RESEARCH ARTICLE

Factors Associated with Organized and Opportunistic Cancer Screening: Results of the Korea National Health and Nutrition Examination Survey (KNHANES) 2007-2011

Minsun Kang[1], Ki-Bong Yoo[1,2], Eun-Cheol Park[2,3], Kisung Kwon[4], Gaeun Kim[5], Doo Ree Kim[6], Jeoung A Kwon[1,2]*

Abstract

Background: Cancer is one of the leading causes of death in Korea. To reduce cancer incidence, the Korean National Cancer Center (KNCC) has been expanding its organized cancer screening program. In addition, there are opportunistic screening programs that can be chosen by individuals or their healthcare providers. The purpose of this study was to investigate factors associated with participation in organized and opportunistic cancer screening programs, with a particular focus on socioeconomic factors. Materials and Methods: We used data from the Korea National Health and Nutrition Examination Survey (KNHANES), a cross-sectional nationwide study conducted by the Korean Ministry of Health and Welfare from 2007 to 2011. The study included information from 9,708 men and 12,739 women aged 19 years or over. Multinomial logistic regression analysis was conducted, adjusting for age, year of data collection, residential region, current smoking status, current alcohol consumption status, exercise, marriage status, job status, perceived health status, stress level, BMI, limitation of activities, cancer history, health insurance type, and private insurance status, to investigate the association between education level, economic status, and cancer screening participation. Results: In terms of education level, disparities in attendance were observed only for the opportunistic screening program. In contrast, there was no association between education level and participation in organized screening. In terms of economic status, disparities in opportunistic screening participation were observed at all income levels, but disparities in organized screening participation were observed only at the highest income level. Conclusions: Our findings reveal that socioeconomic factors, including educational level and economic status, were not significantly associated with participation in organized cancer screening, except at the highest level of income.

Keywords: Socioeconomic position - education levels - cancer screening - organized - opportunistic

Asian Pac J Cancer Prev, **15 (7)**, 3279-3286

Introduction

Cancer is the most common cause of death in Korea (Statistics Korea, 2011). In 2009, 69,780 people died of cancer, accounting for 28.3% of all deaths in Korea. That year, the incidence was 398.9 per 100,000 men and 376.9 per 100,000 women; it had increased rapidly from 1999 to 2009, growing annually by 3.3% (Jung et al., 2012).

Because of the high incidence of cancer, the Korean National Cancer Center (KNCC) has been constantly expanding its organized cancer screening program (Park et al., 2012). The KNCC's National Cancer Screening Program (NCSP) has been in operation since 1999 (Park et al., 2012). In the beginning, the NCSP for gastric (Lee et al., 2011), breast (Kang et al., 2013), and cervical (Jun et al., 2009) cancer was available only to Medical Aid enrollees, a low-income population. Liver (Lee et al., 2010) and colorectal (Shim et al., 2010) cancer screening were added in 2003 and 2004, respectively. Since 2006, the NCSP has provided screening free of charge for both Medical Aid enrollees and National Health Insurance (NHI) beneficiaries with incomes in the lower half of the distribution (Park et al., 2012). NHI beneficiaries with a higher income can receive screening by paying 10% of the cost; the remaining 90% of screening costs are subsidized (Park et al., 2012). Opportunistic screening is also available to individuals and their health-care providers (Miles et al., 2004).

Organized screening could play a significant role in reducing the incidence and mortality of cancer by providing a broad range of coverage (Miles et al., 2004). However, the availability of organized screening does

*[1]Department of Public Health, Graduate School, [6]College of Nursing, [2]Institute of Health Services Research, [3]Department of Preventive Medicine, College of Medicine, Yonsei University, [4]Department of Physical Education, Seoul National University, [5]College of Nursing, Keimyung University, Korea *For correspondence: kwon1984@yuhs.ac*

not always guarantee that inequalities in attendance will be minimal (Spadea et al., 2010). Also, several studies have reported that differences in characteristics such as age, civil status, and socioeconomic position (SEP) are associated with whether an individual receives screening (Ronco et al., 1997) and coverage (Ronco et al., 1991; Borras et al., 1999). Here, SEP includes social and economic status, factors which reflect an individual's place in society. SEP incorporates, for example, education level, income, and wealth (Shaw, 2007). To date, few studies have investigated factors associated with attendance for the two different types of cancer screening in Korea (Park et al., 2012; Suh et al., 2013). To target programs efficiently, it is necessary to understand the factors related to screening attendance. Understanding the factors associated with inequalities in attendance according to screening type is also important. The aim of this study was to describe the factors associated with organized and opportunistic cancer screening program attendance.

Materials and Methods

Subjects

This study used Korea National Health and Nutrition Examination Survey (KNHANES) data, which is cross-sectional nationwide data collected from 2007 to 2011. KNHANES is conducted by the Korean Ministry of Health and Welfare. Sampling in this survey was conducted using a stratified, multistage, clustered probability sampling method (Korea Centers for Disease Control and Prevention, 2012)

The survey has three components: a health interview, a nutrition survey, and a health examination. To obtain the data, household interviews and physical examinations were conducted. An informed consent form was acquired from all participants. The KNHANES website provides survey data to the public. Therefore, ethical approval was not required to analyze KNHANES data.

The total sample size for data collected from 2007 to 2011 was 42,347. Of these individuals, 8,518 were 19 years of age or younger and not included in the analysis. Also, missing data were not analyzed. In the end, 9,708 men and 12,739 women 19 years of age or older were included in the study.

Dependent variable

History of cancer was assessed by asking, "In the last 2 years, have you had a cancer screening?" The responses were: (1) no; (2) yes, opportunistic cancer screening; and (3) yes, organized cancer screening.

Independent variables of primary interest

Educational level was assessed by asking, "What is your educational level?" Response options were: (1) elementary school, (2) middle school, (3) high school, or (4) college or higher. Economic status was evaluated by household monthly income quartile, and the response options were: (1) Q1, (2) Q2, (3) Q3, and (4) Q4. Q1 is the lowest quartile, and Q4 is the highest.

