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Trends in Socioeconomic Disparities in Organized and Opportunistic Gastric Cancer Screening in Korea (2005-2009)

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Abstract

Background: A growth of consensus and increasing activities related to organized cancer screening programs has occurred in Korea since 1999. It is important to assess disparities in the fight against cancer, and it is crucial to identify particular groups that may be experiencing a high burden of cancer-related illness.

Methods: Data from 8,160 men and women ages >40 years from the 2005 to 2009 Korean National Cancer Screening Survey were used to analyze the relationship between socioeconomic position and receiving upper gastrointestinal series or upper endoscopy within the past 2 years. We used absolute and relative concentration indexes, that is, summary measures of disparity based on both rate differences and rate ratios.

Results: For organized screening, the education disparity declined, but the income disparity index increased, indicating that participation in organized screening was relatively more concentrated among the lower-income groups. For opportunistic screening, income and education disparities increased due to the widening of socioeconomic differences.

Conclusions: The results of this study suggested progress toward socioeconomic disparity-related goals in organized screening for gastric cancer. However, the income disparity trends in organized screening may change in a manner similar to those in opportunistic screening in the future because of the much faster rate of organized screening uptake by those higher on the socioeconomic scale.

Impact: This study addresses the routine monitoring of coverage of screening among different socioeconomic groups and could be used to inform polices to reduce disparity in coverage. *Cancer Epidemiol Biomarkers Prev; 19(8); 1919–26. ©2010 AACR.*

Introduction

Gastric cancer is the second most common cause of cancer death worldwide, and countries in East Asia, such as China and Japan, have high incidence rates of gastric cancer. Korea has 66 cases of gastric cancer per 100,000 among men and 34 cases per 100,000 among women. Although the incidence has declined in recent decades, gastric cancer remains the most frequently diagnosed form of cancer in Korea (1, 2). Gastric cancer screening for early detection is an increasingly important activity to control gastric cancer (3, 4). Some countries, such as Japan and Korea, provide gastric cancer screening to populations at average risk to reduce the disease burden.

Cancer screening may be offered in an opportunistic or organized model. Organized screening is primarily distinguished from opportunistic screening in that invitations to screening are issued from population registers (5). Organized screening programs have nationally implemented guidelines defining who should be invited, how frequently they should be screened, and how any abnormalities detected on screening should be followed up and treated. Opportunistic screening depends on requests from individual members of the public or their health advisors. Opportunistic screening involves fewer formal decisions about whether to screen, whom to screen, and at what interval screening should be done.

In 1999, Korea began organized screening for gastric cancer as part of the National Cancer Screening Program (NCSP), which covers the whole population. NCSP provides screening services free of charge for Medicaid enrollees and people with National Health Insurance with a premium below 50%. In addition, NCSP provides gastric cancer screening to people with a premium over 50% and has subsidized 80% of the costs of these services since 2005. The NCSP recommends biennial upper gastrointestinal series or upper endoscopy for men and women ages >40 years. In addition to the NCSP, upper gastrointestinal series or endoscope testing is conducted in outpatient clinics or private health assessment centers for opportunistic screening. However, individuals must

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Table 1. Age-adjusted participation rates of gastric cancer screening and population share by socioeconomic position (%), 2005 to 2009

	2005 (*n* = 1,762)		2006 (*n* = 1,578)		2007 (*n* = 1,594)		2008 (*n* = 1,619)		2009 (*n* = 1,607)		Absolute change	Percentage of change
	Rate	Population	Rate	Population	Rate	Population	Rate	Population	Rate	Population	(2005 and 2009)	
Education												
Level 1	39.9	18.8	42.1	25.3	42.7	22.1	51.7	17.1	44.2	18.4	4.3	10.8%
Level 2	48.3	18.4	46.5	17.8	44.9	17.3	57.8	20.4	53.0	13.6	4.7	9.7%
Level 3	37.3	46.7	41.0	42.4	43.8	44.9	50.1	46.1	52.9	47.7	15.6	41.8%
Level 4	36.4	16.1	48.2	14.5	50.6	15.8	57.4	16.4	65.9	20.4	29.5	81.0%
Income												
Level 1	40.0	14.5	45.3	17.0	26.2	11.7	51.9	11.9	41.7	10.9	1.7	4.3%
Level 2	40.1	45.7	39.1	42.8	46.0	40.0	50.6	37.1	54.0	34.4	13.9	34.6%
Level 3	39.4	30.1	46.1	27.3	46.7	30.6	50.2	35.5	56.6	36.1	17.2	43.5%
Level 4	37.8	9.8	45.9	12.9	51.3	17.7	63.3	15.4	60.4	18.7	22.6	59.8%
Total*	39.7		43.2		45.9		53.7		57.2			

