

RESEARCH ARTICLE

Cancer Screening in Korea, 2012: Results from the Korean National Cancer Screening Survey

Mina Suh, Kui Son Choi, Yoon Young Lee, Boyoung Park, Jae Kwan Jun*

Abstract

We investigated the cancer screening rates for five types of cancer (stomach, liver, colorectal, breast, and cervix uteri) using data from the Korean National Cancer Screening Survey (KNCSS), which is a nationwide, annual cross-sectional survey. The eligible study population included cancer-free men 40 years of age and older and women 30 years of age and older. The lifetime screening rate and screening rate with recommendation were calculated. The lifetime screening rates for gastric, liver, colorectal, breast, and cervical cancers were 77.9%, 69.9%, 65.8%, 82.9%, and 77.1%, respectively. The screening rates with recommendation were 70.9%, 21.5%, 44.7%, 70.9%, and 67.9%, respectively. The most common reason for all types of cancer was “no symptoms,” followed by “lack of time” and “fear of the examination procedure.” Efforts to facilitate participation in liver and colorectal cancer screening among Korean men and women are needed.

Keywords: Early detection of cancer - screening - national health program - health care surveys

Asian Pac J Cancer Prev, 14 (11), 6459-6463

Introduction

In Korea, cancer is associated with the largest disease burden and has been the most frequent cause of death (Lee et al., 2013). A total of 72,046 cancer deaths were reported in 2010, accounting for 28% of all deaths. The cancer incidence rate for all sites combined increased by 3.3% annually (1.5% in males, 5.3% in females) from 1999 to 2010 (Jung et al., 2013).

The Korean government formulated national cancer control programs in 1996 to reduce the disease burden. In 1999, the National Cancer Screening Program (NCSP) was started, and the target population and types of cancer covered have expanded. Until 2001, the NCSP provided Medical Aid recipients with free screening services for three types of cancer (stomach, breast, and cervix). In 2002, National Health Insurance (NHI) beneficiaries in the lower 20% income stratum were included in the NCSP. In 2003, NHI beneficiaries in the lower 30% income stratum and screening services for liver cancer were included. In 2004, colorectal cancer was included in the NCSP, and since 2005, the NCSP has provided Medical Aid recipients and NHI beneficiaries in the lower 50% income stratum with screenings for five types of cancer (stomach, liver, colorectal, breast, and cervix). NHI beneficiaries in the upper 50% income stratum also receive screening services for the same five types of cancer from the NHI Corporation, but they are required to pay 10% of the charge (Shim et al., 2010; Lee et al., 2011; 2012; Noh et al., 2012).

In Korea, people can undergo opportunistic cancer screening in addition to these organized cancer-screening

programs provided by the government. Organized cancer screenings are performed according to nationally implemented protocols that define a target population, screening interval, and follow-up strategies. On the other hand, opportunistic cancer screenings include a variety of options in terms of the items screened, screening intervals, and target cancer depending on individual decisions or recommendations from health care providers. In the case of opportunistic cancer screening, all costs are paid entirely by users without a governmental subsidy. We investigated the cancer screening rates for five types of cancers in both organized and opportunistic cancer screenings among the Korean population.

Materials and Methods

Data from the Korean National Cancer Screening Survey (KNCSS) in 2012 were used. The KNCSS is an annual nationwide, population-based, cross-sectional survey that has been conducted since 2004. Stratified, multistage, random sampling based on resident registration population data is conducted according to geographic area, age, and gender.

During September and October 2012, the data were collected through face-to-face interviews conducted by a professional research agency. For stratified multistage random sampling, the number of enumeration districts was designated in proportion to the population size, and the final study clusters were randomly selected. A total of 9-11 households in an urban area and 14-16 households in a rural area were randomly chosen. Subjects were recruited by door-to-door contact, and at least three attempts were

made to contact each household. One person was selected from each household; if there was more than one eligible person in the household, the person whose date of birth was closest to the study date was selected. Informed consent was obtained from all study participants. A total of 8,879 people were interviewed: 4,447 (50.1%) refused to participate, 292 (3.3%) did not complete the interview, and 4,140 (46.6%) completed the interview. Nine subjects with incomplete data were excluded from the analyses.

