Screening for Gastric Cancer in Korea: Population-Based Preferences for Endoscopy versus Upper Gastrointestinal Series

Kui Son Choi,[1] Min-Son Kwak,[1] Hoo-yeon Lee,[1] Jae Kwan Jun,[1] Myung-Il Hahm,[2] and Eun-Cheol Park[1]

[1]National Cancer Control Research Institute, National Cancer Center, Gyeonggi-do, Korea and [2]Department of U-Healthcare Management, College of Medical Science, Soonchunhyang University, Chungnam, Korea

Abstract

This study assessed the screening rates for gastric cancer by two different screening methods, upper gastrointestinal (UGI) series and endoscopy; intentions to undergo future gastric cancer screening; and the preferred method of screening. The study population was derived from the 2006 Korean National Cancer Screening Survey. The Korean National Cancer Screening Survey is an annual cross-sectional survey that uses nationally representative random sampling to investigate cancer screening rates. A total of 1,625 Koreans over 40 years of age participated in this study. Logistic regression was used to identify the factors associated with undergoing gastric cancer screening, having an intention to be screened, and preferring one of the two screening tests. Among the 1,625 subjects, 15.1% had received a UGI, 33.2% had received an endoscopy, and 43.1% had undergone either or both of the tests in the previous 2 years. About 52% of people reported the intention to be screened within the next 2 years. The odds ratio for intending to be screened was 11.8 and 6.2 higher among those who had undergone a prior UGI test and an endoscopy test within the previous 2 years, respectively, than for those who had never been screened. Among the 1,625 individuals, 67% chose endoscopy and 33% UGI for their preferred future screening method. Collectively, our results highlight the preference for endoscopy testing as a gastric cancer screening method. Providers' assessments of individuals' screening preferences in combination with intervention strategies to promote performance of the preferred test may increase patient compliance with gastric cancer screening recommendations. (Cancer Epidemiol Biomarkers Prev 2009;18(5):1390–8)

Introduction

Until recently, gastric cancer was the second most common type of cancer worldwide. With an estimated 934,000 new cases in 2002 (8.6% of new cancer cases), gastric cancer fell to fourth place behind cancers of the lung, breast, and colon and rectum (1). However, gastric cancer remains the second most common cause of death from cancer (700,000 deaths annually; ref. 1). Korea and some parts of eastern Asia have the highest incidences of gastric cancer in the world (1). Although the incidence has declined in recent decades, gastric cancer remains the most frequent cancer diagnosis in Korea (2). Therefore, the prevention of gastric cancer is a major cancer control strategy (3-6). Countries such as Japan and Korea, where gastric cancer is highly prevalent, provide gastric cancer screening to average-risk population to reduce the disease burden.

Although the debate over the value and risk of screening asymptomatic individuals is ongoing, interest has shifted to determining the preferred screening strategy and discerning the most effective ways of implementing screening for the general population (7). Since 1960, Japan has implemented photofluorography [via indirect upper gastrointestinal (UGI) series] screening programs to detect gastric cancer in its early stages and prevent gastric cancer deaths (8). The cohort studies conducted in Japan showed a significant gastric cancer mortality reduction with photofluorography screening (4, 5). In recent years, endoscopy has replaced photofluorography as the initial mass screening method in several cities in Japan (9). This technique is increasingly useful for gastric cancer screening because of its high detection rate. In a study conducted in Niigata, Japan, the detection of gastric cancer by endoscopy was about 2.7 to 4.6 times higher than by a direct or indirect X-ray examination (9). Despite this promising result, direct evidence about the effectiveness, complications, and acceptability of endoscopy among individuals at average risk of gastric cancer is still not sufficient to justify its use for routine screening (7). Further, studies conducted outside of Japan have produced conflicting data about the efficacy of gastric cancer screening. A case-control study conducted in Venezuela did not show a reduction in mortality among persons screened with radiography (10). Singapore has no nationwide population screening program (7); because its citizens are at intermediate risk for developing gastric cancer, screening is more effectively targeted at high-risk groups rather than at a population level. A cost-benefit analysis of screening for gastric cancer

Received 10/9/08; revised 2/26/09; accepted 3/4/09; published OnlineFirst 4/21/09.

Grant support: Grant-in-Aid for Cancer Research and Control from the National Cancer Center, Korea (grant 0710131).

Requests for reprints: Eun-Cheol Park, National Cancer Control Research Institute, National Cancer Center, 111, Jungbalsan-ro, Ilsandong-gu, Goyang-si, Gyeonggi-do 410-769, Korea. Phone: 82-31-920-2003; Fax: 82-31-920-2036. E-mail: ecpark@ncc.re.kr

doi:10.1158/1055-9965.EPI-08-0940

conducted in Singapore showed that screening by endoscopy was cost effective in moderate to high-risk populations (11). In China, gastric cancer is the second most common form of cancer, but no nationwide screening program is available. Therefore, early detection of gastric cancer relies on opportunistic screening only. Endoscopy tests are widely available in major cities, but barium meal studies (UGI series) and serum pepsinogen testing are not commonly practiced in China because of their limited availability (7).

