425	
	Class3	5,843	311.0	1,878,929		7,248	382.8	1,893,291	
	Class4	5,858	328.7	1,781,925		7,246	382.6	1,888,788	
	Class5 (Low)	5,835	296.1	1,970,674		7,270	380.8	1,909,036	
Age					<.0001				<.0001
	≤39	1,929	39.6	4,875,740		5,606	124.4	4,507,001	
	40-49	4,014	204.5	1,963,124		10,008	510.7	1,959,786	
	50-59	7,424	531.1	1,397,800		9,041	679.2	1,331,197	
	60-69	8,386	1212.8	691,475		5,921	745.8	793,873	
	≥70	7,473	1647.4	453,611		5,704	637.3	895,052	
Residence**					<.0001				<.0001
	Metropolis	6,072	319.4	1,901,357		8,162	417.1	1,957,052	
	Urban	6,771	284.2	2,382,606		8,955	371.5	2,410,746	
	Rural	16,380	321.4	5,095,992		19,155	374.4	5,116,224	

* Crude incidence rate per 100,000 population;** 3 cases missing

Table 2. Age-standardized Incidence Rates for Major Cancers in Korean Men in 2009(per 100,000 populations)

Male		Income											
	Site	Class 1(High)		Class 2		Class 3		Class 4		Class 5(Low)		TOTAL	
	ICD-10	Cases	ASR*	Cases	ASR*	Cases	ASR*	Cases	ASR*	Cases	ASR*	Cases	ASR*
Stomach	C16	1,135	42.8	1,251	70.7	1,320	83.8	1,296	95.4	1,229	56.4	6,231	64.4
Lung etc	C33-C34	524	20.1	582	34.7	650	44.2	685	55.1	734	32.9	3,175	33.6
Liver	C22	533	19.9	607	32.3	632	38.0	622	42.7	668	31.0	3,062	30.9
Colon	C18	551	20.7	517	29.7	474	31.5	495	37.9	466	21.1	2,503	26.1
Rectum	C19-C21	344	13.1	419	23.3	408	25.9	437	31.7	441	20.5	2,049	21.1
Prostate	C61	672	25.6	423	27.3	340	25.4	268	24.2	328	13.1	2,031	22.1
Thyroid	C73	341	14.4	242	12.3	238	13.1	225	12.9	127	6.1	1,173	11.9
Bladder	C67	218	8.4	192	11.4	203	13.6	203	16.4	181	7.8	997	10.6
Kidney	C64-C66, C68	151	6.0	141	7.4	130	7.9	124	8.1	116	5.4	662	6.8
Non-Hodgkin Lymphoma	C82-C85, C96	100	4.3	124	7.0	107	6.5	108	6.9	125	6.0	564	5.9
Others	Re. C00-C97	1,277	51.4	1,346	75.6	1,341	84.2	1,395	99.0	1,420	66.6	6,779	70.9
All Cancer	C00-C97	5,846	226.7	5,844	331.6	5,843	374.1	5,858	430.3	5,835	266.9	29,226	304.2

* Age-standardized incidence rate per 100,000 population

Table 3. Age-standardized Incidence Rates for Major Cancers in Korean Women in 2009(per 100,000 populations)

Female		Income											
Site		Class 1(High)		Class 2		Class 3		Class 4		Class 5(Low)		TOTAL	
	ICD-10	Cases	ASR*	Cases	ASR*	Cases	ASR*	Cases	ASR*	Cases	ASR*	Cases	ASR*
Thyroid	C73	2,212	89.7	2,056	99.5	1,835	96.3	1,546	82.8	1,145	66.5	8,794	87.3
Breast	C50	1,256	49.3	1,348	63.5	1,322	68.0	1,283	67.9	1166	66.7	6,375	61.0
Stomach	C16	562	20.0	568	27.7	570	29.4	612	33.8	723	25.2	3,035	26.0
Colon	C18	375	12.9	326	15.9	319	17.0	328	18.2	428	14.9	1,776	14.9
Cervix uteri, Corpus uteri	C53, C54	199	8.0	234	11.3	315	16.9	447	24.2	461	24.3	1,656	15.7
Lung etc	C33-C34	320	11.2	278	13.4	304	16.4	301	16.9	406	14.5	1,609	13.8
Rectum	C19-C21	235	8.0	221	10.6	222	11.7	240	13.2	309	10.6	1,227	10.3
Liver	C22	153	5.4	158	7.8	157	8.6	177	10.1	230	9.2	875	7.5
Ovary	C56	110	4.4	127	6.4	129	6.6	125	6.6	151	8.2	642	6.1
Skin	C43-C44	107	3.9	89	4.3	109	5.6	92.0	4.9	163	3.9	560	4.2
Others	Re. C00-C97	1,729	71.6	1,853	91.7	1,966	103.3	2,095	112.1	2,088	101.5	9,731	92.5
All Cancer	C00-C97	7,258	284.4	7,258	352.2	7,248	379.8	7,246	390.8	7,270	345.6	36,280	339.3