*Crude rate (%).

pay for all procedure-related costs associated with opportunistic screening.

Data from the Unites States, Canada, the United Kingdom, and Sweden show continuing inequalities in participation in mammographic screening. In Australia, however, economic disadvantages do not seem to represent a barrier to screening program participation (6-14). A different pattern emerges for cervical screening, however, with socioeconomic disadvantages appearing to influence cervical screening rates in France and the United Kingdom as well as in urban areas in Australia. No relationship was found between compliance and socioeconomic status in Sweden (8, 15-18). Studies in the United Kingdom, the United States, Canada, and Australia suggested that similar socioeconomic disparities may be evident if such screening is introduced as a nationwide program (15, 19-25). A trial conducted in France, however, indicated that individuals with lower socioeconomic status were more likely than others to participate in trials of mass screening for fecal occult blood (24). The gastric cancer screening rate has been increasing steadily in Korea. However, the rate of participation in gastric cancer screening programs is still not optimal. Moreover, despite the overall increase in screening rate, disparities in cancer screening based on socioeconomic position remain (9, 26).

It is important to assess disparities in the fight against cancer, and it is crucial to identify particular groups that may be experiencing a high burden of cancer-related illness (6). One of the overarching NCSP goals is the elimination of health disparities according to socioeconomic position. Measurement of progress toward this goal has consequences for prioritizing efforts aimed at reducing such disparities (6, 27). Understanding the association between socioeconomic position and cancer screening rate may provide insight into improving the screening rate in Korea. The present study was done to assess the existence and magnitude of temporal trends in socioeconomic disparities in participation rate across organized and opportunistic gastric cancer screening in the Korean population.

Materials and Methods

Data sources

This study was done using the Korean National Cancer Screening Survey (KNCSS) data from 2005 to 2009. KNCSS is a continuous national interview survey conducted by the Korean National Cancer Center. KNCSS is conducted to investigate Korean participation rates in cancer screening for five common cancers: gastric, liver, colorectal, breast, and cervical cancer (2). Men and women were selected based on the Resident Registration Population data using a stratified, multistage, and random sampling procedure according to geographic area, age, and gender. The Resident Registration Population data are 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.

For the present 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 at each dwelling. Eligible participants were asked about their experiences of screening for five common cancers: health behaviors, health status, and family history of cancer, and socioeconomic and demographic

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information. For this study, we limited our analyses to cancer-free male and female participants over ages 40 years. All subjects provided informed consent for participation in the study. The response rates were 55.8% to 58.3% from 2005 to 2009. There might be respondent bias if response rate is potentially differential in the income and education groupings. However, it was difficult to compare the income and education levels between respondents and nonrespondents because we did not have information on nonrespondents' socioeconomic status.

Measures

To analyze participation rates in screening for gastric cancer, we used the proportion of men and women who reported having upper gastrointestinal series or upper endoscopy within the past 2 years. Education and household income were used to determine socioeconomic position. Education was classified into four categories: less than middle school, middle school graduate and some high school, high school graduate and some college, college graduate or higher. Income was evaluated as household income and was categorized into four groups: ≤1, 1-2.5, 2.5-4, and ≥4 million won per month (1,000 won = US $0.85).