Covariates

The sociodemographic factors considered were age, residential region, marriage status, health insurance type, private insurance status, and job status. Age data were obtained from KNHANES and assigned to four categories: 19-39, 40-59, 60-79, and 80 years of age or older. Residential region had two categories: metropolis (Seoul, Busan, Daegu, Incheon, Kwangju, Daejeon, and Woolsan) or town/country (Kyungki, Kangwon, Chungbuk, Chungnam, Jonbuk, Jonnam, Kyungbuk, Kyungnam, and Jeju). Marriage status also had two categories: married or not married. Health insurance categories included local national health insurance, corporate national health insurance, and Medical Aid (Kwon, 2009). Private insurance status was a dichotomous

Table 1. Characteristics of Subjects (Men)

Variables		Gastric cancer (n=7,272)	Liver cancer (n=7,016)	Colon cancer (n=5,148)
Age (years)	30-39			
	40-49	2,100 (28.9)	2,009 (28.6)	
	50-59	1,907 (26.2)	1,831 (26.1)	1,898 (36.9)
	60-69	1,782 (24.5)	1,721 (24.5)	1,775 (34.5)
	≥70	1,483 (20.4)	1,455 (20.7)	1,475 (28.7)
Year	2007	94 (1.3)	73 (1.0)	44 (0.9)
	2008	1,668 (22.9)	1,558 (22.2)	1,148 (22.3)
	2009	1,953 (26.9)	1,828 (26.1)	1,363 (26.5)
	2010	1,793 (24.7)	1,793 (25.6)	1,272 (24.7)
	2011	1,764 (24.3)	1,764 (25.1)	1,321 (25.7)
Region*	Metropolis	4,493 (61.8)	4,338 (61.8)	3,053 (59.3)
	Town or Country	2,779 (38.2)	2,678 (38.2)	2,095 (40.7)
Marriage status	Single	153 (2.1)	151 (2.2)	47 (0.9)
	Married	7,119 (97.9)	6,865 (97.9)	5,101 (99.1)
Current smoking	Nonsmoking	4,524 (62.2)	4,375 (62.4)	3,437 (66.8)
	Smoking	2,748 (37.8)	2,641 (37.6)	1,711 (33.2)
Current alcohol consumption	Nondrinking	1,506 (20.7)	1,455 (20.7)	1,283 (24.9)
	Drinking	5,766 (79.3)	5,561 (79.3)	3,865 (75.1)
Exercise	No	717 (9.9)	701 (10.0)	536 (10.4)
	Yes	6,555 (90.1)	6,315 (90.0)	4,612 (89.6)
Educational level	Elementary school	1,969 (27.1)	1,904 (27.1)	1,860 (36.1)
	Middle school	1,233 (17.0)	1,194 (17.0)	1,044 (20.3)
	High school	2,232 (30.7)	2,149 (30.6)	1,361 (26.4)
	College or higher	1,838 (25.3)	1,769 (25.2)	883 (17.2)
Economic status	Q1	1,537 (21.1)	1,477 (21.1)	972 (18.9)
	Q2	1,790 (24.6)	1,790 (25.5)	1,315 (25.5)
	Q3	1,843 (25.3)	1,716 (24.5)	1,377 (26.8)
	Q4	2,102 (28.9)	2,033 (29.0)	1,484 (28.8)
Job status	Unemployed	2,063 (28.4)	1,996 (28.5)	1,907 (37)
	Employee	2,445 (33.6)	2,374 (33.8)	1,268 (24.6)
	Employer	2,764 (38.0)	2,646 (37.7)	1,973 (38.3)
Perceived health status	Very good	440 (6.1)	418 (6.0)	325 (6.3)
	Good	2,527 (34.8)	2,423 (34.5)	1,708 (33.2)
	Moderate	2,753 (37.9)	2,675 (38.1)	1,824 (35.4)
	Bad	1,295 (17.8)	1,250 (17.8)	1,045 (20.3)
	Very bad	257 (3.5)	250 (3.6)	246 (4.8)
Stress level	Mild	5,708 (78.5)	5,502 (78.4)	4,202 (81.6)
	Severe	1,564 (21.5)	1,514 (21.6)	946 (18.4)
Body mass index (kg/m^2)	≤18.4	234 (3.2)	228 (3.3)	196 (3.8)
	18.5-24.9	4,497 (61.8)	4,351 (62.0)	3,303 (64.2)
	≥25	2,541 (34.9)	2,437 (34.7)	1,649 (32.0)
Limitation in activities	Yes	1,188 (16.3)	1,151 (16.4)	1,066 (20.7)
	No	6,084 (83.7)	5,865 (83.6)	4,082 (79.3)
Cancer history	No	7,099 (97.6)	6,850 (97.6)	4,982 (96.8)
	Yes	173 (2.4)	166 (2.4)	166 (3.2)
Health insurance type	NHI (self)	2,795 (38.4)	2,675 (38.1)	1,898 (36.9)
	NHI (employee)	4,255 (58.5)	4,124 (58.8)	3,084 (59.9)
	Medicaid aid	222 (3.1)	217 (3.1)	166 (3.2)
Private insurance	No	2,803 (38.6)	2,718 (38.7)	2,519 (48.9)
	Yes	4,469 (61.5)	4,298 (61.3)	2,629 (51.1)
Cancer screening	No screening	5,034 (69.2)	4,778 (68.1)	3,488 (67.8)
	Opportunistic	828 (11.4)	828 (11.8)	592 (11.5)
	Organized	1,410 (19.4)	1,410 (20.1)	1,068 (20.8)

*n (%), Region: Metropolis (Seoul, Busan, Deagu, Inchoen, Kwangju, Daejeon, Woolsan), Town or country (Kyungki, Kangwon, Chungbuk, Chungnam, Jonbuk, Jonnam, Kyungbuk, Kyungnam, Jeju)

yes or no variable. Job status categories were unemployed, employee, or employer.

This study also included data on health behavior such as smoking, drinking, and exercise. Current smoking status encompassed two categories: nonsmoking and smoking. Current alcohol consumption status also encompassed two categories: nondrinking and drinking. Exercise was divided into two categories: no and yes. The year of data collection (2007-2011) was also considered.

In addition, we considered health status variables, including perceived health status, stress level, BMI, limitation of activities, and cancer history. Perceived health status was divided into 5 categories: very good, good, moderate, bad, and very bad. Stress level had two categories: mild or severe. BMI was categorized into less than 18.5 kg/m^2, 18.5-24.9 kg/m^2, and 25.0 kg/m^2 or more. Limitation of activities and cancer history were dichotomous yes/no variables.