In Korea, screening for gastric cancer started in 1999 as a part of the National Cancer Screening Program (NCSP) for low-income groups. Currently, the NCSP provides Medical Aid recipients and National Health Insurance beneficiaries within the lower 50% income bracket with free-of-charge screening services for five common cancers: gastric, liver, colorectal, breast, and cervix (12). The NCSP recommends biennial gastric cancer screening for men and women ages 40 years and older, with either an UGI series or endoscopy. Under the NCSP, eligible men and women receive an invitation letter for gastric cancer screening every 2 years. Those who are invited to have gastric cancer screening can receive either an UGI or endoscopy test at a clinic, hospital, or general hospital that has been designated as a gastric cancer screening unit by the National Health Insurance Corp. To be designated as a gastric cancer screening unit, a clinic or hospital must have both X-ray and endoscopy equipment and at least one full-time medical doctor trained to do the UGI or endoscopy test, nurse, and radiographer. In 2005, ~1.2 million Koreans, ~20% of eligible persons ages 40 years and older, participated in the NCSP for gastric cancer (13). In addition to the NCSP, the National Health Insurance provides gastric cancer screening to their beneficiaries and covers 80% of the costs of these services through the National Health Insurance screening program. Apart from the NCSP, UGI or endoscopy testing is conducted in outpatient clinics or private health assessment centers for opportunistic screening. However, in these cases, individuals must pay for all procedure-related costs associated with opportunistic screening. Based on the 2006 national survey, ~19% of men and women ages 40 years and older had undergone opportunistic screening within the previous 2 years (14).

Although the NCSP offers either UGI or endoscopy examination as an initial screening method for gastric cancer, there is a lack of agreement about the preferred screening method among the government, physicians, and the general population. For a program of this magnitude to succeed, a high level of participation is required, which likely depends on individuals' attitudes about the screening method used. Previous studies about colorectal cancer screening have suggested that individuals prefer to initiate tests that they believe to be the most accurate (e.g., colonoscopy) or least invasive (e.g., fecal occult blood test) or the easiest and least expensive (15-19). Moreover, based on a behavioral model, previous studies reported that predisposing (age, gender, marital status, and family history of colon cancer), enabling (health insurance status, physician visit, and usual source of care), and need (health status) factors were associated with colorectal cancer screening use, and the relevance attributed to screening use was in many cases test specific (17, 20, 21). Further, the intention to have colorectal cancer screening differed significantly by screening status (22). For example, individuals who had a prior colonoscopy were more likely to prefer an invasive versus a noninvasive test (17).

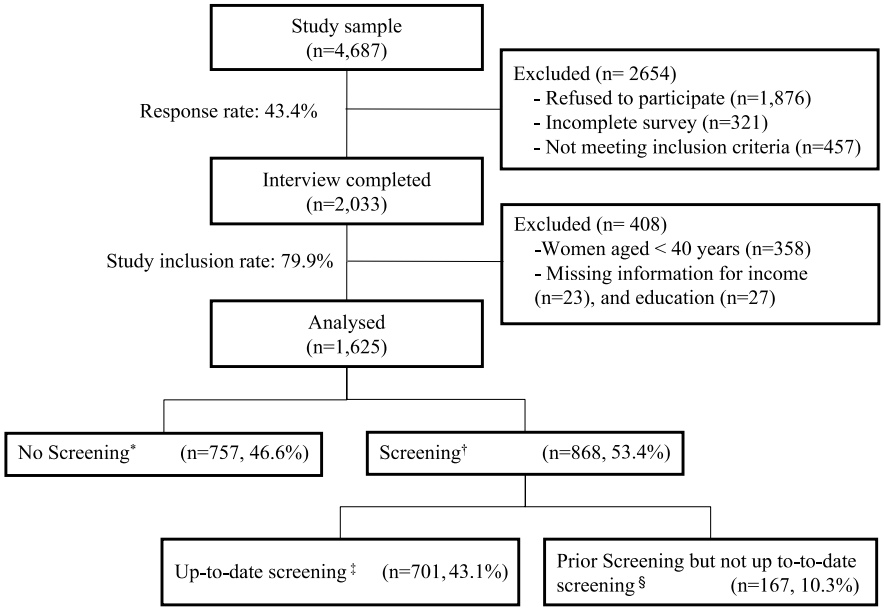
However, screening for gastric cancer is not commonly practiced, and there is a paucity of data to lend support to such a program. To our knowledge, no study has investigated the preferred screening methods for gastric cancer (UGI versus endoscopy). In addition, the influence of prior experiences on future preferences has not been investigated. Although the effectiveness of mass screening for gastric cancer remains controversial, countries with a high incidence of gastric cancer, such as Japan and Korea, have implemented nationwide gastric cancer screening programs and have made an effort to promote cancer screening. Therefore, understanding people's experiences with and preferences for gastric cancer screening methods may provide information necessary for optimizing screening adherence.

The objectives of this study were to assess the rates of gastric cancer screening by two screening methods and to determine the preferred method for widespread screening from a population-based survey of Korea. We examined the gastric cancer screening rates for different screening methods and the factors associated with the use or nonuse of tests. We also examined the intention to be screened for gastric cancer in the future and the preferred method of screening and its associated factors.

Materials and Methods

Study Population. This study was based on the 2006 Korean National Cancer Screening Survey, an annual cross-sectional survey that uses a nationally representative random sampling to investigate Korean participation rates in cancer screening for five common cancers: gastric, liver, colorectal, breast, and cervix (23). A total of 4,687 men and women were selected based on the 2005 Resident Registration Population data using a stratified, multistage, and random sampling according to geographic area, age, and gender. The Resident Registration Population is published annually by the Korea National Statistical Office after data are gathered from residents of the registration population every December 31. The publication provides data about changes in population size and structure and identifies population changes by administrative district (24).