Eligibility criteria were cancer-free men 40 years of age and older and women 30 years of age and older according to the target population of the NCSP. Screening for gastric cancer was provided for people older than 40 years, screening for colorectal cancer was provided for those older than 50 years, screening for breast cancer was provided for women older than 40 years, and cervical cancer screening was provided for women older than 30 years. Screening for liver cancer was restricted to individuals older than 40 years, including those in high-risk groups (e.g., positive for hepatitis B virus surface antigen or hepatitis C virus antibody or presence of liver cirrhosis).

Using a structured questionnaire, participants were asked about sociodemographic characteristics and their experience with cancer screening for five types of cancer (stomach, liver, colorectal, breast, and cervix). The questions included: "Have you ever undergone [cancer type] screening?" and "Which screening method have you experienced?" For the interval between screenings, the question was: "When did you last undergo [cancer type] screening with this method?" To determine the reasons for not undergoing screening, we asked: "What are your primary reasons for not undergoing screening?"

Two types of cancer screening rates were measured. The "lifetime screening rate" was defined as having experienced a screening test for each cancer type using any method throughout life. The "screening rate with recommendation" was assigned to participants who had undergone screening tests according to the protocols of the NCSP; it was calculated using the number of subjects within the target age for each screening method as the denominator and the number of subjects examined in accordance with the protocols as the numerator. According to the NCSP, gastric cancer screening was recommended using an upper gastrointestinal series (UGI) or upper endoscopy within 2 years, liver cancer screening was recommended using ultrasonography and alpha-fetoprotein (AFP) levels every 6 months, breast cancer screening was recommended using mammography within 2 years, and cervical cancer screening was recommended using a pap smear within 2 years. For colorectal screening, respondents who underwent colonoscopy, double-contrast barium enema (DCBE), or fecal occult blood testing (FOBT) within 10, 5, and 1 year, respectively, were considered having undergone screening with recommendation. Calculations of screening rates according to gender, age, and income were also performed. Monthly household income was subgrouped into three tertiles. All screening rates were calculated, as well as the weighted screening rate adjusted for the sampling rate across the geographic area, age, and gender. The

liver cancer screening rate was excluded from subgroup analysis because of an inadequate number of individuals within the high-risk group as well as unstable results that showed a wide 95% CI. This study was approved by the Institutional Review Board of the National Cancer Center, Korea (approval number: NCCNCS-08-129).

Results

The basic characteristics of the participants are presented in Table 1. Of the 4,131 respondents, 58.0% were female, 81.6% were educated to high-school level

Table 1. Baseline characteristics of study participants in the 2012 National Cancer Screening Program in Korea

	Male (n=1,736) N (%)	Female (n=2,395) N (%)	Total (n=4,131) N (%)
Age (years)			
30-39*	-	633 (26.4)	633 (15.3)
40-49	708 (40.8)	678 (28.3)	1,386 (33.6)
50-59	596 (34.3)	587 (24.5)	1,183 (28.6)
60-69	317 (18.3)	350 (14.6)	667 (16.2)
≥70	115 (6.6)	147 (6.1)	262 (6.3)
Education (years)			
≤11	278 (16.0)	482 (20.1)	760 (18.4)
12-15	855 (49.3)	1,236 (51.6)	2,091 (50.6)
≥16	603 (34.7)	677 (28.3)	1,280 (31.0)
Monthly household income (USD)**			
≤2,999	686 (39.5)	880 (36.7)	1,566 (37.9)
3,000-3,999	578 (33.3)	825 (34.5)	1,403 (34.0)
≥4,000	472 (27.2)	690 (28.8)	1,162 (28.1)
Marital status			
Married	1,672 (96.3)	2,218 (92.6)	3,890 (94.2)
Not married/Other***	64 (3.7)	177 (7.4)	241 (5.8)
Residence area			
Metropolitan	758 (43.7)	1,075 (44.9)	1,833 (44.4)
Urban	601 (34.6)	897 (37.5)	1,498 (36.3)
Rural	377 (21.7)	423 (17.7)	800 (19.4)
Health insurance type			
National Health Insurance	1,700 (97.9)	2,362 (98.6)	4,062 (98.3)
Medical Aid Program	36 (2.1)	33 (1.4)	69 (1.7)
Private medical insurance			
Yes	1,288 (74.2)	1,946 (81.3)	3,234 (78.3)
No	448 (25.8)	449 (18.8)	897 (21.7)

*Restricted to women aged 30-39 years; **1 USD=1,000 KWN; ***Others: divorced or separated

Table 2. Lifetime Screening Rates and Screening Rates with Recommendation in 2012 in Korea