Statistical analysis

Multinomial logistic regression analysis was conducted to investigate the associations between education level, economic status, and cancer screening. Our models adjusted for age, year of data collection, residential region, current smoking status, current alcohol consumption status, exercise, marriage status, job status, perceived health status, stress level, BMI, limitation of activities, cancer history, health insurance type, and private insurance status.

Odds ratios and 95% confidence intervals (CIs) were calculated, and statistical significance was set at $p<0.05$. Statistical analyses were performed using SAS, version 9.2 (SAS Institute Inc., Cary, NC, US).

Table 2. Characteristics of Subjects (Women)

Variables		Gastric cancer (n=9,681)		Liver cancer (n=9,498)		Colon cancer (n=6,900)		Breast cancer (n=9,676)		Cervical cancer (n=12,576)	
Age (years)	30-39									2,900	(23.1)
	40-49	2,746	(28.4)	2,703	(28.5)			2,745	(28.4)	2,745	(21.8)
	50-59	2,591	(26.8)	2,550	(26.9)	2,585	(37.5)	2,590	(26.8)	2,590	(20.6)
	60-69	2,273	(23.5)	2,212	(23.3)	2,259	(32.7)	2,272	(23.5)	2,272	(18.1)
	70£	2,071	(21.4)	2,033	(21.4)	2,056	(29.8)	2,069	(21.4)	2,069	(16.5)
Year	2007	76	(0.8)	69	(0.7)	36	(0.5)	76	(0.8)	104	(0.8)
	2008	2,371	(24.5)	2,286	(24.1)	1,664	(24.1)	2,366	(24.5)	3,133	(24.9)
	2009	2,672	(27.6)	2,581	(27.2)	1,846	(26.8)	2,672	(27.6)	3,467	(27.6)
	2010	2,230	(23.0)	2,230	(23.5)	1,619	(23.5)	2,230	(23.1)	2,928	(23.3)
	2011	2,332	(24.1)	2,332	(24.6)	1,735	(25.1)	2,332	(24.1)	2,944	(23.4)
Region*	Metropolis	5,964	(61.6)	5,850	(61.6)	4,036	(58.5)	5,961	(61.6)	8,053	(64.0)
	Town or country	3,717	(38.4)	3,648	(38.4)	2,864	(41.5)	3,715	(38.4)	4,523	(36.0)
Marriage status	Single	89	(0.9)	87	(0.9)	41	(0.6)	89	(0.9)	337	(2.7)
	Married	9,592	(99.1)	9,411	(99.1)	6,859	(99.4)	9,587	(99.1)	12,239	(97.3)
Current smoking	Nonsmoking	9,226	(95.3)	9,055	(95.3)	6,591	(95.5)	9,221	(95.3)	11,914	(94.7)
	Smoking	455	(4.7)	443	(4.7)	309	(4.5)	455	(4.7)	662	(5.3)
Current alcohol consumption	Nondrinking	4,451	(46.0)	4,368	(46)	3,724	(54.0)	4,449	(46.0)	5,122	(40.7)
	Drinking	5,230	(54.0)	5,130	(54)	3,176	(46.0)	5,227	(54.0)	7,454	(59.3)
Exercise	No	1,294	(13.4)	1,277	(13.4)	1,006	(14.6)	1,294	(13.4)	1,542	(12.3)
	Yes	8,387	(86.6)	8,221	(86.6)	5,894	(85.4)	8,382	(86.6)	11,034	(87.7)
Educational level	Elementary school	4,707	(48.6)	4,606	(48.5)	4,471	(64.8)	4,703	(48.6)	4,730	(37.6)
	Middle school	1,372	(14.2)	1,347	(14.2)	988	(14.3)	1,372	(14.2)	1,439	(11.4)
	High school	2,487	(25.7)	2,444	(25.7)	1,091	(15.8)	2,486	(25.7)	3,818	(30.4)
	College or higher	1,115	(11.5)	1,101	(11.6)	350	(5.1)	1,115	(11.5)	2,589	(20.6)
Economic status	Q1	2,675	(27.6)	2,614	(27.5)	1,931	(28)	2,338	(24.2)	2,764	(22.0)
	Q2	2,334	(24.1)	2,366	(24.9)	1,661	(24.1)	2,189	(22.6)	3,356	(26.7)
	Q3	2,162	(22.3)	2,041	(21.5)	1,632	(23.7)	2,639	(27.3)	3,307	(26.3)
	Q4	2,510	(25.9)	2,477	(26.1)	1,676	(24.3)	2,510	(25.9)	3,149	(25.0)
Job status	Unemployed	6,105	(63.1)	5,997	(63.1)	4,796	(69.5)	6,101	(63.1)	7,769	(61.8)
	Employee	2,193	(22.7)	2,166	(22.8)	1,193	(17.3)	2,193	(22.7)	3,155	(25.1)
	Employer	1,383	(14.3)	1,335	(14.1)	911	(13.2)	1,382	(14.3)	1,652	(13.1)
Perceived health status	Very good	331	(3.4)	328	(3.5)	218	(3.2)	331	(3.4)	445	(3.5)
	Good	2,764	(28.6)	2,712	(28.6)	1,781	(25.8)	2,763	(28.6)	3,793	(30.2)
	Moderate	3,494	(36.1)	3,432	(36.1)	2,336	(33.9)	3,493	(36.1)	4,842	(38.5)
	Bad	2,438	(25.2)	2,383	(25.1)	1,962	(28.4)	2,435	(25.2)	2,811	(22.4)
	Very bad	654	(6.8)	643	(6.8)	603	(8.7)	654	(6.8)	685	(5.5)
Stress level	Mild	6,980	(72.1)	6,855	(72.2)	4,962	(71.9)	6,977	(72.1)	8,958	(71.2)
	Severe	2,701	(27.9)	2,643	(27.8)	1,938	(28.1)	2,699	(27.9)	3,618	(28.8)
Body mass index (kg/m^2)	≤18.4	265	(2.7)	260	(2.7)	184	(2.7)	265	(2.7)	497	(4.0)
	18.5-24.9	6,031	(62.3)	5,916	(62.3)	4,089	(59.3)	6,028	(62.3)	8,133	(64.7)
	25≤	3,385	(35.0)	3,322	(35.0)	2,627	(38.1)	3,383	(35.0)	3,946	(31.4)
Limitation in activities	Yes	2,277	(23.5)	2,221	(23.4)	2,017	(29.2)	2,276	(23.5)	2,440	(19.4)
	No	7,404	(76.5)	7,277	(76.6)	4,883	(70.8)	7,400	(76.5)	10,136	(80.6)
Cancer history	No	9,375	(96.8)	9,196	(96.8)	6,654	(96.4)	9,371	(96.9)	12,257	(97.5)
	Yes	306	(3.2)	302	(3.2)	246	(3.6)	305	(3.2)	319	(2.5)
Health insurance type	NHI (self)	3,614	(37.3)	3,550	(37.4)	2,408	(34.9)	3,613	(37.3)	4,549	(36.2)
	NHI (employee)	5,587	(57.7)	5,479	(57.7)	4,093	(59.3)	5,584	(57.7)	7,508	(59.7)
	Medicaid aid	480	(5.0)	469	(4.9)	399	(5.8)	479	(5.0)	519	(4.1)
Private insurance	No	3,681	(38.0)	3,614	(38.1)	3,352	(48.6)	3,679	(38.0)	3,974	(31.6)
	Yes	6,000	(62.0)	5,884	(62.0)	3,548	(51.4)	5,997	(62.0)	8,602	(68.4)
Cancer screening	No screening	6,979	(72.1)	6,796	(71.6)	4,934	(71.5)	6,975	(72.1)	9,358	(74.4)
	Opportunistic	1,030	(10.6)	1,030	(10.8)	688	(10.0)	1,029	(10.6)	1,460	(11.6)
	Organized	1,672	(17.3)	1,672	(17.6)	1,278	(18.5)	1,672	(17.3)	1,758	(14.0)