For the current study, investigators from a professional research agency conducted face-to-face interviews in the participants' homes. Study recruitment involved door-to-door contact. We made at least three attempts to contact a resident in each dwelling. Study eligibility was assessed through a face-to-face interview. Eligible participants were asked about their experiences of screening for five common cancers; health behaviors such as smoking, physical activity, alcohol use, health status, and family history of cancer; and socioeconomic and demographic information. Interviews were completed by 2,033 participants (response rate, 43.4%; age ≥30 y) with no previous cancer diagnosis. Of the 2,033 individuals, cancer-free male and female participants 40 y or older were included in this study. We excluded some participants due to missing information: 23 subjects did not report income and 27 did not report education; of



* No screening: Individuals had never undergone a UGI or endoscopy test.
† Screening: Individuals had undergone either a UGI or endoscopy in their lifetime
‡ Up-to-date screening: Individuals had undergone either a UGI or endoscopy test in the previous 2 years.
§ Prior screening but not up-to-date: Individuals had undergone either a UGI or endoscopy test at least once, but not within the previous 2 years.

Figure 1. Participant selection process.

the latter, 3 had already been excluded due to missing income data. Finally, 1,625 participants were selected as study subjects (Fig. 1). The lower age cutoff follows the recommendation of NCSP for gastric cancer screening for individuals 40 y of age and older (12). We obtained informed consent from all study participants.

Measurement. The questions about gastric cancer screening behaviors were developed to assess the utilization rate of and preferred method for gastric cancer screening (UGI versus endoscopy). The questions were prefaced with a two-to-three-sentence description of the test to help respondents differentiate between the tests. The main distinguishing characteristics of the tests cited were as follows: (*a*) UGI (barium enema) requires an X-ray after drinking a cup of white fluid and (*b*) endoscopy is done with a flexible tube in the physician's office. Previous experience was assessed by the following questions: (*a*) whether the participant had ever been screened for gastric cancer, (*b*) which tests the participant underwent (UGI, endoscopy, or both), and (*c*) when the participant underwent his/her most recent UGI or endoscopy test. Respondents were categorized into one of the following groups: (*a*) up-to-date screening (individuals had undergone either a UGI or endoscopy test in the previous 2 y based on clinical NCSP guidelines; ref. 12), (*b*) prior but not up-to-date screening (individuals had undergone either a UGI or endoscopy test at least once but not within the previous 2 y), or (*c*) no screening (individuals had never undergone either a UGI or an endoscopy test). The primary outcome measures assessed up-to-date gastric cancer screening, specifically (*a*) UGI use within the previous 2 y, (*b*) endoscopy use within the previous 2 y, and (*c*) either test (UGI and/or endoscopy) conducted within the previous 2 y. The information about the reason for screening, that is, whether the screening was conducted for screening purposes or symptom/diagnostic purposes, and test results were not collected for individuals who indicated that they had undergone either UGI or endoscopy tests.

Screening intention was measured by asking participants the following: ''Do you have any intention to get screened for gastric cancer within the next two years? (1 = yes; 2 = no)''. In addition, all respondents, including those who had no intention of getting screened, were asked to select one preference from the choices of UGI and endoscopy. Based on a previous study (19), we selected a forced choice response format because the primary purpose was to determine the preferred method of gastric cancer screening between the UGI and endoscopy in a general population.

We also examined demographic and socioeconomic factors (e.g., gender, age, education, and household income) that might affect decisions about gastric cancer screening. Household income was categorized into three groups based on monthly household post-tax income (US$1 = 1,000 won). We also included questions on whether individuals had ever had health checkups (including a physical examination) in their lifetime, which were considered a proxy for the ability to afford and/or have access to health care. We considered the subjects' family histories of gastric cancer, where ''family'' included only blood relatives, including half-siblings. With regard to health behavior, we ascertained smoking status and alcohol consumption. The participants were classified as current smokers if they reported

Table 1. Descriptive information for the sample population and UGI, endoscopy, or any test use in the previous 2 y

Characteristics	Total (n = 1,625)	Screening strategy		
		UGI*	Endoscopy†	Any test‡
	n (%)	%	%	%
Totals				
No. participants	—	1,625	1,625	1,625
No. screened	—	245	540	701
Percent screened	—	15.1	33.2	43.1
Gender				
Male	792 (48.7)	12.9	32.2	40.0
Female	833 (51.3)	17.2	34.2	46.1
P		0.016	0.388	0.014
Age (y)				
40-49	683 (42.0)	12.5	29.3	36.9
50-59	428 (26.3)	14.7	35.3	45.3
60-69	380 (23.4)	21.6	39.5	53.7
≥70	134 (8.3)	11.2	29.1	38.1
P		0.001	0.004	<0.001
Education (y)				
Did not complete high school	711 (43.7)	17.3	34.5	46.8
High school graduate or above	914 (56.3)	13.4	32.3	40.3
P		0.027	0.354	0.009
Monthly household income (US$)				
<2,000	689 (42.4)	16.4	32.2	44.7
2,000-2,999	455 (28.0)	13.6	30.6	39.3
≥3,000	481 (29.6)	14.6	37.2	44.5
P		0.408	0.073	0.156
Previous health checkup				
No	413 (25.4)	5.6	13.3	17.7
Yes	1,137 (70.0)	19.0	40.2	52.5
Missing (don't know)	75 (4.6)	8.0	37.3	41.3
P		<0.001	<0.001	<0.001
Family history of gastric cancer				
No	1,571 (96.7)	11.1	50.0	53.7
Yes	54 (3.3)	15.2	32.7	42.8
P		0.526	0.008	0.111
Smoking status				
Current smoker	419 (25.8)	14.1	27.7	35.6
Ex-smoker	196 (12.1)	12.2	35.7	43.4
Nonsmoker	1,010 (62.1)	16.0	35.1	46.2
P		0.319	0.020	0.001
Alcohol consumption				
None in the past 30 d	878 (54.0)	16.5	35.0	45.6
Once a week or less	326 (20.1)	13.5	30.1	39.3
Two or 3 d per week	233 (14.3)	12.9	32.6	42.9
Four or more days per week	188 (11.6)	13.8	31.4	38.8
P		0.367	0.392	0.138