* Age-standardized incidence rate per 100,000 population

population) of the major common cancers were calculated for men and women separately. A logistic regression analysis adjusted for the age and residential area was performed to estimate the cancer incidence risk according to income classes with an odds ratio and 95% confidence intervals. SAS (version 9.2) was used for all procedures.

Results

Table 1 presents the general characteristics of the subjects. According to the 2009 National Health Insurance cancer registration data, cancer cases included 29,226 men and 36,280 women.

Table 2 presents the age-standardized major cancer incidence rate (per 100,000 populations) in men. The major cancers, in order of incidence in men, were stomach cancer, lung cancer, liver cancer, colon cancer and rectal cancer. The incidence of top ten cancers accounted for 77% (22,447) of total cancer incidence in men. Table 3 presents the age-standardized major cancer incidence rate (per 100,000 populations) in women. The major cancers, in order of incidence in women, were thyroid cancer, breast cancer, stomach cancer, colon cancer, and cervical cancer. The incidence of the top ten cancers accounted for 73% (26,552) of the total cancer incidence in women.

Table 4 and 5 present the results of logistic regression of the relationship between income classes and cancer incidence risk. In men, the lowest income class (Class 5) showed higher risk of stomach cancer (OR 1.22 [1.02-1.23]), lung cancer (OR 1.61 [1.43-1.81]), liver cancer (OR 1.22 [1.08-1.37]), and rectal cancer (OR 1.37 [1.18-1.59]) than the highest income class (Class 1). In contrast, the incidence risk of thyroid cancer (OR 0.24 [0.20-0.30]) and prostate cancer (OR 0.56 [0.48-0.64]) was lower in income Class 5 than in income Class 1 (Table 4). In women, the lowest income class (Class 5) showed higher

risk of breast cancer (OR 1.49 [1.20-1.83]), stomach cancer (OR 1.22 [1.08-1.37]) and cervical cancer (OR 2.47 [2.08-2.94]) than in income Class 1. In contrast, the risk of thyroid cancer (OR 0.45 [0.41-0.48]) was lower in income class 5 than in income class 1 (Table 5).

Discussion

In this study, the relationship between income class and cancer incidence risk was analyzed using the Korean National Health Insurance cancer registration data of the self-employed insured and medical aid beneficiaries. In men, the incidence risk of stomach cancer, lung cancer, and rectal cancer increased as Income Class decreased. In women, the incidence risk of stomach cancer and cervical cancer increased as Income class decreased.

In Italy, the incidence risk of stomach cancer was higher among people of low income (1.3 times in men and 2.21 times in women) (Faggiano et al., 1997). In Finland, this risk was also higher (1.84 times in men and 1.36 times in women) (Pukkala, 1995). In Germany, the incidence risk of stomach cancer was 5.53 times higher among people of low income (the bottom 20%) (Geyer, 2008). The incidence risk of lung cancer, in Italy, was higher among people of low income (1.81 times in men) (Faggiano et al., 1994). For men in Finland it was 3.07 times higher (Pukkala, 1995) and for men in New Zealand it was 3.07 times higher (Blakely et al., 2011). In Germany, the incidence risk of lung cancer was 2.0 times higher among low-income individuals (the bottom 20%) (Geyer, 2008). However, in Finland, the incidence risk for lung cancer in women in low-income groups was 96% of that of high-income groups, showing an opposite pattern (Pukkala, 1995). The incidence risk for liver cancer among low-income groups was 2.0 times higher in Italy (Faggiano et al., 1994). A study conducted on the correlation between socioeconomic status and cancer mortality in Australia showed that the risk of death from liver cancer was 1.18 times higher among low-income individuals (Yu et al., 2008). The incidence risk of rectal cancer was 1.04 times higher among low-income individuals in Denmark (Egeberg et al., 2008). However, the incidence risk of rectal cancer was 87% of the mean among men in Ontario, Canada, and 94% in men and 98% in women in the U.S., indicating that the risk was lower among people in the high income group (Boyd et al., 1999; Mackillop et al., 2000). The incidence risk of cervical cancer was higher among low-income women in Australia (1.33 times) (Yu et al., 2008) and New Zealand (1.35 times) (Blakely et al., 2011). The incidence risk of cervical cancer was lower among high-income women in Ontario, Canada (0.71 times) and in the U.S. (0.69 times) (Mackillop et al., 2000). When compared with the results of other countries, the inequality in stomach cancer, lung cancer, and liver cancer between income levels seems to be relatively small in Korea.

