Factors associated with use of gastric cancer screening services in Korea

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Abstract

AIM: To identify the factors associated with participation in gastric cancer screening programs.

METHODS: Using data from the Korea National Health and Nutrition Examination Survey 2005 (KNHANES Ⅲ), a nationwide health-related survey in Korea, a cross-sectional study was performed to investigate the multiple factors associated with gastric cancer screening attendance among persons aged at least 40 years. The study population included 4593 individuals who completed a gastric cancer screening questionnaire and had no previous cancer history. Four groups of individual-level or environmental level covariates were considered as potential associated factors.

RESULTS: Using KNHANES Ⅲ data, an estimated 31.71% of Korean individuals aged at least 40 years adhered to gastric cancer screening recommendations. Subjects who graduated from elementary school [adjusted odds ratio (aOR), 1.66; 95% CI: 1.21-2.26], middle/high school (aOR, 1.38; 95% CI: 1.01-1.89), and university or higher (aOR, 1.64; 95% CI: 1.13-2.37) were more likely to undergo gastric cancer screening than those who received no formal education at all. The population with the highest income tertile had more attendance at gastric screening compared to those with the lowest income tertile (aOR, 1.36; 95% CI: 1.06-1.73). Gastric screening was also negatively associated with excessive alcohol consumption (aOR, 0.71; 95% CI: 0.53-0.96). A positive attitude to preventive medical evaluation was significantly associated with better participation in gastric cancer screening programs (aOR, 5.26; 95% CI: 4.35-6.35).

CONCLUSION: Targeted interventions for vulnerable populations and public campaigns about preventive medical evaluation are needed to increase gastric cancer screening participation and reduce gastric cancer mortality.

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INTRODUCTION

Gastric cancer is a major public health burden. Although the worldwide incidence of gastric cancer and associated mortality is decreasing, gastric cancer is still the fourth most common cancer and the second leading cause of cancer-related death, causing 700 000 deaths annually[1]. In contrast to the worldwide trend, in Korea the incidence of gastric cancer has been reported to be stable or increasing, and is still one of the most common forms

of cancer and one of the leading causes of death from cancer among both sexes[2,3]. According to the Korea Central Cancer Registry Data, gastric cancers comprised 18% of all new cancers and caused 15.3% of cancer deaths in 2005.

Despite the increasing incidence of gastric cancer in Korea, mortality due to gastric cancer is decreasing. This is due to advances in surgical techniques, chemotherapy and radiological therapy, and to early detection by gastric cancer screening programs[4]. Because patients with early-stage gastric cancer often show no clinical symptoms, a significant proportion of patients are diagnosed when the disease is at an advanced stage, which is associated with poor prognosis. If screening for gastric cancer were universal, beginning at the age of 40 years, and combined with timely treatment of surgical or endoscopic mucosal removal of early cancers, the gastric cancer mortality rate could be markedly reduced[5,6]. A recent study in Korea also showed that repeated endoscopic screening within 2 years decreased the incidence of gastric cancer and endoscopic resection could be applied to more patients who underwent EGD screening within 2 years[7].
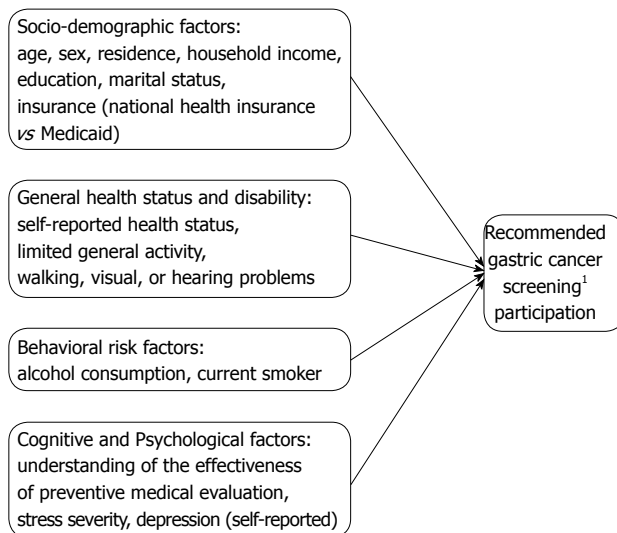
In the past decade, the Korean Ministry of Health and Welfare (MOHW) agency has established multiple cancer control programs. In 1996, the Korean government initiated a comprehensive "10-year plan for cancer control". As part of this program, the Korean Government initiated the National Cancer Screening Program (NCSP) in 1999. Since then, the NCSP has provided free cancer screening for common cancers to low-income individuals receiving medical aid[8]. However, the rate of participation in gastric cancer screening programs is not optimal[9,10]. Therefore, to increase the participation rate and improve the survival rate of gastric cancer patients, identification and removal of potential barriers to cancer screening participation might be of great importance. However, few studies have investigated the individual and environmental predictors of gastric cancer screening participation in the Korean population.