Data analysis

To summarize disparities across socioeconomic position, we used the concentration index to measure both the relative (uptake ratios) and absolute (uptake differences) discrepancies in uptake according to socioeconomic status. The concentration index is a population-weighted measure that accounts for changes over time in the underlying distribution of social groups, measuring disparity as differences from the population average rate on health indices, and placing additional weight on the health of socioeconomically disadvantaged groups (6, 27, 28). To account for differences in age distribution among socioeconomic subgroups, we used seven age- specific rates (5-y age groups from ages 40-45 up to 75 y) and calculated age-adjusted participation rates using the 2005 KNCSS population as the standard. To compare trends in disparity, we calculated the percentage change in each index.

The relative concentration index (RCI) measures the extent to which health or illness is concentrated among particular social groups. This index may be used only with ordinally designated social groups (that is, those with have an inherent ranking, such as income or education). The general formula for the RCI for grouped data are given as $RCI = (2/\mu) \times (\Sigma p_j y_j X_j) - 1$, in which μ is the population average rate of health, p_j is the group's population share, y_j is the group's mean health, and X_j is the relative rank of the *j*th socioeconomic group, which is defined as $X_j = p_\gamma - 0.5p_j$, in which p_γ is the cumulative share of the population up to and including group *j*, and p_j is the share of the population in group *j*. X_j indicates the cumulative share of the population up to the midpoint of each group interval (27, 29).

When the outcome is a downward health gradient (in which health worsens with increasing social group rank), this results in a positive RCI, whereas an upward health gradient results in a negative RCI. Thus, in the present study, a negative RCI indicates that participation rate is lower among more disadvantaged groups. When no disparity exists, the RCI is 0.

The absolute concentration index (ACI) measures the extent to which health or illness is concentrated among particular social groups on an absolute scale. The

Table 2. Age-adjusted participation rates of organized and opportunistic gastric cancer screening by socioeconomic position (%), 2005 to 2009

	Organized							Opportunistic						
	2005	2006	2007	2008	2009	Absolute change (2005 and 2009)	Percentage of change (2005 and 2009)	2005	2006	2007	2008	2009	Absolute change (2005 and 2009)	Percentage of change (2005 and 2009)
Education														
Level 1	25.4	26.7	29.2	35.8	35.4	10.0	39.5%	14.8	15.4	14.2	15.9	10.2	−4.6	−31.1%
Level 2	26.8	28.2	33.8	37.9	37.9	11.1	41.6%	21.9	18.3	11.7	19.9	15.3	−6.6	−30.0%
Level 3	19.1	24.8	23.6	32.6	35.2	16.1	84.5%	18.2	16.4	20.8	17.5	18.4	0.2	0.9%
Level 4	16.3	27.3	18.8	29.2	39.0	22.8	140.0%	20.1	20.9	31.8	28.1	27.8	7.7	38.0%
Income														
Level 1	23.9	33.7	18.4	45.4	33.7	9.8	41.1%	18.4	11.6	7.8	6.5	8.6	−9.8	−53.2%
Level 2	21.0	23.2	29.0	35.4	40.6	19.6	93.1%	17.0	16.1	17.8	15.2	14.3	−2.7	−15.6%
Level 3	19.6	26.6	24.0	31.5	34.8	15.3	78.0%	20.7	19.5	23.1	18.7	22.5	1.8	8.8%
Level 4	15.5	23.0	22.8	33.5	35.8	20.3	131.1%	23.9	22.9	29.2	29.8	24.8	0.9	3.6%
Total*	21.2	25.7	25.5	35.4	39.0			18.6	17.6	21.0	18.3	18.9		

*Crude rate (%).