*n (%), Region : Metropolis (Seoul, Busan, Deagu, Inchoen, Kwangju, Daejeon, Woolsan), Town or country (Kyungki, Kangwon, Chungbuk, Chungnam, Jonbuk, Jonnam, Kyungbuk, Kyungnam, Jeju)

Results

A total of 6,259 men and 6,231 women had not had cancer screening, while 1,256 men and 3,196 women had opportunistic cancer screening, and 2,193 men and 3,312 women had organized cancer screening. Table 1 shows the characteristics of the sample.

Multinomial logistic regression analyses

The results of the multinomial logistic regression analysis of education, economic status, and cancer screening are presented in Table 2. The results were adjusted for age, year of data collection, residential region, current smoking status, current alcohol consumption status, exercise, marriage status, job status, perceived health status, stress level, BMI, limitation of activities, cancer history, health insurance type, and private insurance status.

In terms of age, the odds ratios for organized screening in men and women were very similar. Relative to men aged 19-39 years, the odds ratios for opportunistic screening were 2.91 (95%CI: 2.38-3.55; p<0.001) for 40-59 year olds, 4.57 (95%CI: 3.46-6.05; p<0.001) for 60-79 year olds, and 2.49 (95%CI: 1.34-4.62; p<0.001) for men 80 years or older. However, the odds ratios for opportunistic screening in women showed a negative association with age.

The odds ratios associated with the year of collection variable were significant only for organized screening after 2010, as compared to 2007. With respect to the residential region variable, the odds ratio for opportunistic screening in men was 0.81 (95%CI: 0.68-0.95; p=0.01) for town/country residence compared to metropolis residence.

Among the health behavior variables, the odd ratios for current smoking status and exercise showed a negative association with screening. However, the odds ratio for organized screening attendance in men was 1.26 (95%CI: 1.04-1.54; p=0.02) for drinkers as compared to

Table 3. Multinomial Logistic Regression Analysis (Men)

Variables		Gastric cancer		Liver cancer		Colon cancer	
		Opportunistic	Organized	Opportunistic	Organized	Opportunistic	Organized
Age (years)	40-49	1.00	1.00	1.00	1.00		
	50-59	1.56 *	1.66 *	1.55 *	1.66 *	1.00	1.00
	60-69	1.68 *	2.36 *	1.66 *	2.37 *	0.98	1.35 *
	70£	1.62 *	1.60 *	1.57 *	1.59 *	0.86	0.89
Year	2007	1.00	1.00	1.00	1.00	1.00	1.00
	2008	1.31	1.77	1.05	1.41	0.9	0.88
	2009	0.88	1.65	0.7	1.31	0.63	0.82
	2010	2.09 *	13.36 *	1.53	9.64 *	1.63	6.83 *
	2011	0.56	3.73 *	0.41 *	2.69 *	0.44	1.9
Region*	Metropolis	1.00	1.00	1.00	1.00	1.00	1.00
	Town or country	0.84	1.13	0.84	1.13	0.85	1.03
Marriage status	Single	1.00	1.00	1.00	1.00	1.00	1.00
	Married	2.54	1.14	2.63	1.14	-	1.04
Current smoking	Nonsmoking	1.00	1.00	1.00	1.00	1.00	1.00
	Smoking	0.69 *	0.76 *	0.70 *	0.77 *	0.73 *	0.65 *
Current alcohol consumption	Nondrinking	1.00	1.00	1.00	1.00	1.00	1.00
	Drinking	1.24	1.36 *	1.22	1.35 *	1.23	1.16
Exercise	No	1.00	1.00	1.00	1.00	1.00	1.00
	Yes	1.21	1.11	1.24	1.12	1.27	1.16
Educational level	Elementary school	1.00	1.00	1.00	1.00	1.00	1.00
	Middle school	1.35	1.11	1.35	1.11	1.35	1.09
	High school	1.42 *	1.05	1.42 *	1.04	1.43 *	1.06
	College or higher	1.47 *	1.26	1.47 *	1.24	1.60 *	1.2
Economic status	Q1	1.00	1.00	1.00	1.00	1.00	1.00
	Q2	1.48 *	1.16	1.48 *	1.12	1.16	1
	Q3	1.52 *	1.13	1.48 *	1.17	1.39	1.37 *
	Q4	2.37 *	1.18	2.36 *	1.19	1.84 *	1.18
Job status	Unemployed	1.00	1.00	1.00	1.00	1.00	1.00
	Employee	0.98	1.04	0.95	1.02	0.91	0.95
	Employer	1.2	1.08	1.19	1.08	1.16	1.00
Perceived health status	Very good	1.00	1.00	1.00	1.00	1.00	1.00
	Good	0.82	0.98	0.79	0.97	0.82	0.95
	Moderate	0.94	0.97	0.92	0.96	0.87	0.84
	Bad	1.32	1.2	1.3	1.18	1.25	1.1
	Very bad	1.26	0.58	1.22	0.58	0.77	0.53 *
Stress level	Mild	1.00	1.00	1.00	1.00	1.00	1.00
	Severe	0.91	0.99	0.9	0.99	0.84	1.09
Body mass index (kg/m2)	≤ 18.4	1.00	1.00	1.00	1.00	1.00	1.00
	18.5 - 24.9	1.25	1.08	1.27	1.09	1.61	1.21
	25 ≤	1.15	1.25	1.19	1.27	1.66	1.44
Limitation in activities	Yes	1.00	1.00	1.00	1.00	1.00	1.00
	No	0.76	1.05	0.75	1.04	0.84	1.07
Cancer history	No	1.00	1.00	1.00	1.00	1.00	1.00
	Yes	2.13 *	0.67	2.17 *	0.69	2.42 *	0.75
Health insurance type	NHI(self)	1.00	1.00	1.00	1.00	1.00	1.00
	NHI(employee)	1.18	1.28 *	1.18	1.28 *	1.07	1.24 *
	Medicaid aid	0.54	1.2	0.53	1.22	0.37	1.12
Private insurance	No	1.00	1.00	1.00	1.00	1.00	1.00
	Yes	1.61 *	1.41 *	1.64 *	1.42 *	1.33	1.34 *