*Individuals had undergone a UGI test in the previous 2 y.
†Individuals had undergone an endoscopy test in the previous 2 y.
‡Individuals had undergone either a UGI or endoscopy, or both tests in the previous 2 y. The number screened does not equal the sum of participants (i.e., individuals may have had more than one test).

current smoking for at least 1 y or as nonsmokers if they had never smoked or had previously smoked but had not smoked for more than 1 y. For alcohol consumption, participants were asked, ''During the past 30 days, how often did you have at least one drink of any alcoholic beverage?'' For the main analysis, the participants were categorized as ''none in the past 30 days,'' ''once a week or less,'' ''two or three days per week,'' or ''four or more days per week.''

Statistical Analysis. Descriptive statistics were computed for all demographic, socioeconomic, health behavior, and dependent variables, including the frequency distribution for each categorical variable. We first did bivariate analyses to evaluate unadjusted effects of each variable and then conducted multivariate analyses to examine the adjusted associations of these variables with (*a*) up-to-date gastric cancer screening procedure use (UGI, endoscopy, and either UGI and/or endoscopy), (*b*) the intention to have future screening (intention versus no intention), and (*c*) preferences for future gastric cancer screening methods (endoscopy versus UGI) in a population. We used multiple logistic regressions in all of our adjusted analyses. Three multivariate models were used to determine the independent variables associated with undergoing up-to-date gastric cancer screening by each method: UGI within the previous 2 y, endoscopy within the previous 2 y, and either or both within the previous 2 y. Additional models were designed to identify the factors associated with

having an intention to be screened and preference for one of the two screening tests (endoscopy versus UGI). We added the individuals' gastric screening history (up-to-date screening, prior but not up-to-date screening, and no screening) and method of previous cancer screening within the previous 2 y (UGI, endoscopy, and both) as independent variables to evaluate the influence of prior experiences on future screening intention and preferred methods. All statistical analyses were conducted using Statistical Analysis System statistical software (version 9.1; SAS Institute, Inc.).

Results

Sample Characteristics. Of the 1,625 survey respondents, approximately 51% were women, 42% were 40 to 49 years old, 56% were educated at a high school level or above, and ~3% had a family history of gastric cancer. With regard to gastric cancer screening history, 43.1 of respondents had undergone either a UGI or endoscopy test in the previous 2 years (up-to-date screening), 10.3% had undergone either a UGI or endoscopy test at least once but not within the previous 2 years (prior but not up-to-date screening), and 46.6% had never undergone either a UGI or endoscopy test (no screening; Fig. 1).

Rate of Gastric Cancer Screening in the Previous 2 Years. Among the 1,625 subjects ages 40 years and older, 245 (15.1%) had undergone UGI testing, 540 (33.2%) had received an endoscopy test, and 701 (43.1%) had undergone either or both of the two tests within the previous 2 years (Table 1). In bivariate analyses, women were more likely to have had UGI screening than men. UGI test rates increased with increasing age until 60 to 69 years and then decreased. Respondents who were less educated and had undergone a recent health checkup were more likely to report having had an UGI test than other respondents. Respondents differed significantly in endoscopy use by age, health checkup, family history of gastric cancer, and smoking status. Patterns of associations with endoscopy use by age and health checkup were similar to those for UGI use. However, individuals with a family history of gastric cancer were more likely to report having undergone an endoscopy test than those without such a history. Current smokers reported lower rates of endoscopy use than nonsmokers. Finally, patterns of associations for any test (UGI and/or endoscopy) were similar to those for UGI use, with one exception: current smokers reported lower rates of having undergone any test.

Factors Associated with Gastric Cancer Screening in the Previous 2 Years. Table 2 lists the adjusted associations of subjects' characteristics with their use of