Type of cancer	Screening tool	Lifetime screening rate	Screening rate with recommendation
Gastric cancer	Total*	77.9%	70.9%
	UGI	31.0%	26.4%
	Upper endoscopy	70.8%	63.3%
Liver cancer	US and AFP	69.9%	21.5%
	Total*	65.8%	44.7%
Colorectal cancer	FOBT	46.2%	29.6%
	Colonoscopy	43.5%	30.2%
	DCBE	5.6%	3.8%
	Total*	82.9%	70.9%
Breast cancer	Mammography	78.7%	70.9%
	Ultrasonography	50.1%	-
	Total*	77.1%	67.9%
Cervical cancer	Pap smear	77.1%	67.9%

*The counts may overlap because some participants underwent more than two examinations; **UGI, upper gastrointestinal series; US, ultrasonography; AFP, alpha-fetoprotein; DCBE, double-contrast barium enema; FOBT, fecal occult blood test

Table 3. Distribution of Reasons Stated for Lifetime Nonattendance at Screening in the 2012 National Cancer Screening Program in Korea

Cause of nonattendance	Gastric cancer	Liver cancer*	Colorectal cancer	Breast cancer	Cervical cancer
No symptoms	40.3	50.5	39.6	55.0	47.8
Lack of time	35.8	23.3	24.8	22.3	23.6
Fear of exam procedure	10.0	7.7	17.4	8.9	11.7
Economic reasons	6.7	7.6	9.8	6.4	7.7
Fear of detecting cancer	3.2	2.2	2.8	2.6	2.6
Ignorance about screening	1.4	5.5	1.5	1.5	1.7
Distrust of screening	1.7	1.7	2.9	1.4	1.7
Other	0.9	1.5	1.2	2.0	3.3

*Screening tests are recommended for the high-risk group, defined as those 40 years old and older and diagnosed with liver cirrhosis, hepatitis B antigen, C antibody carrier

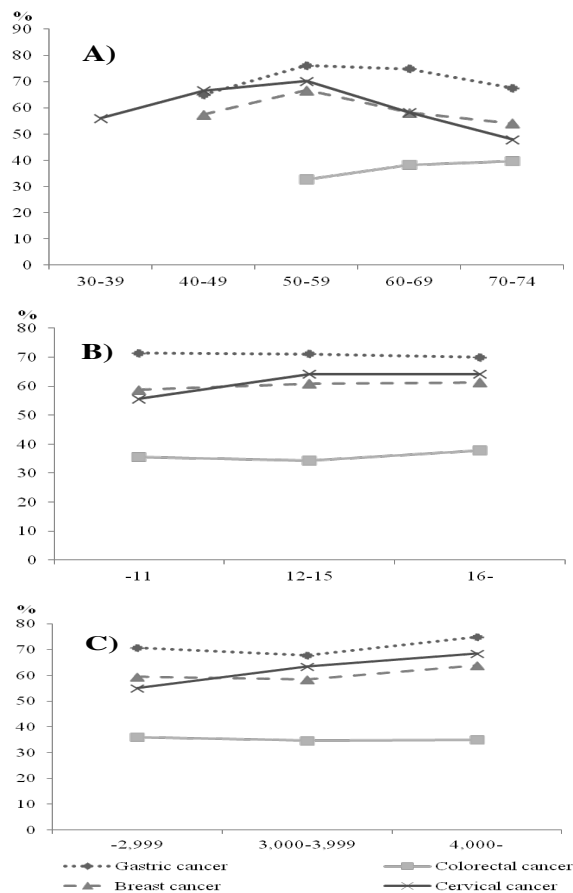


Figure 1. Cancer Screening Rates with Recommendation according to A) Age, B) Education, and C) Income (Monthly household income: US dollars*). *1 USD=1,000 won

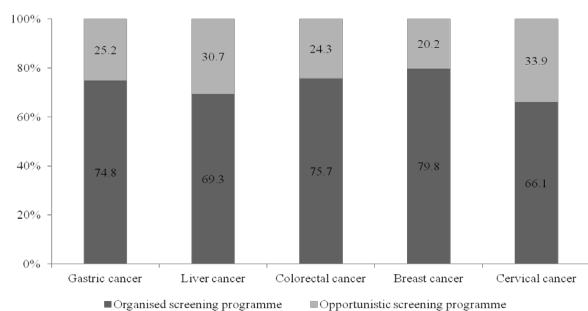


Figure 2. Proportion of Organized and Opportunistic Screening Programs among Those Who Underwent Cancer Screening with Recommendation