*p<0.05

nondrinkers, and the odds ratio for opportunistic screening attendance in women was 1.15 (95%CI: 1.02-1.30; p=0.02) for drinkers compared to nondrinkers. Among the health behavior variables, only the current alcohol consumption variable showed a positive association with screening.

The odds ratios for opportunistic screening in both men and women revealed a positive association with education level. The odds ratio for organized screening in men was 0.77 (95%CI: 0.62-0.95; p=0.02) for those with a high school education compared to those with an elementary school education.

In terms of economic status, the odds ratios for opportunistic screening were significant for men in Q2-Q4 as compared to those in Q1. However, the odds ratios for organized screening were 1.28 (95%CI: 1.01-1.61; p=0.04) for men and 1.21 (95%CI: 1.01-1.46; p=0.04) for women in Q4 as compared to Q1. The odds ratio for opportunistic screening in women was 1.39 (95%CI: 1.14-1.69; p<0.001) for Q4, as compared to Q1.

Compared to the unemployed, the employee odds ratios for organized screening were 1.24 (95%CI: 1.01-1.53; p=0.04) in men and 1.31 (95%CI: 1.15-1.50; p<0. 001) in women. For opportunistic screening, no significant associations were seen in men employees, but a negative association with attendance was seen in women employees, as compared to the unemployed.

People who perceived themselves to be unhealthy were more likely to attend cancer screenings. The odds ratio for organized screening was 0.76 (95%CI: 0.66-0.87; p<0. 001) for women with severe as opposed to mild stress. In terms of organized screening attendance, women with limited activity had an odds ratio of 1.18 (95%CI, 1.01-1.38; p=0.04) compared to those with no limitation of activity.

In both men and women, the odds ratios for opportunistic screening were elevated in those with a history of cancer. The odds ratios for men with corporate national health insurance were significantly elevated for both types of screening program compared to those with local national health insurance. In women, the odds ratio for opportunistic screening was 0.59 (95%CI: 0.39-0.90;

Table 4. Multinomial Logistic Regression Analysis (Women)

Variables		Gastric cancer		Liver cancer		Colon cancer		Breast cancer		Cervical cancer	
		Opportunistic	Organized	Opportunistic	Organized	Opportunistic	Organized	Opportunistic	Organized	Opportunistic	Organized
Age (years)	30-39									1.00	1.00
	40-49	1.00	1.00	1.00	1.00			1.00	1.00	1.21	6.60 *
	50-59	1.73 *	1.65 *	1.75 *	1.66 *	1.00	1.00	1.73 *	1.65 *	2.15 *	11.24 *
	60-69	1.56 *	1.95 *	1.61 *	1.99 *	0.86	1.16	1.54 *	1.92 *	1.88 *	13.20 *
	70£	0.69	0.94	0.71	0.96	0.38 *	0.60 *	0.69	0.92	0.79	6.21 *
Year	2007	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	2008	0.61	0.49	0.54	0.45	0.88	0.37	0.6	0.49	0.65	0.49
	2009	0.46 *	0.45	0.41 *	0.41 *	0.74	0.36	0.46 *	0.45	0.54	0.43 *
	2010	2.65 *	6.99 *	2.25 *	6.13 *	3.71 *	5.02 *	2.65 *	7.01 *	3.88 *	7.66 *
	2011	0.24 *	0.72	0.20 *	0.63	0.34 *	0.6	0.24 *	0.72	0.26 *	0.7
Region*	Metropolis	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Town or country	0.76 *	1.01	0.75 *	1.00	0.68 *	1.00	0.76 *	1.00	0.79 *	0.98
Marriage status	Single	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Married	1.01	0.90	1.03	0.90	2.29	1.34	1.02	0.90	1.57	1.16
Current smoking	Nonsmoking	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Smoking	0.79	0.65 *	0.78	0.65 *	0.74	0.56 *	0.78	0.65 *	0.77	0.63 *
Current alcohol consumption	Nondrinking	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Drinking	1.19	0.88	1.19	0.88	1.13	0.93	1.19	0.88	1.21 *	0.92
Exercise	No	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Yes	1.17	1.13	1.17	1.14	1.30	1.02	1.17	1.13	1.17	1.13
Educational level	Elementary school	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Middle school	1.44 *	1.23	1.45 *	1.24	1.62 *	1.26	1.45 *	1.24	1.47 *	1.24
	High school	1.70 *	1.17	1.72 *	1.17	1.46 *	1.29	1.73 *	1.17	1.79 *	1.19
	College or higher	1.79 *	0.97	1.82 *	0.97	1.76 *	1.06	1.81 *	0.97	1.96 *	1.05
Economic status	Q1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Q2	1.20	1.07	1.23	1.07	1.29	1.06	1.20	0.99	1.13	1.03
	Q3	1.46 *	1.05	1.44 *	1.05	1.59 *	1.03	1.39 *	0.99	1.38 *	1.01
	Q4	1.97 *	1.25	1.97 *	1.25	1.87 *	1.00	1.95 *	1.18	1.82 *	1.26
Job status	Unemployed	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Employee	0.72 *	1.12	0.72 *	1.11	0.66 *	1.19	0.72 *	1.12	0.73 *	1.19 *
	Employer	0.93	1.05	0.95	1.07	0.90	0.93	0.94	1.05	0.99	1.06
Perceived health status	Very good	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Good	1.66	1.14	1.68	1.15	1.84	1.07	1.66	1.14	1.38	0.98
	Moderate	1.74 *	1.15	1.77 *	1.16	2.27 *	1.01	1.73 *	1.15	1.32	0.95
	Bad	1.93 *	1.22	1.99 *	1.23	2.22 *	1.10	1.92 *	1.21	1.63 *	1.06
	Very bad	1.68	0.85	1.69	0.86	1.61	0.74	1.67	0.85	1.37	0.73
Stress level	Mild	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Severe	1.19	0.86	1.20	0.86	1.17	0.97	1.19	0.86	1.14	0.83 *
Body mass index(kg/m^2)	≤ 18.4	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	18.5 - 24.9	1.76	1.49	1.79	1.50	1.57	1.67	1.76	1.49	1.43	1.17
	25 ≤	1.42	1.24	1.45	1.24	1.14	1.38	1.42	1.23	1.15	0.97
Limitation in activities	Yes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	No	1.09	1.07	1.08	1.06	1.08	1.13	1.09	1.06	1.15	1.07
Cancer history	No	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Yes	2.05 *	0.99	2.07 *	1.00	1.70 *	1.02	2.07 *	1.00	2.19 *	1.03
Health insurance type	NHI(self)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	NHI(employee)	1.13	1.01	1.14	1.01	1.08	0.83 *	1.14	1.01	1.12	1.07
	Medicaid aid	0.62	1.08	0.62	1.09	0.69	0.79	0.61	1.07	0.54 *	1.08
Private insurance	No	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Yes	1.36 *	1.27 *	1.39 *	1.28 *	1.18	1.30 *	1.37 *	1.27 *	1.39 *	1.26*