Table 2. Logistic regression for UGI, endoscopy, or any test in the previous 2 y

Characteristics	Model 1: UGI* (n = 1,625)	Model 2: endoscopy† (n = 1,625)	Model 3: any test‡ (n = 1,625)
	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)
Gender			
Male	1.00 (reference)	1.00 (reference)	1.00 (reference)
Female	1.33 (0.85-2.10)	0.75 (0.54-1.05)	0.86 (0.62-1.19)
Age (y)			
40-49	0.88 (0.61-1.28)	0.78 (0.59-1.03)	0.75 (0.57-0.98)
50-59	1.00 (reference)	1.00 (reference)	1.00 (reference)
60-69	1.51 (1.03-2.23)	1.23 (0.90-1.68)	1.38 (1.01-1.87)
≥70	0.76 (0.41-1.44)	0.88 (0.56-1.39)	0.82 (0.53-1.26)
Education (y)			
Did not complete high school	1.00 (reference)	1.00 (reference)	1.00 (reference)
High school graduate or more	0.91 (0.64-1.31)	0.92 (0.70-1.22)	0.88 (0.67-1.15)
Monthly household income (US$)			
<2,000	1.00 (reference)	1.00 (reference)	1.00 (reference)
2,000-2,999	0.93 (0.64-1.35)	1.01 (0.75-1.34)	0.89 (0.68-1.18)
≥3,000	1.00 (0.69-1.46)	1.42 (1.07-1.89)	1.16 (0.88-1.54)
Previous health checkup			
No (missing/don't know)	1.00 (reference)	1.00 (reference)	1.00 (reference)
Yes	3.65 (2.43-5.49)	3.26 (2.49-4.27)	4.12 (3.21-5.30)
Family history for gastric cancer			
No	1.00 (reference)	1.00 (reference)	1.00 (reference)
Yes	0.66 (0.27-1.57)	2.05 (1.17-3.60)	1.53 (0.86-2.70)
Smoking status			
Current smoker	1.00 (reference)	1.00 (reference)	1.00 (reference)
Ex-smoker	0.77 (0.45-1.29)	1.29 (0.88-1.88)	1.20 (0.83-1.73)
Nonsmoker	0.86 (0.53-1.38)	1.65 (1.16-2.36)	1.69 (1.19-2.38)
Alcohol consumption			
None in the past 30 d	1.00 (reference)	1.00 (reference)	1.00 (reference)
Once a week or less	0.90 (0.61-1.33)	0.86 (0.64-1.16)	0.90 (0.68-1.20)
Two or 3 d per week	0.90 (0.56-1.43)	0.96 (0.67-1.36)	1.08 (0.77-1.52)
Four or more days per week	1.05 (0.62-1.76)	1.02 (0.69-1.51)	1.03 (0.71-1.52)

Abbreviations: aOR, adjusted odds ratio; 95% CI, 95% confidence interval.
*Individuals had undergone a UGI test in the previous 2 y.
†Individuals had undergone an endoscopy test in the previous 2 y.
‡Individuals had undergone either a UGI or endoscopy, or both tests in the previous 2 y. The number screened does not equal the sum of participants (i.e., individuals may have had more than one test).

Table 3. Intention to have gastric cancer screening within the next 2 y and preferred method

Characteristics	Having screening intention (n = 1,625)		Preference for future screening method (n = 1,625)		
	%	P	UGI (%)	Endoscopy (%)	P
Total	52.2	—	33.0	67.0	—
Gender					
Male	49.4	0.027	32.8	67.2	0.896
Female	54.9		33.1	66.9	
Age (y)					
40-49	55.2	<0.001	32.8	67.2	0.893
50-59	57.7		32.9	67.1	
60-69	48.4		34.2	65.8	
≥70	30.6		30.6	69.4	
Education (y)					
Did not complete high school	45.4	<0.001	34.6	65.4	0.222
High school graduate or more	57.4		31.7	68.3	
Monthly household income (US$)					
<2,000	47.0	<0.001	36.9	63.1	0.017
2,000-2,999	52.3		30.1	69.9	
≥3,000	59.5		30.2	69.8	
Previous health checkup					
No	35.4	<0.001	36.8	63.2	0.115
Yes	58.9		31.4	68.6	
Missing (don't know)	42.7		36.0	64.0	
Family history for gastric cancer					
No	52.0	0.435	33.2	66.8	0.408
Yes	57.4		27.8	72.2	
Smoking status					
Current smoker	46.8	0.036	32.7	67.3	0.972
Ex-smoker	53.6		33.7	66.3	
Nonsmoker	54.2		33.0	67.0	
Alcohol consumption					
None in the past 30 d	51.4	0.520	34.5	65.5	0.462
Once a week or less	55.5		30.1	69.9	
Two or 3 d per week	53.2		33.0	67.0	
Four or more days per week	48.9		30.9	69.1	
Previous screening history					
No screening	30.5	<0.001	37.3	62.7	0.001
Prior screening	53.9		35.3	64.7	
Up-to-date screening	75.2		27.8	72.2	
Previous screening methods					
No up-to-date screening*	34.7	<0.001	36.9	63.1	<0.001
UGI (≤2 y)	81.4		52.2	47.8	
Endoscopy (≤2 y)	71.1		18.6	81.4	
Both (≤2 y)	82.1		31.0	69.0	

*Includes no screening and prior screening but not up-to-date screening.

gastric cancer screening procedures. Individuals ages 60 to 69 years were more likely to have undergone a UGI test than those ages 50 to 59 years. In addition, individuals who had undergone a health checkup were more likely to have had a UGI test than those who had not. As with UGI use, individuals who had undergone a health checkup were more likely to have had an endoscopy test. Endoscopies were significantly more likely among those with higher income and a family history of gastric cancer. Among health behavior factors, nonsmokers were more likely to have had an endoscopy test compared with current smokers. Overall, individuals who had been screened for gastric cancer within the previous 2 years were more likely to be older, to be nonsmokers, and to have health checkups.

Intention to Have Gastric Cancer Screening. With regard to future gastric cancer screening intentions, 848 (52.2%) participants intended to be screened within the next 2 years (Table 3). The rate of intention to be screened was significantly higher in women compared with men. Individuals ages 50 to 59 years were the more likely to report an intention to be screened in the future compared with other age groups. In addition, individuals with more education, those with higher income, and those who had undergone a health checkup had higher rates of intention to be screened. Nonsmokers had higher rates of intention compared with current or ex-smokers. Individuals who had been screened for gastric cancer within the previous 2 years were more likely to have an intention to be screened in the future than those who had not been previously screened or those who had undergone screening but not up-to-date screening. Further, individuals who had undergone either a UGI test or both UGI and endoscopy testing were more likely to have an intention to be screened than those who had undergone only an endoscopy or those who did not have up-to-date screening.