In the present study, we analyzed the relationship among four dimensions of individual-level factors, including socio-demographic characteristics, general health status, gastric cancer risk factors and cognitive factors, and gastric cancer screening participation (Figure 1), among individuals included in the Third Korea National Health and Nutrition Examination Survey 2005 (KNHANES III).
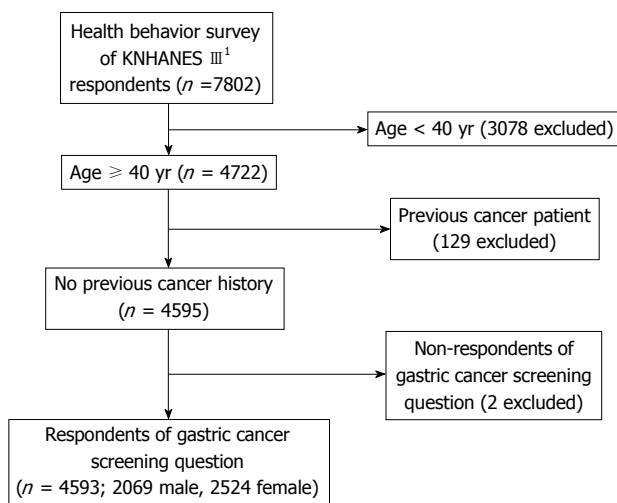
MATERIALS AND METHODS

Study population

This study was based on data obtained from the KNHANES III. The KNHANES is a national household survey that provides comprehensive information on health status, health care utilization, and socio-demographics of a nationally representative sample of 34 145 individuals from 13 800 households. The KNHANES III is composed of four parts: health interview survey, health behavior survey, health examination survey and nutrition survey.

Figure 1 Framework of study investigating factors associated with gastric cancer screening participation. [1]Endoscope or upper gastrointestinal series; every 2 years, starting at the age of 40 years.

Figure 2 The study population framework. [1]2005 Korean National Health and Nutrition Examination Survey.

We performed a cross-sectional analysis of data from the 7802 individuals who completed the health behavior survey. We then selected individuals aged at least 40 years who answered the gastric cancer screening behavior question, yielding 4722 individuals. After excluding 129 individuals who had previously been diagnosed with cancer, 4593 people (2069 men and 2524 women) were eligible for our analyses (Figure 2).

Gastric cancer screening behavior outcome

According to the KNCSP guidelines, persons aged at least 40 years should undergo gastroscopy or upper gastrointestinal series (UGIS) examinations every 2 years. Subjects were asked the question "when was the last time you had a gastric cancer screening examination (endoscope or UGIS)?" The possible responses were "never", "less than 1 year", "1-2 years", "more than 2 years".

In the present study, the outcome variable is whether

the individuals adhere to KNCSP guidelines or not. We recognized that individuals who reported never taking a gastric cancer screening examination or having undergone examinations more than 2 years prior to completing the questionnaire would be classified as not adhering to KNCSP guidelines.

Independent variables

Data about variables were also obtained from the KNHANES Ⅲ and their associations with gastric cancer screening were investigated. We considered 17 variables as potential factors that could be associated with gastric cancer screening (Figure 1); these 17 variables were classified into one of four groups: (1) socio-demographic factors [age, gender, residential area (metropolitan area or not), household income, education level, marital status, insurance (national health insurance or Medicaid)]; (2) general health status and disability (self-reported health status, limitation of general activity, walking problem, visual problem, hearing problem; (3) gastric cancer risk factors (alcohol consumption, current smoker); (4) cognitive and psychological factors (attitude to routine health checks, stress severity, depression).