*p<0.05

Table 5. Multinomial Logistic Regression Analysis by Age (Men)

Variables			40-49		50-59		60≤	
			Opportunistic	Organized	Opportunistic	Organized	Opportunistic	Organized
Gastric cancer	Educational level	Elementary school	1.00	1.00	1.00	1.00	1.00	1.00
		Middle school	1.24	1.10	1.49	0.94	1.23	1.23
		High school	1.45	0.93	1.57	1.01	1.26	1.15
		College or higher	1.40	1.18	1.51	1.12	1.80 *	1.26
	Economic status	Q1	1.00	1.00	1.00	1.00	1.00	1.00
		Q2	5.31 *	1.44	1.12	1.05	1.43	1.18
		Q3	4.97 *	1.13	1.38	1.39	1.39	1.15
		Q4	8.74 *	1.48	1.91	1.18	1.86 *	0.91
Liver cancer	Educational level	Elementary school	1.00	1.00	1.00	1.00	1.00	1.00
		Middle school	1.29	1.11	1.46	0.92	1.25	1.25
		High school	1.53	0.93	1.59	1.00	1.26	1.14
		College or higher	1.47	1.16	1.54	1.12	1.78 *	1.25
	Economic status	Q1	1.00	1.00	1.00	1.00	1.00	1.00
		Q2	5.62 *	1.37	1.10	0.97	1.41	1.16
		Q3	4.67 *	1.13	1.36	1.48	1.45	1.19
		Q4	8.67 *	1.48	1.90	1.20	1.90 *	0.93
Colon cancer	Educational level	Elementary school			1.00	1.00	1.00	1.00
		Middle school			1.50	0.94	1.20	1.21
		High school			1.64	1.00	1.27	1.12
		College or higher			1.63	1.15	1.78 *	1.17
	Economic status	Q1			1.00	1.00	1.00	1.00
		Q2			0.57	0.49	1.43	1.25
		Q3			0.76	1.00	1.64 *	1.44 *
		Q4			1.00	0.81	2.00 *	1.27

* p<0.05, Adjusting for age, year of data collection, residential region, marriage status, current smoking status, current alcohol consumption status, exercise, job status, perceived health status, stress level, BMI, limitation of activities, cancer history, health insurance type, and private insurance status

Table 6. Multinomial Logistic Regression Analysis by Age (Women)

Variables			≤49		50-59		60≤	
			Opportunistic	Organized	Opportunistic	Organized	Opportunistic	Organized
Gastric cancer	Educational level	Elementary school	1.00	1.00	1.00	1.00	1.00	1.00
		Middle school	0.91	1.07	1.46	1.14	2.16 *	1.55 *
		High school	1.93	0.84	1.28	1.13	2.16 *	1.60 *
		College or higher	1.97	0.65	1.51	0.96	2.57 *	1.04
	Economic status	Q1	1.00	1.00	1.00	1.00	1.00	1.00
		Q2	1.88	2.61 *	1.29	1.11	0.91	1.03
		Q3	1.96	2.34	1.32	1.10	1.81 *	1.15
		Q4	2.79 *	3.55 *	1.80 *	1.41	1.95 *	0.77
Liver cancer	Educational level	Elementary school	1.00	1.00	1.00	1.00	1.00	1.00
		Middle school	0.90	1.06	1.47	1.15	2.17 *	1.56 *
		High school	1.92	0.83	1.29	1.14	2.16 *	1.62 *
		College or higher	1.98	0.64	1.51	0.96	2.62 *	1.04
	Economic status	Q1	1.00	1.00	1.00	1.00	1.00	1.00
		Q2	1.90	2.57 *	1.27	1.10	1.50	0.94
		Q3	1.99	2.42	1.34	1.11	1.64	1.00
		Q4	2.81 *	3.60 *	1.81 *	1.41	1.63	1.15
Colon cancer	Educational level	Elementary school		1.00	1.00	1.00	1.00	
		Middle school		1.48 *	1.16	2.01 *	1.60 *	
		High school		1.30	1.16	2.09 *	1.57 *	
		College or higher		1.64	1.03	2.56 *	1.06	
	Economic status	Q1		1.00	1.00	1.00	1.00	
		Q2		1.57	1.09	1.18	1.18	
		Q3		1.65	1.10	1.69 *	1.11	
		Q4		1.89	1.18	2.15 *	0.91	
Breast cancer	Educational level	Elementary school	1.00	1.00	1.00	1.00	1.00	1.00
		Middle school	0.93	1.11	1.47	1.14	2.13 *	1.55 *
		High school	1.97	0.86	1.31	1.13	2.15 *	1.61 *
		College or higher	2.00	0.65	1.54	0.96	2.62 *	1.04
	Economic status	Q1	1.00	1.00	1.00	1.00	1.00	1.00
		Q2	1.52	1.81	1.60	1.09	0.88	0.99
		Q3	1.60	1.72	1.39	1.11	1.71 *	1.12
		Q4	2.31	2.59	2.02 *	1.41	1.97 *	0.76
Cervical cancer	Educational level	Elementary school	1.00	1.00	1.00	1.00	1.00	1.00
		Middle school	0.94	1.16	1.47	1.16	2.20 *	1.55 *
		High school	1.70	0.62	1.31	1.16	2.18 *	1.58 *
		College or higher	1.76	0.40 *	1.57	1.01	2.71 *	1.02
	Economic status	Q1	1.00	1.00	1.00	1.00	1.00	1.00
		Q2	1.03	1.46	1.32	1.19	1.09	1.03
		Q3	1.30	1.51	1.35	1.05	1.58 *	1.12
		Q4	1.78 *	2.61 *	1.72 *	1.32	1.94 *	0.81