Preference for Future Gastric Cancer Screening Method. Of the 1,625 participants, 1,085 (67.0%) chose endoscopy and 540 (33.0%) chose UGI for their preferred future screening method (Table 3). Individuals with a higher income were significantly more likely to prefer

endoscopy testing to UGI testing compared with individuals with a lower income. Endoscopy tests were preferred by the majority of respondents who had undergone an endoscopy test within the previous 2 years. However, individuals who had undergone a UGI test preferred the UGI test to the endoscopy test.

Factors Associated with Intention to be Screened. Table 4 presents the results of the multivariate models of intention to be screened within the next 2 years. Women were more likely to report having an intention to be screened within the next 2 years than were men. However, whereas individuals ages 60 to 69 or 70 and older were less likely to report an intention to be screened within the next 2 years compared with those ages 50 to 59 years, individuals who were highly educated and those who had undergone a health checkup had significantly higher odds of reporting an intention to be screened compared with those who had less education or who had not undergone a health checkup. Those who had undergone a UGI test, an endoscopy test, or both tests within the previous 2 years had 11.79, 11.12, and 6.22 higher odds of intending to be screened again, respectively, than those who had not been screened. In addition, those who had undergone gastric cancer screening but not up-to-date screening had higher odds of having an intention to be screened than those who had not been screened.

Factors Associated with Preferred Method. With regard to preference for future screening method, individuals who had undergone an endoscopy test within the previous 2 years were significantly more likely to prefer endoscopy to UGI testing, whereas individuals who had undergone UGI testing within the previous 2 years were less likely to prefer endoscopy (Table 4). In addition, individuals with a household income US$2,000 to US$2,999 were 1.39 times more likely to prefer endoscopy than those with a lower household income. However, other socioeconomic and health behavior factors did not significantly affect preferences for future screening method.

Discussion

Gastric cancer screening remains underused in Korea; only 43% of the targeted Korean population had undergone gastric cancer screening within the previous 2 years. It is difficult to make direct comparisons between

Table 4. Logistic regression for reporting an intention to undergo gastric cancer screening and preferences for endoscopy over UGI

Characteristics	Intention vs no intention (n = 1,625)	Endoscopy vs UGI (n = 1,625)
	aOR (95%CI)	aOR (95% CI)
Gender		
Male	1.00 (reference)	1.00 (reference)
Female	1.43 (1.01-2.02)	1.10 (0.79-1.54)
Age (y)		
40-49	0.92 (0.69-1.24)	0.95 (0.72-1.26)
50-59	1.00 (reference)	1.00 (reference)
60-69	0.62 (0.45-0.87)	1.08 (0.79-1.48)
≥70	0.37 (0.23-0.60)	1.39 (0.89-2.17)
Education (y)		
Did not graduate from high school	1.00 (reference)	1.00 (reference)
High school graduate or more	1.71 (1.27-2.28)	1.07 (0.81-1.41)
Monthly household income (US$)		
<2,000	1.00 (reference)	1.00 (reference)
2,000-2,999	1.00 (0.75-1.35)	1.39 (1.05-1.85)
≥3,000	1.27 (0.94-1.71)	1.32 (0.99-1.76)
Previous health checkup		
No (missing/don't know)	1.00 (reference)	1.00 (reference)
Yes	1.37 (1.06-1.76)	1.13 (0.89-1.44)
Family history for gastric cancer		
No	1.00 (reference)	1.00 (reference)
Yes	0.91 (0.49-1.69)	1.04 (0.56-1.95)
Smoking status		
Current smoker	1.00 (reference)	1.00 (reference)
Ex-smoker	1.31 (0.88-1.93)	0.88 (0.61-1.29)
Nonsmoker	1.08 (0.75-1.55)	0.95 (0.67-1.35)
Alcohol consumption		
None in the past 30 d	1.00 (reference)	1.00 (reference)
Once a week or less	1.28 (0.95-1.74)	1.28 (0.95-1.71)
Two or 3 d per week	1.18 (0.82-1.68)	1.11 (0.79-1.57)
Four or more days per week	1.21 (0.81-1.82)	1.27 (0.86-1.87)
Gastric cancer screening history		
No screening	1.00 (reference)	1.00 (reference)
Prior screening	2.94 (2.04-4.23)	1.09 (0.76-1.56)
Up-to-date screening with		
UGI (≤2 y)	11.79 (7.49-18.58)	0.54 (0.38-0.78)
Endoscopy (≤2 y)	6.22 (4.70-8.24)	2.57 (1.92-3.44)
Both (≤2 y)	11.12 (6.06-20.41)	1.26 (0.77-2.08)

studies because, to our knowledge, no previous study has investigated the gastric cancer screening rate using a population-based sample. Individuals who had been screened for gastric cancer within the previous 2 years were more likely to be older, nonsmokers, or those who have regular health checkups. Factors associated with gastric cancer screenings are similar to those found in colorectal cancer screening (21, 25). About screening methods, rates of endoscopy testing (32.2% and 34.2%) were more than double those of UGI testing (12.9% and 17.2%) in both men and women, respectively. Similarly, the prevalence of colorectal cancer screening using endoscopy (i.e., flexible sigmoidoscopy or colonoscopy) was more than twice as prevalent as screening by the fecal occult blood test among both men and women in the United States (21, 26). The factors for having had an endoscopy test differed somewhat from those for having had a UGI test. Interestingly, respondents with higher income levels were more likely to have had an endoscopy test. Under the Korean health insurance system, the cost of an endoscopy test is almost the same as that for a UGI test. In addition, the NCSP offers free-of-charge endoscopy test for gastric cancer screening. Despite these programs, disparities in the use of endoscopy vary with household income, possibly suggesting that misconceptions exist about the cost of endoscopy. In addition, the higher rates of endoscopy use in those with a family history of gastric cancer might indicate that the endoscopy test was the preferred test for a high-risk population.