Table 4. Odds Ratio of Having Cancer by Income Class, Age and Residence in Men

	Stomach	Lung etc	Liver	Colon	Rectum	Prostate	Thyroid	Bladder	Kidney	Non-Hodgkin lymphoma
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Income Class										
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	1.12 (1.03-1.23)	1.21 (1.07-1.38)	1.06 (0.93-1.20)	0.98 (0.87-1.11)	1.24 (1.07-1.44)	0.74 (0.65-0.84)	0.53 (0.45-0.63)	0.96 (0.79-1.17)	0.85 (0.67-1.07)	1.11 (0.85-1.45)
3	1.20 (1.10-1.32)	1.39 (1.23-1.57)	1.11 (0.98-1.25)	0.92 (0.81-1.05)	1.24 (1.06-1.44)	0.60 (0.52-0.69)	0.49 (0.41-0.58)	1.02 (0.84-1.24)	0.77 (0.61-0.98)	0.90 (0.68-1.19)
4	1.19 (1.08-1.30)	1.49 (1.32-1.69)	1.09 (0.96-1.23)	0.99 (0.86-1.11)	1.34 (1.15-1.55)	0.47 (0.41-0.55)	0.43 (0.36-0.52)	1.03 (0.84-1.25)	0.73 (0.57-0.93)	0.87 (0.66-1.15)
5	1.12 (1.02-1.23)	1.61 (1.43-1.81)	1.22 (1.08-1.37)	0.92 (0.81-1.05)	1.37 (1.18-1.59)	0.56 (0.48-0.64)	0.24 (0.20-0.30)	0.90 (0.73-1.10)	0.69 (0.54-0.89)	1.02 (0.78-1.34)
P*	<.0001	<.0001	0.1312	0.3211	0.0014	<.0001	<.0001	0.4807	0.0059	0.2095
Age										
≤39	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
40-49	2.58 (2.20-3.04)	1.10 (0.88-1.38)	3.88 (3.09-4.88)	1.90 (1.45-2.49)	2.18 (1.66-2.87)	9.64 (1.30-71.69)	0.56 (0.47-0.67)	1.81 (1.11-2.98)	1.04 (0.76-1.43)	0.42 (0.33-0.55)
50-59	2.46 (2.11-2.88)	1.69 (1.37-2.07)	3.47 (2.78-4.33)	2.66 (2.06-3.44)	2.65 (2.05-3.44)	51.04 (7.17-363.11)	0.28 (0.24-0.34)	2.74 (1.73-4.35)	0.90 (0.67-1.21)	0.26 (0.20-0.34)
60-69	2.46 (2.11-2.87)	2.49 (2.04-3.04)	2.19 (1.75-2.74)	2.94 (2.28-3.79)	2.30 (1.77-2.98)	159.18 (22.45-999.99)	0.12 (0.10-0.15)	3.41 (2.16-5.38)	0.63 (0.46-0.85)	0.20 (0.15-0.26)
≥70	2.11 (1.81-2.46)	2.72 (2.22-3.32)	1.41 (1.12-1.78)	2.78 (2.15-3.59)	1.94 (1.49-2.52)	303.51 (42.82-999.99)	0.05 (0.04-0.07)	5.43 (3.45-8.53)	0.41 (0.30-0.57)	0.20 (0.16-0.27)
Residence										
City	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Urban	1.20 (1.10-1.31)	1.08 (0.96-1.22)	1.14 (1.02-1.28)	0.91 (0.81-1.03)	0.84 (0.73-0.96)	0.90 (0.78-1.03)	0.78 (0.66-0.93)	1.08 (0.89-1.32)	1.03 (0.81-1.30)	0.89 (0.69-1.15)
Rural	1.13 (1.10-1.22)	1.24 (1.12-1.37)	1.05 (0.95-1.16)	0.84 (0.76-0.93)	0.94 (0.84-1.05)	0.83 (0.74-0.94)	0.79 (0.68-0.91)	1.11 (0.94-1.31)	1.09 (0.89-1.33)	1.01 (0.82-1.25)