* p<0.05, Adjusting for age, year of data collection, residential region, marriage status, current smoking status, current alcohol consumption status, exercise, job status, perceived health status, stress level, BMI, limitation of activities, cancer history, health insurance type, and private insurance status

p=0.01) for Medical Aid beneficiaries as compared to those with local national health insurance, and the odds ratio for organized screening was 1.16 (95%CI: 1.02-1.31; p=0.02) for corporate national health insurance as compared to local national health insurance. Having private insurance was positively associated with both screening types in both men and women.

Discussion

The most cost-effective way of reducing cancer mortality is to provide screening as part of an organized program. Both organized and opportunistic cancer screening are widely available in Korea. Although studies have consistently indicated that SEP is associated with cancer screening rates (Link et al., 1998; Nelson et al., 2003; Swan et al., 2003), it is unclear whether organized and opportunistic screening respond to the needs of different socioeconomic groups or not. To expand organized screening, it is essential to know who uses organized *vs* opportunistic screening. This study focused on identifying factors associated with participation in both types of cancer screening.

Overall, the participation rate for organized cancer screening increased significantly over time, while the rate for opportunistic screening remained relatively constant or decreased somewhat. These trends were consistent with those reported previously (Lee et al., 2010; Lim et al., 2010), and this finding indicates that organized cancer screening programs have played an important role in expanding screening in Korea. Significant trends toward increased organized cancer screening rates were observed, especially for men.

Age, marital status, smoking behavior, and private insurance status were significantly associated with participation in both opportunistic and organized screening. The participation rate in cancer screening increased until age 60-79 years, then decreased, except in the case of opportunistic screening for women. Single people and current smokers were less likely to participate in cancer screening, consistent with previous studies (Choi et al., 2010a; 2010b; Hansen et al., 2011). People with private medical insurance in addition to National Health Insurance or Medical Aid were slightly more likely to participate in both organized and opportunistic screening.

Previous studies of cancer screening have shown that cancer survivors have higher rates of cancer screening compared to the general population (Cullati et al., 2009; Cho et al., 2010). Significant trends toward increased rates of opportunistic screening were observed among participants with previous cancer history, but no such trends were seen for organized screening in this study. In contrast to the findings of a previous study (Yang et al., 2013), a significant association between residential region and participation in organized screening was not observed. The participation rate for opportunistic screening among men residents of metropolitan areas was slightly higher than those from town/country areas.

In this study, it was important to know whether participation rate differed according to SEP. Several previous studies have observed differences among socioeconomic groups (Hahm et al., 2011; Park et al., 2011) with low SEP being inversely associated with participation in organized screening (Lee et al., 2010). This study extended previous findings on the association between cancer screening participation rates and SEP by investigating two type of screening. Fortunately, education level and economic status were not significantly associated with organized cancer screening participation in this study, with the exception of increased participation in organized screening in the highest income quartile. Our results indicate that SEP is only associated with participation in opportunistic screening. The odds of opportunistic cancer screening participation among women with a college degree or higher and men with a high income were more than twice as high than those for lower socioeconomic groups. Since one advantage of organized screening programs is decreased social inequality in the utilization of preventive health services, SEP disparities may not be equally important in organized and opportunistic screening settings.

This study has several limitations. It is possible that information regarding cancer screening was systematically biased because all data were gathered from self-reported health surveys that are potentially subject to problems, including recall bias. Another limitation is that information regarding some health-seeking behaviors relevant to cancer prevention was not available in this study, because the dataset did not contain them. Previous research has indicated that an individual's knowledge of, perception of, and attitude toward cancer risk and prevention affects awareness of cancer screening (Demark-Wahnefried et al., 1995; Chamot et al., 2007; Gwede et al., 2010). However, our analysis did not include these variables, and this could cause inaccurate outcome classification and biased estimation. Despite these limitations, the results of this study were obtained from a large, representative sample with a stratified, multistage, clustered probability design, thus minimizing the possibility of selection bias. Also, while many studies have investigated the association between health-seeking behaviors and cancer screening in general, this study examined organized and opportunistic screening separately.

In conclusion, we found that differences in age, marital status, smoking behavior, previous cancer history, private insurance status, residential region, educational level, and economic status partially predict participation in organized and opportunistic cancer screening programs. Our findings underscore the fact that socioeconomic factors, including educational level and economic status, were not significantly associated with participation in organized cancer screening, except for at the highest level of income. Therefore, our results suggest that strategies to promote participation and reduce inequality in attendance should differ according to the type of screening offered.

References

Borras JM, Guillen M, Sanchez V, et al (1999). Educational level, voluntary private health insurance and opportunistic cancer screening among women in Catalonia (Spain). *Eur J Cancer Prev*, **8**, 427-34.