Approximately 52% of the people in this study reported an intention to be screened for gastric cancer within the next 2 years. Identifying the factors associated with screening intention is important because studies have consistently found a positive association between intention and completion of several cancer screening behaviors (22, 27, 28). In our study, women, individuals who were highly educated, and those who had undergone a health checkup had significantly higher odds of reporting an intention to be screened. However, those ages 60 and older were less likely to report an intention to be screened within the next 2 years. These differences in screening intention highlight a need for interventions targeted at the large proportion of individuals having no intention of complying with screening recommendations, particularly males, those over 60 years of age, those with less education, and those who have never had a health checkup. In addition, our findings revealed that individuals who had undergone up-to-date screening are more likely to be screened according to gastric cancer screening recommendations. Further, individuals who had undergone a UGI test within the previous 2 years had the highest intention to be screened.

With regard to gastric cancer screening preferences, endoscopy was preferred by the majority of respondents (67.0%). Prior experience with screening procedures was strongly associated with a preference for a future screening procedure. Individuals who had received a prior endoscopy test were significantly more likely to prefer an endoscopy test to a UGI test, whereas individuals who had previously undergone a UGI test were less likely to prefer an endoscopy test. This may be the result of education and information acquired at previous screening tests. Our findings are somewhat consistent with previous research, which found that individuals who had previously undergone a colonoscopy were significantly more likely to prefer an invasive (e.g., sigmoidoscopy or colonoscopy) versus a noninvasive (e.g., fecal occult blood test) test (17). Reasons for this preference may involve psychological and test-specific characteristics. Previous studies showed that those who selected endoscopy (e.g., colonoscopy or sigmoidoscopy) reported that the accuracy of the test was the most important reason for their choice (17-19). Discomfort was reported as an important decisional factor for those who were more likely to prefer a noninvasive test (17). Therefore, clinicians, public health workers, and policymakers must carefully consider the messages that are communicated to the public about gastric cancer test options.

We examined gastric cancer screening use and preferences for future screening procedures in a population sample. However, this study had some limitations that must be considered when interpreting the results. First, Korean National Cancer Screening Survey data were self-reported, which may have introduced a bias, as several studies have suggested that self-reports overestimate the prevalence of cancer screening (29, 30). Second, we were unable to explore the influence of other important correlates, such as test-specific characteristics (e.g., preparation, cost, time constraints, transportation, or geographic capacity for screening) and psychological factors (e.g., discomfort, concern about complications, or anxiety about the procedure) involved in utilization of gastric cancer screening and preference for future methods. Third, items designed to assess screening test preferences may not predict respondents' actual preferences. Because we used a forced choice format when asking about screening tests, individuals who would have preferred no screening or those who had no preference were included in the analysis. However, when we did the analysis to assess the associated factors with preferred method among those who had an intention to be screened, the patterns of association were similar to those for preferences in a population (results not shown). Finally, the cross-sectional design used in this study precludes conclusions about whether observed associations were causal.

Collectively, our study results highlight that the endoscopy test is the preferred gastric cancer screening method according to a population-based survey. Recent reports have proposed endoscopic screening as an alternative strategy to radiography (8, 31). Although endoscopy is generally considered to have a high detection rate, its sensitivity compared with that of radiography is unclear based on population-based screenings (31). Moreover, endoscopy is an invasive test that must be done by a physician. Therefore, endoscopy tests depend heavily on the skills of the endoscopist and on the availability of a gastroscope. Even assuming that the capacity exists to do screening endoscopies on every age-eligible person at the recommended frequency, we recommend caution in promoting endoscopy over UGI as a gastric cancer screening test. Our data show that roughly half of previous UGI users preferred UGI to endoscopy based on their prior experience. Therefore, reliance on endoscopy alone may be insufficient to ensure high participation in gastric cancer screenings at a population level.

The options for gastric cancer screening tests allow for flexibility but can also render decisions about recommending or choosing a particular test difficult. Each test has its tradeoffs in terms of efficacy, complications, discomfort, time, and cost (21). The best test is a matter of personal preference, which should be considered when physicians make recommendations for screening (15). Providers' (clinicians, public health workers, and policymakers) assessments of individuals' screening preferences, in combination with intervention strategies to promote performance of the preferred screening method, may increase compliance with gastric cancer screening recommendations. Future research should investigate ways to improve shared decision making in test selection, specifically within a Korean context. In addition, we recommend further studies of cancer detection rates, participation rates, economic costs, and the side effects of different screening modalities in populations.

Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

Acknowledgments

The costs of publication of this article were defrayed in part by the payment of page charges. This article must therefore be hereby marked *advertisement* in accordance with 18 U.S.C. Section 1734 solely to indicate this fact.