or above, 94.2% were married, and 78.3% had private medical insurance. Table 2 shows the lifetime screening rates and the screening rates with recommendation in 2012. The lifetime screening rates for gastric, liver, colorectal, breast, and cervical cancers were 77.9%, 69.9%, 65.8%, 82.9%, and 77.1%, respectively. The screening rates with recommendation were 70.9%, 21.5%, 44.7%, 70.9%, and 67.9%, respectively. UGI for gastric cancer screening was performed in 31.0% of subjects during their lifetime, and 70.8% underwent upper endoscopies; 26.4% of the participants followed the guideline received UGI, and 63.3% underwent upper endoscopies. Among those who underwent colorectal cancer screening during their lifetime, FOBT was performed in 46.2%, colonoscopy in 43.5%, and DCBE in 5.6%. The rate of adherence to the guidelines was highest for colonoscopy (30.2%), followed by FOBT (29.6%) and DCBE (3.8%). Mammography was performed in 78.7% of those who underwent breast cancer screening, and 50.1% underwent breast ultrasonography.

Figure 1 presents the screening rates with recommendation according to age, education, and monthly household income level. For colorectal cancer, this rate increased with age. The screening rates with recommendation for gastric, breast, and cervical cancers increased in the 50-59 year age group, then decreased. The screening rates with recommendation for colorectal, breast, and cervical cancers were higher with an increasing level of education; on the other hand, the screening rates for gastric cancer plateaued. With the exception of colorectal cancer, the screening rates with recommendation increased with household income. Figure 2 shows the relative proportions of organized and opportunistic screening. The screening rates with organized screening programs for gastric, liver, colorectal, breast, and cervical cancers were 74.8%, 69.3%, 75.7%, 79.8%, and 66.1%, respectively.

The reasons for nonattendance at screenings for each cancer type are shown in Table 3. The most common reason for all types of cancer was “no symptoms,” followed by “lack of time.” The third most frequently cited reason was “fear of the examination procedure,” followed by “economic reasons,” “fear of cancer detection,” “ignorance about screening,” and “distrust of screening,” respectively.

Discussion

The KNCSS has been conducted annually since 2004. Compared to 2004, the lifetime screening rates have increased (Park et al., 2012). In 2012, the lifetime screening rates for gastric, liver, breast, and cervical cancers were similar to or greater than 70%. However, colorectal cancer (65.8%) had lowest screening rate of the five types of cancer. The screening rates with recommendation for stomach and breast cancer exceeded 70% in 2012. One of the goals of the second-term 10-Year Plan for Cancer Control, 2006-2015 was to achieve an increase in cancer screening rates with recommendation to 70% by 2015 (Han et al., 2011). These rates achieved the target screening rate of the 10-Year Plan for Cancer Control. The screening rates for cervical cancer (67.9%) also came close to reaching that goal.

For gastric cancer screening, the rate of upper endoscopy was higher than that of UGI for both the lifetime screening rate and the screening rate with recommendation. Previous studies have shown that upper endoscopy is better than UGI in gastric screening cancer screening (Lee et al., 2010; Choi et al., 2012). These studies suggest that upper endoscopy screening is more accurate, has a higher detection rate, and is associated with a lower cost for detection of gastric cancer than UGI. In the NCSP, people with abnormal findings on UGI as an initial screening method would be offered an upper endoscopy. The cost of these cases was nearly twice that of upper endoscopy as an initial screening method. Therefore, upper endoscopy has better performance and was preferred for gastric cancer screening.

The lifetime screening rate for liver cancer was 69.9%, and this rate was higher than the 2010 rate of 54.2%. On the other hand, the screening rate with recommendation (21.5%) in 2012 was one-third the lifetime screening rate, and there was a slight decrease from 22.9% in 2010. In the NCSP, liver cancer screening is recommended between 6 months in high-risk groups, such as those positive for hepatitis B virus surface antigen or hepatitis C virus antibody or who have liver cirrhosis. A previous study conducted in Korea reported disparities according to gender, age, and risk factors for liver cancer in liver cancer screening (Kim et al., 2008; Noh et al., 2012). Efforts to increase participation in liver screening among high-risk groups are needed.