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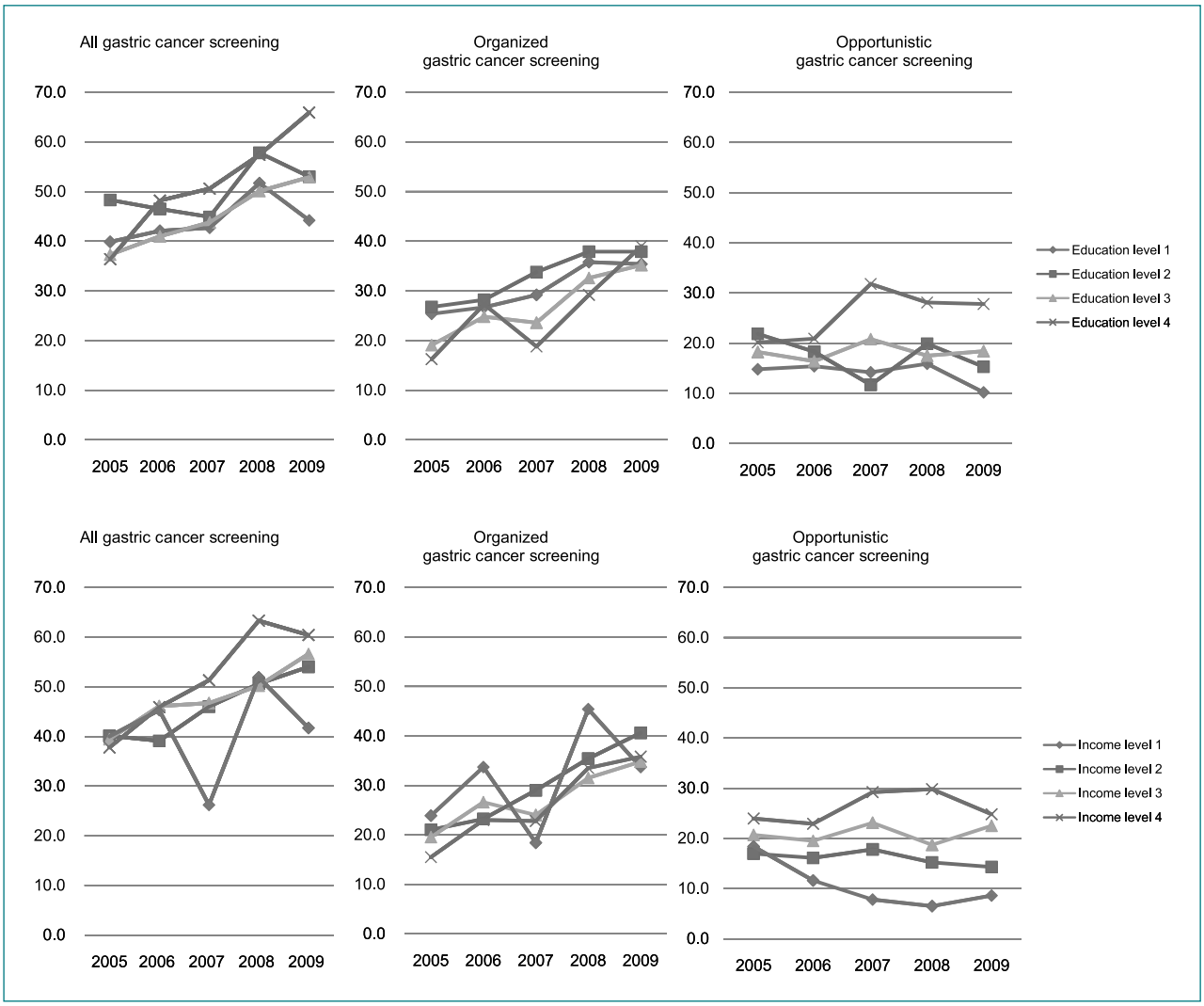

Figure 1. Changes in age-adjusted participation rates (%) of gastric cancer screening by education and income levels, 2005 to 2009.

absolute version of the concentration index is calculated by multiplying the RCI by the mean of the health variable: ACI = μRCI, in which RCI is the RCI defined above, and μ is the mean level of health in the population.