References

1. Parkin DM, Bray F, Ferlay T, Pisani P. Global cancer statistics, 2002. CA Cancer J Clin 2005;55:74–108.
2. Shin HR, Won YJ, Jung KW, et al. Nationwide cancer incidence in Korea, 1999-2001: first result using the national cancer incidence database. Cancer Res Treat 2005;37:325–31.
3. Lambert R, Guilloux A, Oshima A, et al. Incidence and mortality from stomach cancer in Japan, Slovenia and the USA. Int J Cancer 2002;97:811–8.
4. Miyamoto A, Kuriyama S, Nishino Y, et al. Lower risk of death from gastric cancer among participants of gastric cancer screening in Japan: a population-based study. Prev Med 2007;44:12–9.
5. Lee KJ, Inoue M, Otani T, Iwasaki M, Sasazuki S, Tsugane S. Gastric cancer screening and subsequent risk of gastric cancer: a large-scale population-based cohort study, with a 13-year follow-up in Japan. Int J Cancer 2006;118:2315–21.
6. Stewart BW, Kleihues P, editors. World cancer report. Lyon (France): IARC; 2003.
7. Pisani P, Oliver WE, Parkin DM, Alvarez N, Vivas J. Case-control study of gastric cancer screening in Venezuela. Br J Cancer 1994;69:1102–5.
8. Leung WK, Wu M-s, Kakugawa Y, et al. Screening for gastric cancer in Asia: current evidence and practice. Lancet Oncol 2008;9:279–87.
9. Tusbono Y, Hisamichi S. Screening for gastric cancer in Japan. Gastric Cancer 2000;3:9–18.
10. Tashiro A, Sano M, Kinameri K, et al. Comparing mass screening techniques for gastric cancer in Japan. World J Gastroenterol 2006;12:4874–75.
11. Dan YY, So JB, Yeoh KG. Endoscopic screening for gastric cancer. Clin Gastroenterol Hepatol 2006;4:709–16.
12. Yoo KY. Cancer control activities in the republic of Korea. Jpn J Clin Oncol 2008;38:327–33.
13. Choi IJ. Screening and surveillance of gastric cancer. Korean J Gastroenterol 2007;49:15–22.
14. Park EC, Kwak MS, Kim SK, et al. Evaluation of cancer screening and cost of cancer. Seoul: National Cancer Center in Korea; 2006. p. 114.
15. Leard LE, Savides TJ, Ganiats TG. Patient preferences for colorectal cancer screening. J Fam Pract 1997;45:211–8.
16. Hawley ST, Volk RJ, Krishnamurthy P, Jibaja-Weiss M, Vernon SW, Kneuper S. Preferences for colorectal cancer screening among racially/ethnically diverse primary care patients. Med Care 2008;46:S10–16.
17. Janz NK, Lakhani I, Vijan S, Hawley ST, Chung LK, Katz SJ. Determinants of colorectal cancer screening use, attempts, and nonuse. Prev Med 2007;44:452–8.
18. Ling BS, Moskowitz MA, Wachs D, Pearson B, Schroy PC. Attitudes toward colorectal cancer screening tests. J Gen Intern Med 2001;16:822–30.
19. DeBourcy AC, Lichtenberger S, Felton S, Butterfield KT, Ahnen DJ, Denberg TD. Community-based preferences for stool cards versus colonoscopy in colorectal cancer screening. J Gen Intern Med 2008;23:169–74.
20. Wong ST, Gildengorin G, Nguyen T, Mock J. Disparities in colorectal cancer screening rates among Asian Americans and non-Latino Whites. Cancer 2005;104:2940–7.
21. Meissner HI, Breen N, Klaunde CN, Vernon SW. Patterns of colorectal cancer screening uptake among men and women in the United States. Cancer Epidemiol Biomarkers Prev 2006;15:389–94.
22. Watts BG, Vernon SW, Myers RE, Tilley BC. Intention to be screened over time for colorectal cancer in male automotive workers. Cancer Epidemiol Biomarkers Prev 2003;12:339–49.
23. Hahm MI, Choi KS, Park EC, Kwak MS, Lee HY, Hwang SS. Personal background and cognitive factors as predictors of the intention to be screened for stomach cancer. Cancer Epidemiol Biomarkers Prev 2008;17:2473–9.
24. Korea National Statistical Office. 2005 Resident registration population. Seoul: Korea National Statistical Office; 2005.
25. Farmer MM, Bastani R, Kwan L, Belman M, Ganz PA. Predictors of colorectal cancer screening from patients enrolled in a managed care health plan. Cancer 2008;112:1230–38.
26. Smith RA, Cokkinides V, Brawley OW. Cancer screening in the United States, 2008: a review of current American Cancer Society guidelines and cancer screening issues. CA Cancer J Clin 2008;58:161–79.
27. Lechner L, De Vries H, Offermans N. Participation in a breast cancer screening program: influence of past behavior and determinants on future screening participation. Prev Med 1997;26:473–82.
28. Myers RE, Balshem AM, Wolf TA, Ross EA, Millner L. Adherence to continuous screening for colorectal neoplasia. Med Care 1993;31:508–19.
29. Gorden NP, Hiatt RA, Lampert DI. Concordance of self-reported data and medical record audit for six cancer screening procedures. J Natl Cancer Inst 1993;85:566–570.
30. Newell S. Accuracy of patient's recall of Pap and cholesterol screening. JAMA 2000;90:1431–5.
31. Hamashima C, Shibuya D, Yamazaki H, et al. The Japanese guidelines for gastric cancer screening. Jpn J Clin Oncol 2008;38:259–67.

Screening for Gastric Cancer in Korea: Population-Based Preferences for Endoscopy versus Upper Gastrointestinal Series

Kui Son Choi, Min-Son Kwak, Hoo-yeon Lee, et al.

Cancer Epidemiol Biomarkers Prev 2009;18:1390-1398.