The FOBT screening rate (46.2%) was highest of the three colorectal cancer screening methods. In the NCSP, FOBT was conducted as an initial test for colorectal cancer screening. Therefore, a greater proportion of the population has experience with FOBT screening. In terms of the screening rate with recommendation, the colonoscopy screening rate (30.2%) increased from 23.3% in 2010 to 23.6% in 2011 (Park et al., 2012). Although the screening rate with recommendation of FOBT (29.6%) was similar to that of colonoscopy, the ranking changed compared to previous years. In 2010, the ranking of colorectal cancer screening methods were followed the FOBT, colonoscopy, and DCBE, respectively (Lee et al., 2011). In a previous study in Korea, the proportion of subjects who underwent FOBT increased significantly, whereas the proportion who underwent colonoscopy did not increase significantly (Choi et al., 2010). The number of subjects who undergo colonoscopy for colorectal cancer screening is expected to rise going forward.

For breast cancer screening, mammography is conducted in NCSP. However, subjects who underwent ultrasonography for breast cancer screening during their lifetime made up nearly half of the population in Korea. There are reports that breast density appears to be greater in Asian women than in Western women (del Carmen et al., 2007), and ultrasound has been proposed as a supplemental screening test in women with dense breast tissues (Corsetti et al., 2006; Bae et al., 2011).

In the American population, screening rates are associated with higher education levels in colorectal, breast, and cervical cancer screening (Smith et al., 2012). In a recent Italian study, education and occupation were

positively associated with breast and cervical cancer screening (Damiani et al., 2012). Previous Korean studies have also reported that cancer screening rates are associated with age and socioeconomic status such as education level and household income (Kwak et al., 2005; Myong et al., 2012; Lee et al., 2013). The results of our study are consistent with previous studies in showing that age, education level, and household income are significantly associated with cancer screening rates among the Korean population.

The first and second most common reasons for nonattendance at screening were “no symptoms” and “lack of time,” respectively. This ranking has not changed compared to that in 2011 (Park et al., 2012). Between 2011 and 2012, the proportion of “fear of the examination procedure” showed an increase in gastric and breast cancer, making it the third most frequently cited reason among all five types of cancer screening. Therefore, efforts to understand the examination process and ways to reduce fear are needed.

This study has some limitations. There may be an effect of recall bias on self-reported data about cancer screening practices that may overestimate the percentage of the population that has been screened and underestimate the interval since the last screening (Gordon et al., 1993). However, many studies have found that the reliability of self-reported histories of cancer screening show good agreement with medical records (Caplan et al., 2003; Hoffmeister et al., 2007; Jones et al., 2008). In addition, the response rate in our study was 46.6%; however, compared to other nationwide studies conducted in Korea, in which the response rates were less than 50% (Ock et al., 2009; Park et al., 2011), our response rate can be considered to be acceptable. Despite some limitations, this study used data from a large nationwide, population-based survey. Furthermore, this survey provided detailed information about sociodemographic characteristics and health behavior for cancer screening.

The screening rates of some types of cancer, excluding liver and colorectal cancers, reached the 10-Year Plan for Cancer Control target of 70%. Thus, the National Cancer Control Plan to reduce the economic burden of cancer has been successfully implemented. In addition, socioeconomic factors appear to be associated with participation in cancer screening. Thus, greater effort is still needed to increase the screening rates, especially for liver and colorectal cancer.

Acknowledgements

This study was supported by a Grant-in-Aid for Cancer Research and Control from the National Cancer Center of Korea (#1010201).

References

- Bae MS, Han W, Koo HR, et al (2011). Characteristics of breast cancers detected by ultrasound screening in women with negative mammograms. *Cancer Sci*, **102**, 1862-7.
- Caplan LS, McQueen DV, Qualters JR, et al (2003). Validity of women's self-reports of cancer screening test utilization in a managed care population. *Cancer Epidemiol Biomarkers*