To generate estimates of precision, we used a resampling or "bootstrap" technique (6, 27). For each year, socioeconomic subgroup, we used the observed age-adjusted rate and its SEM to estimate each group's rate 1,000 times, assuming a random normal distribution. We then calculated each measure of disparity 1,000 times and used the resulting distribution to estimate the SEM of each index. We estimated the change in each index from the beginning to the end of the period of observation and calculated a 95% confidence interval for this change by use of formula $\sqrt{\mathrm{SEM}_{\mathrm{time1}}^2 + \mathrm{SEM}_{\mathrm{time2}}^2}$ to estimate the SEM of the change.

Results

Participation rates

Tables 1 and 2, and Fig. 1 show the participation rates for total, organized, and opportunistic gastric cancer screening according to socioeconomic position from 2005 to 2009. Total participation rates have generally increased across the board since 2005. Total participation rates for all gastric cancer screening programs were 39.7% in 2005 and 57.2% in 2009. The rates of participation in organized type screenings were 21.2% in 2005 and 39.0% in 2009. For opportunistic screening, the rates have been relatively stable, 18.6% in 2005 and 18.9% in 2009. The improvement of total participation rate was chiefly due to the large increase in the rate of participation in organized screening.

The participation rates for total and organized screening programs have generally increased in all education

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Table 3. Relative and absolute education disparity in gastric cancer screening, 2005 to 2009

	2005	2006	2007	2008	2009	Absolute change (95% CI)	Percentage of change
ACI							
Total	1.4	0.8	−0.3	1.1	−3.4	−4.8 (−7.0 to −2.6)	−338.4%
Organized	2.0	0.8	2.8	1.6	0.1	−1.8 (−4.2 to 0.6)	−93.3%
Opportunistic	−0.5	−0.1	−3.1	−0.5	−3.4	−2.9 (−5.0 to −0.8)	604.3%
RCI(×100)							
Total	2.3	1.5	−0.6	2.4	−7.3	−9.6 (−14.3 to −4.9)	−412.7%
Organized	2.5	1.1	3.9	2.5	0.2	−2.3 (−6.1 to 1.5)	−91.6%
Opportunistic	−0.6	−0.1	−3.9	−0.7	−4.2	−3.6 (−6.2 to −1.0)	598.6%

levels. In 2005, the rates of participation in all programs and in organized programs among the higher two education groups were lower than in the other groups. However, the degree of the increment in participation rate was much higher with increasing social group rank, and participation rates for total and for organized programs were higher for the most advantaged group in 2008. On the other hand, the participation rates in opportunistic programs have decreased in the more disadvantaged groups. The participation rates of all education levels in organized screening programs have moved toward similar levels, whereas the gap in participation in opportunistic screening programs between disadvantaged and advantaged groups has widened since 2005. The participation rates in all programs and in organized screening programs have generally increased in all income levels with the exception of those in 2007. The participation rates in opportunistic screening programs have decreased in the lower income groups.

Absolute and relative disparity

Changes in socioeconomic disparities are shown in Tables 3 and 4, and Fig. 2 shows the trends in measures of absolute and relative disparity over the whole study period. A lack of participation in opportunistic screening programs was more common among the lower income groups, as indicated by negative RCI and ACI. On the other hand, the higher income groups showed less participation in organized screening programs, indicated by positive RCI and ACI. From 2005 to 2009, the disparity in participation in organized screening programs related to education moved toward 0, indicating that education disparities had narrowed among education group ranks with regard to participation in organized programs. However, both absolute and relative income disparities in participation in organized screening rose far above zero, but relative income disparity increased to a greater extent than did absolute income disparity. These observations indicated that progress has been made in all groups, but lower income groups showed a slightly faster rate of participation in organized screening programs. For opportunistic screening, the degree of income disparity increased slightly, whereas education disparities increased by about 600% from 2005 to 2009, indicating persistent or widening socioeconomic differences by education rank.