* for odds ratio trend adjusted for all variables

Table 5. Odds Ratio of Having Cancer by Income Class, Age and Residence in Women

	Thyroid	Breast	Stomach	Colon	Cervix uteri, Corpus uteri	Lung etc	Rectum	Liver	Ovary	Skin
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Income Class										
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.83 (0.77-0.89)	1.17 (0.93-1.46)	1.09 (0.97-1.23)	0.99 (0.85-1.16)	1.17 (0.96-1.41)	0.95 (0.81-1.12)	1.05 (0.87-1.27)	1.17 (0.93-1.46)	1.14 (0.88-1.48)	0.92 (0.69-1.22)
3	0.70 (0.65-0.75)	1.19 (0.95-1.50)	1.11 (0.98-1.25)	1.02 (0.87-1.19)	1.59 (1.32-1.91)	1.07 (0.91-1.26)	1.10 (0.91-1.33)	1.19 (0.95-1.50)	1.17 (0.90-1.51)	1.11 (0.84-1.46)
4	0.55 (0.51-0.59)	1.39 (1.11-1.74)	1.23 (1.09-1.39)	1.08 (0.92-1.26)	2.30 (1.94-2.74)	1.08 (0.92-1.27)	1.23 (1.02-1.48)	1.39 (1.11-1.74)	1.12 (0.86-1.45)	0.94 (0.71-1.26)
5	0.45 (0.41-0.48)	1.48 (1.20-1.83)	1.22 (1.08-1.37)	1.12 (0.97-1.30)	2.47 (2.08-2.94)	1.20 (1.03-1.40)	1.29 (1.08-1.53)	1.48 (1.20-1.83)	1.42 (1.11-1.83)	1.15 (0.90-1.49)
P*	<.0001	0.0039	<.0001	0.2547	<.0001	0.0869	0.0185	0.0039	0.5639	0.0964
Age										
≤39	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
40-49	0.90 (0.84-0.97)	1.77 (1.24-2.54)	1.69 (1.43-1.99)	2.38 (1.77-3.21)	1.09 (0.94-1.27)	1.06 (0.84-1.33)	2.93 (2.07-4.16)	1.77 (1.24-2.54)	0.92 (0.73-1.16)	0.59 (0.38-0.94)
50-59	0.78 (0.73-0.84)	3.20 (2.27-4.51)	2.22 (1.89-2.62)	5.27 (3.96-7.01)	1.01 (0.86-1.18)	2.20 (1.78-2.71)	5.54 (3.94-7.77)	3.20 (2.27-4.51)	0.90 (0.71-1.15)	1.19 (0.79-1.79)
60-69	0.44 (0.40-0.48)	6.86 (4.90-9.59)	3.71 (3.15-4.37)	9.00 (6.77-11.96)	0.97 (0.82-1.16)	3.33 (2.69-4.12)	7.23 (5.13-10.18)	6.86 (4.90-9.59)	0.72 (0.55-0.96)	2.76 (1.88-4.05)
≥70	0.15 (0.13-0.16)	6.41 (4.58-8.98)	5.20 (4.43-6.10)	11.75 (8.86-15.57)	0.72 (0.60-0.87)	4.61 (3.75-5.67)	11.10 (7.94-15.53)	6.41 (4.58-8.98)	0.65 (0.49-0.86)	8.72 (6.15-12.4)
Residence										
City	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Urban	1.04 (0.97-1.12)	1.20 (0.98-1.49)	1.22 (1.08-1.37)	0.98 (0.85-1.14)	1.04 (0.90-1.20)	1.10 (0.94-1.29)	0.96 (0.81-1.15)	1.20 (0.98-1.49)	0.80 (0.63-1.01)	0.90 (0.69-1.18)
Rural	1.00 (0.94-1.07)	1.26 (1.05-1.52)	1.25 (1.13-1.38)	1.00 (0.89-1.13)	1.03 (0.91-1.17)	1.22 (1.07-1.40)	1.08 (0.93-1.25)	1.26 (1.05-1.52)	0.98 (0.81-1.19)	1.10 (0.88-1.38)