Patients were stratified by age; age 40-49, 50-59, 60-69 and ⩾ 70 years. Residential area was classed as metropolitan or non-metropolitan area. Income was calculated by dividing the household monthly income by the square root of the household size (equivalized income), and was categorized into three groups[11,12]. Education level was categorized as uneducated, elementary school graduate, high school graduate, and college or higher education graduate. Marital status was recorded as married, unmarried, widowed, or divorced, and was dichotomized as living with or without spouse. South Korea has a universal health insurance system; hence we compared individuals with national health insurance (NHI) and those receiving Medicaid (the Korean government program for low-income or medically needy individuals).

Alcohol consumption was assessed using the question "how often do you binge drink?" (binge drinking was defined as seven or more drinks for men and five or more drinks for women), and was categorized into three groups: (1) non-binge drinker, nondrinker or social drinker who reported binge drinking no more than once per mouth; (2) binge drinker, reported binge drinking 1-4 times per month; and (3) frequent binge drinker, reported binge drinking more than twice per week[13]. Individuals were asked "Do you now smoke cigarettes?" and, based on responses, were categorized by smoking status into three groups: (1) never smoker, have never smoked; (2) ex-smoker, have quit smoking; and (3) current smoker, smoke daily or intermittently smoke.

For cognitive and psychological factors, we considered attitudes to preventive medical evaluation, stress severity and self-reported depression.

Statistical analysis

The dependent variable of interest was whether the patient had undergone gastric cancer screening within the previous 2 years; independent variables were the 17 factors described above.

Descriptive statistical methods were used to describe the basic characteristics of the study population; numbers and percentages are reported for each variable. First, to identify the factors associated with undergoing gastric cancer screening, we used univariate logistic regression analysis. Odds ratios and confidence intervals for the associations between gastric cancer screening attendance and each factor were calculated. A *P*-value less than 0.05 was considered significant. Next, the factors identified as significantly associated with gastric cancer screening by univariate analysis ($P < 0.05$) were analyzed by multivariate logistic regression analysis. All statistical tests were performed using STATA, version 10.0.

RESULTS

General characteristics of the study population

Characteristics of the study population are summarized in Table 1. In the study population, 1457 individuals (31.71%) had undergone a gastric cancer screening examination within the previous 2 years. The mean age of our study population was 55.12 years; 54.95% were women. Three-quarters of the population were living with a spouse and most were enrolled in the national health insurance program. Of the study population, 8.69% were frequent binge drinkers, consuming large quantities of alcohol almost daily. A total of 6.30% of women were current smokers, compared with 48.77% of men; this result is similar to that reported for adult men in Korea in 2006 (44.7%)[8].

Factors associated with gastric cancer screening attendance

Table 2 shows the univariate analysis results; crude odds ratios (ORs) and 95% confidence intervals (95% CIs) were reported. The factors associated with gastric cancer screening participation were age (more than 70 years), income, education level, marital status, limited general activity, visual problems, smoking status, attitude to preventive medical health assessments, stress and alcohol consumption.

By multivariate logistic regression analysis, only four of these factors were significantly and independently associated with gastric cancer screening (Table 3): household monthly income, education level, alcohol consumption and attitude to preventive medical evaluation.

Of the socio-demographic factors considered, higher household income was found to be associated with a higher OR. Compared with the lowest income tertile, the adjusted OR (aOR) of the highest income tertile was 1.36 (95% CI: 1.06-1.73). There was also a clear trend to increased rates of gastric cancer screening with greater education level (elementary school graduate: aOR, 1.66; 95% CI: 1.21-2.26; middle or high school graduate: aOR, 1.38; 95% CI: 1.01-1.89; university or higher education graduate: aOR, 1.64; 95% CI: 1.13-2.37).