Discussion

The total participation rate including that in organized and opportunistic gastric cancer screening has been over 50% since 2008. The participation rate increased substantially for organized gastric cancer screening, but it remained relatively constant for opportunistic screening. The more advantaged groups are likely to participate in organized and opportunistic screening. The NCSP has been continuously expanded benefit participants who

Table 4. Relative and absolute income disparity in gastric cancer screening, 2005 to 2009

	2005	2006	2007	2008	2009	Absolute change (95% CI)	Percentage of change
ACI							
Total	0.3	−0.6	−1.8	−0.4	0.0	−0.3 (−2.6 to 2.0)	−106.2%
Organized	1.0	0.4	0.3	1.6	2.4	1.3 (−0.8 to 3.4)	128.3%
Opportunistic	−0.6	−0.5	−0.8	−0.6	−1.1	−0.5 (−2.7 to 1.7)	85.0%
RCI (×100)							
Total	0.5	−1.0	−3.4	−0.8	0.0	−0.5 (−5.3 to 4.3)	−108.8%
Organized	1.3	0.6	0.4	2.5	3.9	2.6 (−0.7 to 5.9)	194.8%
Opportunistic	−0.7	−0.6	−1.0	−0.7	−1.4	−0.6 (−2.4 to 1.2)	85.9%

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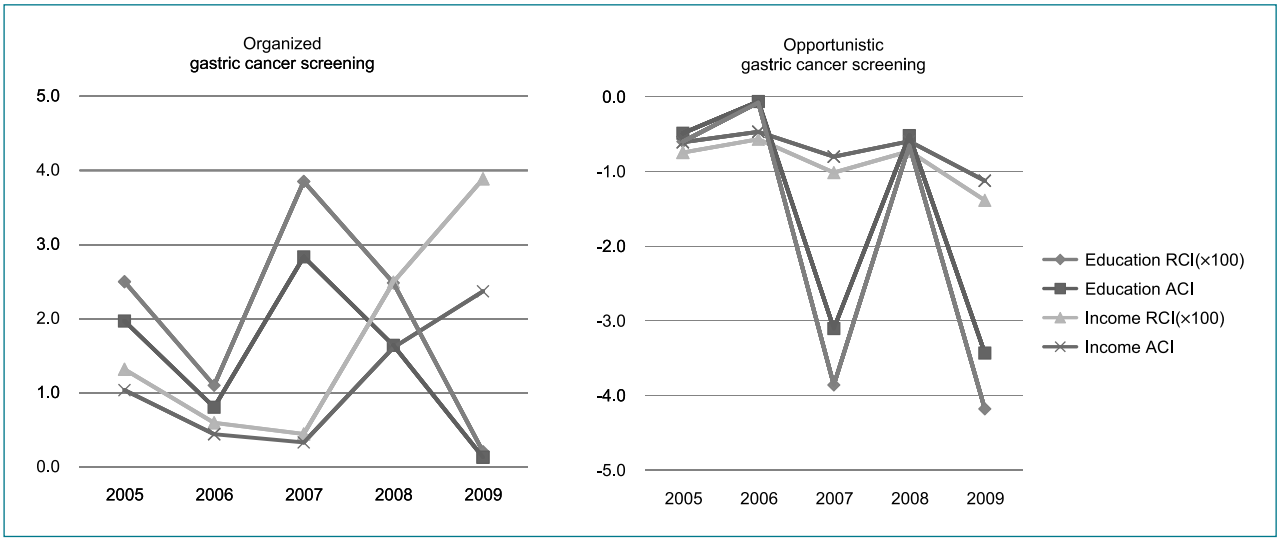

Figure 2. Changes in relative and absolute socioeconomic disparity in gastric cancer screening, 2005 to 2009.

can receive services free of charge and increased subsidization of the screening cost. From 2010, the NCSP plans to subsidize 90% for people with National Health Insurance with a premium over 50%. In addition, the National Health Insurance and the Public Health Centers send invitation letters and encourage the target population to participate by campaign or reminders such as by telephone or letter. For these factors, organized screening could have a positive effect across all groups.

No consistent patterns of disparity index were observed according to socioeconomic position or cancer screening type (30). Education disparity was significantly related to total or opportunistic screening but not to organized screening. The participation in organized screening programs was concentrated in the lower income groups, but disparities in opportunistic gastric cancer screening were persistent or widened over the study period. These observations highlight the relatively slower uptake of opportunistic screening over time by groups with lower education levels. Low socioeconomic status, as indicated by income and education, is a known barrier to cancer screening. These factors related to socioeconomic position are interlinked, thus compounding the disadvantages experienced (5, 6, 9, 10, 15, 26, 30).