Chamot E, Charvet AI, Perneger TV (2007). Who gets screened, and where: a comparison of organised and opportunistic mammography screening in Geneva, Switzerland. *Eur J Cancer*, **43**, 576-84.

Cho J, Guallar E, Hsu YJ, et al (2010). A comparison of cancer screening practices in cancer survivors and in the general population: the Korean national health and nutrition examination survey (KNHANES) 2001-2007. *Cancer Causes Control*, **21**, 2203-12.

Choi KS, Jun JK, Lee HY, et al (2010). Increasing uptake of colorectal cancer screening in Korea: a population-based study. *BMC Public Health*, **21**, 265.

Choi KS, Lee S, Park EC, et al (2010). Comparison of breast cancer screening rates between Korean women in America versus Korea. *Womens Health*, **19**, 1089-96.

Cullati S, Charvet-Brard AI, Perneger TV (2009). Cancer screening in a middle-aged general population: factors associated with practices and attitudes. *BMC Public Health*, **29**, 118.

Demark-Wahnefried W, Strigo T, Catoe K, et al (1995). Knowledge, beliefs, and prior screening behavior among blacks and whites reporting for prostate cancer screening. *Urology*, **46**, 346-51.

Gwede CK, William CM, Thomas KB, et al (2010). Exploring disparities and variability in perceptions and self-reported colorectal cancer screening among three ethnic subgroups of U. S. Blacks. *Oncol Nurs Forum*, **37**, 581-591.

Hahm MI, Park EC, Choi KS, et al (2010). Inequalities in adoption of cancer screening from a diffusion of innovation perspective: identification of late adopters. *Cancer Epidemiol*, **35**, 90-6.

Hansen BT, Hukkelberg SS, Haldorsen T, et al (2011). Factors associated with non-attendance, opportunistic attendance and reminded attendance to cervical screening in an organized screening program: a cross-sectional study of 12,058 Norwegian women. *BMC Public Health*, **26**, 264.

Jun JK, Choi KS, Jung KW, et al (2009). Effectiveness of an organized cervical cancer screening program in Korea: results from a cohort study. *Int J Cancer*, **124**, 188-93.

Jung KW, Park S, Kong HJ, et al (2012). Cancer statistics in Korea: incidence, mortality, survival, and prevalence in 2009. *Cancer Res Treat*, **44**, 11-24.

Kang MH, Park EC, Choi KS, et al (2013). The National Cancer Screening Program for breast cancer in the Republic of Korea: is it cost-effective? *Asian Pac J Cancer Prev*, **14**, 2059-65.

Korea Centers for Disease Control and Prevention (2012). The Fifth Korea National Health and Nutrition Examination Survey guideline (KNHANES V).

Kwon S (2009). Thirty years of national health insurance in South Korea: lessons for achieving universal health care coverage. *Health Policy Plan*, **24**, 63-71.

Lee EH, Han MA, Lee HY, et al (2010). Liver cancer screening in Korea: a report on the 2008 National Cancer Screening Programme. *Asian Pac J Cancer Prev*, **11**, 1305-10.

Lee HY, Park EC, Jun JK, et al (2010). Trends in socioeconomic disparities in organized and opportunistic gastric cancer screening in Korea (2005-2009). *Cancer Epidemiol Biomarkers Prev*, **19**, 1919-26.

Lee KS, Oh DK, Han MA, et al (2008). Gastric cancer screening in Korea: report on the national cancer screening program in 2008. *Cancer Res Treat*, **43**, 83-8.

Lim SM, Lee HY, Choi KS, et al (2010). Trends of mammography use in a national breast cancer screening program, 2004-2008. *Cancer Res Treat*, **42**, 199-202.

Link BG, Northridge ME, Phelan JC, et al (1998). Social epidemiology and the fundamental cause concept: on the structuring of effective cancer screens by socioeconomic status. *Milbank Q*, **76**, 375-402.

Miles A, Cockburn J, Smith RA, et al (2004). A perspective from countries using organized screening programs. *Cancer*, **101**, 1201-13.

Nelson DE, Bolen J, Marcus S, et al (2003). Cancer screening estimates for U.S. metropolitan areas. *Am J Prev Med*, **24**, 301-9.

Park B, Choi KS, Lee YY, et al (2012). Trends in cancer screening rates among Korean men and women: results from the Korean National Cancer Screening Survey (KNCSS), 2004-2011. *Cancer Res Treat*, **44**, 113-20.

Park B, Lee HY, Choi KS, et al (2011). Cancer screening in Korea, 2010: results from the Korean National Cancer Screening Survey. *Asian Pac J Cancer Prev*, **12**, 2123-8.

Ronco G, Segnan N, Giordano L, et al (1997). Interaction of spontaneous and organised screening for cervical cancer in Turin, Italy. *Eur J Cancer*, **33**, 1262-7.

Ronco G, Segnan N, Ponti A (1991). Who has Pap tests? Variables associated with the use of Pap tests in absence of screening programmes. *Int J Epidemiol*, **20**, 349-53.

Shaw M, G.B., Lawlor DA, Lynch J, et al (2007). The Handbook of Inequality and Socioeconomic Position: Concepts and Measures. The Policy Press, Bristol, UK.

Shim JI, Kim Y, Han MA, et al (2010). Results of colorectal cancer screening of the national cancer screening program in Korea, 2008. *Cancer Res Treat*, **42**, 191-8.

Spadea T, Bellini S, Kunst A, et al (2010). The impact of interventions to improve attendance in female cancer screening among lower socioeconomic groups: a review. *Prev Med*, **50**, 159-64.

Statistics Korea (2011), Cause of death Statistics.

Suh M, Choi KS, Lee YY, Park B, Jun JK (2013). Cancer screening in Korea, 2012: results from the Korean National Cancer Screening Survey. *Asian Pac J Cancer Prev*, **14**, 6459-63.

Swan J, Breen N, Coates RJ, et al (2003). Progress in cancer screening practices in the United States: results from the 2000 National Health Interview Survey. *Cancer*, **97**, 1528-40.

Yang HK, Shin DW, Hwang SS, et al (2013). Regional factors associated with participation in the national health screening program: a multilevel analysis using national data. *J Korean Med Sci*, **28**, 348-56.