Table 1 Basic characteristics of the study population (n = 4593)		
		n (%)
Socio-demographic factor		
Age (yr)	40-49	1854 (40.37)
	50-59	1204 (26.21)
	60-69	924 (20.12)
	≥ 70	611 (13.3)
Sex	Male	2069 (45.05)
	Female	2524 (54.95)
Residence[1]	Metropolis	2058 (44.81)
	Town or country	2535 (55.22)
Household income[2]	Lowest tertile	1446 (31.88)
	Middle tertile	1550 (34.17)
	Highest tertile	1540 (33.95)
Education	Uneducated	497 (10.83)
	Elementary school	1117 (24.32)
	Middle-high school	2206 (48.03)
	University or higher	773 (16.83)
Marital status[3]	Without spouse	1053 (22.94)
	With spouse	3537 (77.06)
National health insurance	NHI	4355 (95.17)
(NHI) vs Medicaid[4]	Medicaid	221 (4.83)
General health status		
Self-reported health status	Healthy	1522 (33.14)
	Middle	1682 (36.62)
	Unhealthy	1389 (30.24)
Limitation of general activity	Limited	671 (14.61)
	Unlimited	3922 (85.39)
Walking problem	Limited	881 (19.19)
	Unlimited	3711 (80.81)
Visual problem	Limited	1600 (34.84)
	Unlimited	2993 (65.16)
Hearing problem	Limited	635 (13.83)
	Unlimited	3958 (86.17)
Cancer risk factor		
Smoking	Never	2536 (55.21)
	Ex-smoker	889 (19.36)
	Current smoker	1168 (25.43)
Alcohol consumption (number of	Non-binge drinker	2781 (60.55)
binge drinking sessions per month)[5]	Binge drinker	1413 (30.76)
	Frequent binge drinker	399 (8.69)
Psychological factors		
Gastric cancer screening[6]	Participated	1457 (31.72)
	Did not participate	3136 (68.28)
Attitude to health check-up	Not effective[7]	1730 (15.46)
	Effective	2862 (84.54)
Stress severity	None	845 (18.4)
	Mild	2126 (46.29)
	Moderate	1311 (28.54)
	Severe	311 (6.77)
Depression (self-reported)	No	3788 (82.49)
	Yes	804 (17.51)

[1]There are seven metropolitan areas in Korea, the other areas were defined as town or country; [2]Defined as "household income/square root of number of persons in household"; [3]State of "without spouse" includes never married, divorced, and separation by death; [4]National health insurance includes regional health insurance and workplace health insurance; [5]Binge drinking means alcohol consumption of more than 70 g of alcohol per episode for men or 50 g per episode for women in this study. One glass of Soju contains 10 g of alcohol; [6]Experience or not of EGD (Esophago-Gastro-Duodenoscopy) or UGIS (Upper Gastrointestinal Series) within the previous 2 years; [7]Includes people with negative thoughts about medical check-ups and those who have not previously undergone a medical check-up.

Table 2 Factors associated with gastric cancer screening[1] by univariate analysis (n = 4593)			
		OR (crude)	95% CI
Socio-demographic factor			
Age (yr)	40-49	1 (ref)	
	50-59	1.07	0.89-1.29
	60-69	0.99	0.80-1.22
	≥ 70	0.61	0.47-0.79
Sex	Male	1 (ref)	
	Female	0.95	0.84-1.07
Residence	Metropolis	1 (ref)	
	Town or country	1.15	0.96-1.36
Household income	Lowest tertile (≤ 1.00 × 10⁶ kW)	1 (ref)	
	Middle tertile (1.00-2.42 × 10⁶ kW)	1.25	1.03-1.53
	Highest tertile (≥ 2.45 × 10⁶ kW)	1.80	1.47-2.20
Education	Uneducated	1 (ref)	
	Elementary school	1.83	1.38-2.43
	Middle or high school	1.71	1.31-2.26
	University or higher	2.51	1.84-3.46
Marital status	Without spouse	1 (ref)	
	With spouse	1.42	1.20-1.68
NHI vs Medicaid	NHI	1 (ref)	
	Medicaid	0.98	0.66-1.45
General health status			
Self-reported health status	Healthy	1 (ref)	
	Middle	1.07	0.91-1.27
	Unhealthy	1.09	0.92-1.29
Limitation of general activity	Limited	1 (ref)	
	Unlimited	1.20	1.00-1.45
Walking problem	Limited	1 (ref)	
	Unlimited	1.15	0.96-1.39
Visual problem	Limited	1 (ref)	
	Unlimited	1.15	1.00-1.32
Hearing problem	Limited	1 (ref)	
	Unlimited	1.16	0.97-1.39
Cancer risk factor			
Alcohol consumption	Non-binge drinker	1 (ref)	
	Binge drinker	1.03	0.89-1.20
	Frequent binge drinker	0.76	0.59-0.98
Smoking	Never	1 (ref)	
	Ex-smoker	1.05	0.88-1.24
	Current smoker	0.80	0.69-0.94
Psychological factor			
Attitude to health check-up	No	1 (ref)	
	Yes (cancer screening is effective)	5.61	4.66-6.75
Stress severity	None	1 (ref)	
	Mild	1.18	0.99-1.41
	Moderate	1.23	1.01-1.49
	Severe	0.95	0.72-1.24
Depression (self-reported)	No	1 (ref)	
	Yes	1.03	0.87-1.23

OR: Odds ratio; CI: Confidence interval. [1]Endoscope or Upper Gastrointestinal Series (UGIS) every 2 years.

than twice per week were significantly less likely to undergo gastric cancer screening compared with non-binge drinkers or binge drinkers (aOR, 0.71; 95% CI: 0.53-0.96).