In summary, the results of the present study were generally suggestive of progress toward disparity-related goals for gastric cancer in organized cancer screening in terms of socioeconomic position. These results were consistent with those reported previously (24). To date, organized systems have been effective for removing financial barriers to improving participation in gastric cancer screening. However, it is possible that the income disparity trends in organized screening could change similar to those in opportunistic screening in the future because of the faster uptake of organized screening by the higher income groups.

We quantified disparities across income and education subgroups. This study provides new evidence on disparity in screening and shows the need for information on socioeconomic position to be collected routinely. It would facilitate the routine monitoring of coverage of screening among different socioeconomic groups and could be used to inform polices to reduce disparity in coverage (20). In addition, examining the trends in differences in gastric cancer screening rate according to socioeconomic position in countries similar to Korea, which has a high burden of gastric cancer, will suggest practical implications for understanding and intervening in the increasing rates of gastric cancer and aid in assessment of the effects of organized cancer screening programs. Other health or educational polices might have affected on the increment of the participation rate with lower income and education. However, any effect of health or educational policies was not considered in our study.

The choice of a summary measure of disparity may affect the interpretation of changes in health disparities. Important issues to consider are the reference point from which differences are measured, whether to measure disparity on an absolute or relative scale, and whether to weight disparity measures by population size (27). Analyses using other income and education ranks by different definitions could produce different results. However, we also analyzed the data using alternative socioeconomic groupings and found results generally similar to those reported here.

Implementing an opportunistic or organized cancer screening program is a matter of policies regarding health care provision or of the medical care system in a given country (5). For decades, it has been proposed that organized cancer screening programs can improve accessibility and promote quality and accountability (5, 31, 32). Actually, a growth of consensus and increasing

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activities related to organized cancer screening programs have occurred, and several countries in Europe and Asia as well as Canada have developed action plans and made efforts to improve cancer screening programs (33-36).

In countries with organized screening systems, socioeconomic status–related inequalities in screening persist in some settings. Some previous studies indicated persistent income disparities in cancer screening, although the test was inexpensive or fully reimbursed (5, 7, 8, 10, 15, 26, 37). Having health insurance is a necessary precondition for improving the use of preventive health care, but it is only a start. Practical barriers to screening remain an issue in organized and opportunistic settings. These barriers included geographic factors, demands on time, and the physical health of the potential participants. Even in organized screening settings, attitudes, beliefs, and knowledge are consistently associated with screening use. Therefore, interventions are still required to encourage participation, and both organized and opportunistic screening systems face similar challenges in maximizing adherence to screening recommendations.

To date, attempts to promote cancer have used a public health model that targets entire communities, e.g., mass media campaigns screening, for the organized screening system in Korea. Additional individual-directed interventions in health care settings about cancer screening use are required, such as individualized in-person or telephone counseling, individualized letters and reminders, or other individual-directed strategies, especially for those in the lower socioeconomic groups, to increase participation and reduce the disparity in cancer screening (10, 38, 39).

Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

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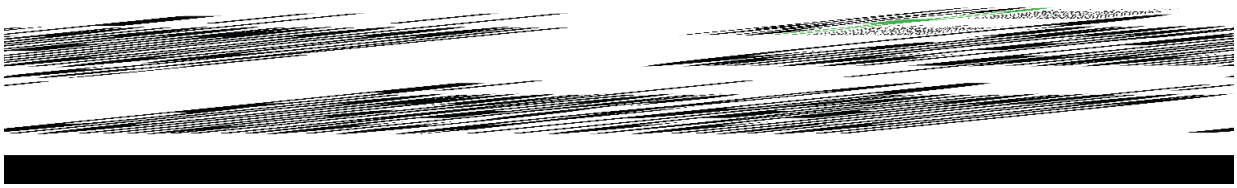

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