** for odds ratio trend adjusted for all variables

In men, prostate cancer and thyroid cancer showed the higher risk in the highest income class. In women, the risk of thyroid cancer increased as income class increased. According to a study conducted in California, U.S., among African-Americans, non-Hispanic Whites, Hispanics and Asian/Pacific Islanders, the prostate cancer incidence risk was 1.28 times higher in the high socioeconomic class than in the low one (Cheng et al., 2009). A study conducted in Columbia also showed that the prostate cancer incidence risk was higher in the high socioeconomic class (Cuello et al., 1982; Teppo, 1984). According to a survey conducted in Wisconsin, U.S., on the incidence of thyroid cancer between 1980 and 2004, thyroid cancer incidence increased by 0.5 per 100,000 persons as median income increased by $10,000 (Sprague et al., 2008).

The Korean National Health Insurance provides regular health check-up benefit which includes screening tests for major cancers (stomach, breast, colorectal, cervical, and liver) for all adults over 40 in every 2 years. However, many people who are usually wealthy voluntarily buy the more expensive comprehensive medical check-up which usually includes the screening for the thyroid and prostate cancer (Kim et al., 2011). The reason why the incidence risk of thyroid cancer and prostate cancer was higher in the higher income class may be because of the higher rate of early detection of those cancers in this class, since higher income individuals may undergo this kind of screening more often (Han et al., 2011).

Based on the previous studies and this study, it may be concluded that socioeconomic factors, such as income level, affects cancer incidence. Those who are in a low-income class may be less able to manage their health, participate in routine physical exercise, and undergo preventive health examinations while coping with the social structural circumstances of their occupational obligations and their family responsibilities. Previous studies showed that the probability of early cancer detection was lower in the lower socioeconomic classes (Halpern et al., 2007; Kaffashian et al., 2003; Schwartz et al., 2003; Yabroff and Gordis, 2003). Additionally, people in a low socioeconomic class may have less concern for their health. Those who are at a higher income level may follow a healthier lifestyle, have easy access to medical information, and enjoy more resources that are helpful to health (Galobardes et al., 2006; Liberatos et al., 1988).

However, it may not be sufficient to analyze the correlation between cancer incidence and income class, occupation, education, marriage, and life style to understand how socioeconomic factors affect cancer incidence. To understand how socioeconomic factors affect cancer incidence, data need to be collected and analyzed in a life-course perspective. For example, the socioeconomic factors such as occupation, income, and education level may have a life-long effect on health disparity. In addition, health status should be considered as a complex result of biological, physiochemical, and social factors. Thus, it is necessary to develop an extensive understanding of the cancer incidence mechanism by collecting and analyzing data on socioeconomic factors as well as socio-cultural and psychological factors.

The results of this study might have underestimated the disparity of the cancer incidence risk among income classes because the low income classes may take less advantage of medical services. In addition, this study does not consider other indicators of socioeconomic status besides income class, such as education, occupation, and marital status and thus the socioeconomic status of the subjects might not have been comprehensively reflected. Future studies may need to include other socioeconomic indicators, such as educational level and marital status, which may have direct and indirect effects on economic status and occupation. In spite of the limitations, this study is significant in the following aspects. First, the income class parameter was derived from the monthly health insurance premium. Since the monthly health insurance premium is determined on the basis of income class, it may be considered as an appropriate criterion for classifying income classes. In practice, it is difficult to obtain accurate income data in this kind of study. The income data collected through interviews are hardly reliable. The monthly health insurance premium is considered as a highly reliable proxy indicator of actual income class. Second, previous studies were conducted on a single type of cancer or a few types of cancer. Some of the studies were conducted on cancer patients registered in hospitals. However, this study incorporated all the people who made use of medical services because of cancer and, thus, they were enlisted in the National Health Insurance cancer registration data, one of the representative public data sources in Korea for the self-employed insured and medical aid beneficiaries. This data source enabled a thorough investigation of the relationship between income class and cancer incidence.

This study showed that there is an economic inequality in the incidence of cancer in Korea. The results of this study will provide basic data to enable intensified early cancer detection for those who are at a low socioeconomic level and in a vulnerable class as well as continuous and appropriate management in order to ultimately reduce the disparity of cancer incidence risk among the income classes.

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