A positive attitude to preventive medical evaluation showed the greatest association with gastric cancer screening participation. Individuals who recognized

Analysis of gastric cancer risk factors revealed that frequent binge drinkers who consumed more than seven glasses of Soju (70 g alcohol in total), the most widely consumed traditional beverage in Korea, per day more

		Multivariate OR	95% CI
Socio-demographic factor			
Age (yr)	40-49	1 (ref)	
	50-59	1.02	0.83-1.25
	60-69	0.95	0.74-1.23
	$\geqslant$ 70	0.82	0.59-1.16
Household income	Lowest tertile ($\leqslant$ 1.00 × 10⁶ kW)	1 (ref)	
	Middle tertile (1.00-2.42 × 10⁶ kW)	1.08	0.86-1.36
	Highest tertile ($\geqslant$ 2.45 × 10⁶ kW)	1.36	1.06-1.73
Education	Uneducated	1 (ref)	
	Elementary school	1.66	1.21-2.26
	Middle or high school	1.38	1.01-1.89
	University or higher	1.64	1.13-2.37
Marital status	Without spouse	1 (ref)	
	With spouse	1.05	0.87-1.26
General health status			
Limitation of general activity	Limited	1 (ref)	
	Unlimited	0.95	0.76-1.19
Visual problem	Limited	1 (ref)	
	Unlimited	1.03	0.88-1.21
Cancer risk factor			
Alcohol consumption	Non-binge drinker	1 (ref)	
	Binge drinker	0.93	0.77-1.13
	Frequent binge drinker	0.71	0.53-0.96
Currently smoking	Never	1 (ref)	
	Ex-smoker	1.08	0.87-1.33
	Current smoker	0.86	0.70-1.06
Psychological factor			
Attitude to health check-up	No	1 (ref)	
	Yes (cancer screening is effective)	5.26	4.35-6.35
Stress severity	None	1 (ref)	
	Mild	1.06	0.87-1.30
	Moderate	1.20	0.98-1.48
	Severe	1.06	0.80-1.41

Table 3 Factors associated with gastric cancer screening[1] by multivariate analysis (n = 4593)

[1]Endoscope or UGIS every 2 years.

the effectiveness of preventive medical evaluation were more likely to undergo recommended gastric cancer screening compared with those who did not (aOR, 5.26; 95% CI: 4.35-6.35).

DISCUSSION

In this national representative household survey, we found that the participation rate of gastric cancer screening in Korea amongst individuals aged 40 years or more, is only 31.71%, even though gastric cancer is largely treatable when detected at an early stage. Our study also found that low household income, low education level, frequent binge drinking and a negative attitude to preventive medical evaluation were significantly associated with poor participation in gastric cancer screening programs. Our study is the first to use multivariate analysis to identify the factors associated with gastric cancer screening in clinical practice, including demographic factors, general health status, behavioral risk factors and psychological factors.

Factors associated with unhealthy behavior, such as alcohol consumption and smoking, are considered

gastric cancer risk factors[14-17], and high levels of tobacco smoking and alcohol consumption have been shown to substantially increase the relative risk of this cancer[15]. Therefore, preventive measures, such as gastroscopy or UGIS, are likely to be of particular benefit in frequent binge drinkers and smokers. However, in this study, we found that frequent binge drinkers were less likely to undergo gastric cancer screening tests compared with others. Current smokers also showed a low participation rate in screening programs, although the difference compared with non-smokers was not significant. These findings indicate that more interventions are needed for individuals with unhealthy behavioral risk factors, and suggest that successful preventive measures could markedly reduce the number of gastric cancer deaths.

Our study also showed that a positive attitude to the effectiveness of preventive medical evaluation is strongly associated with gastric cancer screening participation. Previously, several studies have demonstrated that cognitive elements can directly affect the decision to undergo gastric cancer screening, and personal background and other socio-demographic factors might have indirect effects through their effects on cognitive variables[9,18]. These findings indicate that improved public education about the benefits of preventive cancer screening and routine health checks could have important influences on individual patient decisions to undergo gastric cancer screening.