- Prev*, **12**, 1182-7.
- Choi KS, Jun JK, Lee HY, et al (2010). Increasing uptake of colorectal cancer screening in Korea: a population-based study. *BMC Public Health*, **10**, 265.
- Choi KS, Jun JK, Park EC, et al (2012). Performance of different gastric cancer screening methods in Korea: a population-based study. *PLoS One*, **7**, e50041.
- Corsetti V, Ferrari A, Ghirardi M, et al (2006). Role of ultrasonography in detecting mammographically occult breast carcinoma in women with dense breasts. *Radiol Med*, **111**, 440-8.
- Damiani G, Federico B, Basso D, et al (2012). Socioeconomic disparities in the uptake of breast and cervical cancer screening in Italy: a cross sectional study. *BMC Public Health*, **12**, 99.
- del Carmen MG, Halpern EF, Kopans DB, et al (2007). Mammographic breast density and race. *AJR Am J Roentgenol*, **188**, 1147-50.
- Gordon NP, Hiatt RA, Lampert DI (1993). Concordance of self-reported data and medical record audit for six cancer screening procedures. *J Natl Cancer Inst*, **85**, 566-70.
- Han MA, Choi KS, Park JH, Moore MA, Park EC (2011). Midcourse evaluation of the second-term 10-year plan for cancer control in Korea. *Asian Pac J Cancer Prev*, **12**, 327-33.
- Hoffmeister M, Chang-Claude J, Brenner H (2007). Validity of self-reported endoscopies of the large bowel and implications for estimates of colorectal cancer risk. *Am J Epidemiol*, **66**, 130-6.
- Jones RM, Mongin SJ, Lazovich D, Church TR, Yeazel MW (2008). Validity of four self-reported colorectal cancer screening modalities in a general population: differences over time and by intervention assignment. *Cancer Epidemiol Biomarkers Prev*, **17**, 777-84.
- Jung KW, Won YJ, Kong HJ, et al (2013). Cancer statistics in Korea: incidence, mortality, survival and prevalence in 2010. *Cancer Res Treat*, **45**, 1-14.
- Kim CW, Lee SY, Moon OR (2008). Inequalities in cancer incidence and mortality across income groups and policy implications in South Korea. *Public Health*, **122**, 229-36.
- Kwak MS, Park EC, Bang JY, et al (2005). Factors associated with cancer screening participation, Korea. *J Prev Med Public Health*, **38**, 473-481.
- Lee EH, Lee HY, Choi KS, et al (2011). Trends in cancer screening rates among Korean men and women: results from the Korean national cancer screening survey (KNCSS), 2004-2010. *Cancer Res Treat*, **43**, 141-7.
- Lee HY, Park EC, Jun JK, Choi KS, Hahm MI (2010). Comparing upper gastrointestinal X-ray and endoscopy for gastric cancer diagnosis in Korea. *World J Gastroenterol*, **16**, 245-250.
- Lee KS, Park JH (2013). Burden of disease in Korea during 2000-10. *J Public Health (Oxf)*, [Epub ahead of print].
- Lee M, Park EC, Chang HS, et al (2013). Socioeconomic disparity in cervical cancer screening among Korean women: 1998-2010. *BMC Public Health*, **13**, 553.
- Lee YH, Choi KS, Lee HY, Jun JK (2012). Current status of the National Cancer Screening Program for cervical cancer in Korea, 2009. *J Gynecol Oncol*, **23**, 16-21.
- Lee YY, Oh DK, Choi KS, et al. (2011). The current status of gastric cancer screening in Korea: report on the National Cancer Screening Programme, 2009. *Asian Pac J Cancer Prev*, **12**, 3495-3500.
- Myong JP, Shin JY, Kim SJ (2012). Factors associated with participation in colorectal cancer screening in Korea: the Fourth Korean National Health and Nutrition Examination Survey (KNHANES IV). *Int J Colorectal Dis*, **27**, 1061-9.
- Noh DK, Choi KS, Jun JK, Lee HY, Park EC (2012). Factors associated with attending the National Cancer Screening Program for liver cancer in Korea. *Asian Pac J Cancer Prev*, **13**, 731-6.
- Ock SM, Choi JY, Cha YS, et al (2009). The use of complementary and alternative medicine in a general population in South Korea: results from a national survey in 2006. *J Korean Med Sci*, **24**, 1-6.
- Park B, Choi KS, Lee YY, Jun JK, Seo HG (2012a). Cancer screening status in Korea, 2011: results from the Korean National Cancer Screening Survey. *Asian Pac J Cancer Prev*, **13**, 1187-91.
- Park B, Choi KS, Lee YY, Jun JK, Seo HG (2012b). 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 YK, Cho LY, et al (2011). Estimation of nationwide vaccination coverage and comparison of interview and telephone survey methodology for estimating vaccination status. *J Korean Med Sci*, **26**, 711-9.
- 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.
- Smith RA, Cokkinides V, Barwly OW (2012). Cancer screening in the United States, 2012: A review of current American Cancer Society guidelines and current issues in cancer screening. *CA Cancer J Clin*, **62**, 129-42.