Household income and education level were shown to be significant predictors of participation in gastric cancer screening in the present study. Previous studies have reported inconsistencies in the relative strength and significance of the correlations between cancer screening and socio-demographic factors[1,9,18-21]. There are several possible reasons for this inconsistency. One possibility is that physiologic medical accessibility may vary with health care policy and location; for example, developed vs non-developed countries or urban vs rural area. Therefore, the study location and health policy status should be considered when different studies are compared. Another possible reason is the differences in study design. Several recent reports in Korea have highlighted the factors associated with cancer screening participation, but showed no associations between gastric cancer screening and socio-economic factors[9,18]. This can be explained by the differences in study design, such as variable categories and outcome variable. In the present study, we used equivalized household income which was calculated by dividing the household monthly income by the square root of the household size, while other previous studies usually did not consider the household size and simply used the crude household income[9]. In addition, a major focus of one study was the intention to receive gastric cancer screening, not receipt of gastric cancer screening, which could lead to different results from our study[18].

The Korean Government initiated the National Cancer Screening Program (NCSP) in 1999, and it has since expanded its target population. Currently, NCSP provides Medical Aid recipients and NHI beneficiaries within the lower 50% income bracket with free gastric cancer screening services[8].

In addition, the costs of gastric cancer screening in Korea are low compared with other countries, which could improve the accessibility of these services to low-income individuals[22]. However, our results indicate that socio-economic inequalities in gastric cancer screening participation have not yet been sufficiently overcome. To increase gastric cancer screening participation, improved intervention programs for individuals with low income and education level are needed.

No general health status or disability-related factor was significantly associated with gastric cancer screening participation, which is in contrast to our original hypothesis that there might be disability-related barriers to participation in screening programs. A recent cross-sectional study reported that individuals with a disability showed reduced levels of participation in mass screening programs compared with those without a disability[23]. However, few studies have assessed the association between physical disability and gastric cancer screening participation. Further research about gastric cancer screening patterns among individuals with a disability is required to determine these associations.

Our study has several limitations. First, as the findings were based on patient self-reported health status data, respondents may under-report, over-report, or choose not to respond, leading to possible inaccuracy. Second, information about gastric cancer screening was obtained from the responses to a single question, and any symptoms at the time of the examination were not reported. Cancer screening prevention programs are designed for individuals with no associated symptoms; therefore, there could be some misclassification of gastric cancer screening participation by including individuals with symptoms indicative of gastric cancer. However, previous studies have also not considered accompanying symptoms, and used a similar definition of cancer screening participation[21,24,25].

In conclusion, we found that more than two-thirds of the Korean population did not comply with the gastric cancer screening recommendations. These findings indicate that there is scope for further improvement. In particular, targeted interventions are needed for vulnerable populations such as those with low income, low education level and unhealthy behaviors. In addition, public campaigns to improve attitudes to preventive medical evaluation could be powerful methods to increase gastric cancer screening participation.

ACKNOWLEDGMENTS

COMMENTS

Background

The mortality of gastric cancer is decreasing despite the increasing incidence in Korea. This can be explained by surgical technique development and early detection by endoscopic screening or upper gastrointestinal study.

Research frontiers

Despite the development in national cancer control programs, the rate of participation in gastric cancer screening programs is still not optimal. However, few studies have investigated the individual and environmental predictors of gastric cancer screening participation in the Korean population. In this study, the authors identified the factors associated with participation in gastric cancer screening programs.

Innovations and breakthroughs

Recent reports in Korea have highlighted the factors associated with cancer screening participation, but reported inconsistencies in the results. It can mainly be explained by the differences in study design, that is, different variable categories and outcome variables. Our study shows predictors associated with gastric cancer screening in multiple dimensions, both at the individual level and at the environmental level.

Applications

The authors' findings indicate that targeted interventions and public campaigns for vulnerable populations could be powerful methods to increase gastric cancer screening participation.

Peer review

In the present study, authors have performed a cross-sectional study investigating the factors associated with participation in a gastric cancer screening program in Korea, and multivariate analyses have revealed independent predictive factors to be household income, education, alcohol consumption and attitude to health check-up. The manuscript is relatively well written, and the results are moderately interesting.

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