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Population-based Analysis of Differences in Gastric Cancer Incidence Among Races and Ethnicities in Individuals Age 50 Years and Older

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Abstract

Background & Aims: There are racial and ethnic differences in the incidence of gastric adenocarcinoma worldwide and in the United States. Based on a decision analysis, screening for noncardia gastric adenocarcinoma might be cost effective for non-white individuals age 50 years or older. However, a lack of precise, contemporary information on gastric adenocarcinoma incidence in specific anatomic sites for this age group has impeded prevention and early detection

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programs in the United States. We aimed to estimate the differences in gastric adenocarcinoma incidence in specific anatomic sites among races and ethnicities in individuals age 50 years or older.

Methods: We analyzed California Cancer Registry data, from 2011 through 2015, to estimate incidences of gastric adenocarcinoma in specific anatomic sites for non-Hispanic white (NHW), non-Hispanic black, Hispanic, and the 7 largest Asian American populations. We calculated the differential incidence between non-white groups and NHW using incidence rate ratios and 95% CIs.

Results: Compared to NHW subjects, all non-white groups had significantly higher incidences of noncardia gastric adenocarcinoma; the incidence was highest among Korean American men ≥50 years old (70 cases per 100,000). Compared to NHW subjects ≥50 years old, the risk of noncardia gastric adenocarcinoma was 1.8-fold (95% CI, 1.37–2.31) to 7.3-fold (95% CI, 5.73–9.19) higher in most non-white groups and 12.0-fold (95% CI, 9.96–14.6) to 14.5-fold (95% CI, 12.5–16.9) higher among Korean American men and women ≥50 years old, respectively. Compared to NHW men ≥50 years old, all non-white men, except Japanese and Korean American men, had a significantly lower risk of cardia gastric adenocarcinoma.

Conclusions: We identified several-fold differences in incidences of gastric adenocarcinoma in specific anatomic sites among racial and ethnic groups, with significant age and sex differences. These findings can be used to develop targeted risk reduction programs for gastric adenocarcinoma.

Lay Summary

There are differences in the incidence of gastric adenocarcinoma at specific anatomic sites according to racial and ethnic group in the United States. Among persons 50 years or older, all non-white racial and ethnic groups had significantly higher risk of noncardia gastric adenocarcinoma—ranging from 1.8-fold to 14.5-fold higher—than non-Hispanic whites.

Keywords

Helicobacter pylori; stomach cancer; epidemiology; healthcare disparity

Introduction

Globally, gastric cancer ranks as the 3rd most common cause of cancer-related deaths and remains the 5th most common cause of cancer overall. In 2018 an estimated 1 million new cases and 780,000 related deaths occurred.[1] There is marked global variation, however, with Asian-Pacific countries accounting for 50% of all new cases, followed by Central/Latin American and Eastern European countries.[1] The United States (US) is overall considered a low-intermediate incidence country for gastric cancer, with an estimated 27,510 new cases occurring in 2019, and a projected 36,500 new annual cases in 2035.[2,3] The burden of disease is not uniformly distributed among the US population. Anatomic noncardia gastric adenocarcinoma (GA) comprises the bulk of gastric cancer.[4] While anatomic cardia GA is rarer, it is more common among the non-Hispanic white (NHW) population, especially men, and generally follows the same demographic and risk factor profile as adenocarcinoma of

the esophagus or gastroesophageal junction. By contrast, noncardia GA is significantly more common among non-white populations[5–7], particularly among immigrants from countries where GA is endemic.[5]

Population-based screening for GA occurs in some countries with universally high incidence and is initiated between age 40–50 years old depending on the country.[8–10] While GA screening does not routinely occur in the US, a recent decision analysis using modeled data estimates demonstrated that among individuals age 50 years or older, bundling an upper endoscopy for noncardia GA screening at the time of colonoscopy for average-risk colorectal cancer screening might be cost-effective for non-white populations, including non-Hispanic black (NHB), Hispanic, and Asian Americans as an aggregated group, but not for the NHW population.[11] Notably, the cost effectiveness of the model largely depended on the incidence of noncardia GA. Unfortunately, the incidence of GA based on anatomic site has not been previously reported according to detailed race and ethnic group, nor age group (e.g. ≥50 years old) in the US. This contributes to the uncertainty surrounding endoscopy for GA screening among select US populations.[11,12] Indeed, while one recent descriptive analysis of regional Surveillance, Epidemiology, and End Results (SEER) Program cancer registries (1990–2014) reported the age-adjusted noncardia GA incidence rates for the six largest Asian American ethnicities as well as for the NHW population, rates based on age group and other major US race and ethnic groups were not provided.[7] Otherwise, the few studies that have previously analyzed GA epidemiology in the US according to race/ethnicity were similarly restricted to one anatomic site or did not discriminate sites;[7,13–16] included only a few selected race or ethnic groups or combined all non-white non-Hispanics as “other”;[6,14,16–18] used earlier, less representative time intervals or aggregated these with contemporary data such that the reported estimates might not accurately reflect current incidence rates;[7,16] or presented graphical incidence trends without providing quantitative estimates.[19]

To our knowledge, no studies have provided anatomic site-specific GA incidence rates for the major race and ethnic groups in the US, nor specifically for the population ≥50 years old. In addition to its clinical relevance as the age group for which selected GA screening might be cost-effective, this is also the age group considered for endoscopic screening of other gastrointestinal tract malignancies, including average-risk colorectal cancer screening and, in selected groups, esophageal adenocarcinoma screening. We therefore aimed to address these fundamental knowledge gaps by analyzing contemporary GA incidence data from the California Cancer Registry (CCR) for the 7 most populous Asian American ethnicities by country/region of origin (Chinese, Japanese, Korean, Filipino, Vietnamese, South Asians, and Southeast Asians) and the Hispanic, NHB and NHW populations, separately for men and women ≥50 years old. Providing precise estimates of anatomic site-specific GA incidence rates, as well as more nuanced, clinically relevant evaluation of differences, such as comparative risk estimates, is foundational from the vantage points of resource allocation and more accurately defining the high-risk groups for whom targeted GA prevention and early detection efforts might be most beneficial.

Methods

Data Source and Analytic Cohort

The CCR is designated as a National Cancer Institute SEER program registry, and is the largest, most diverse SEER-designated state cancer surveillance registry in the US. Cancer reporting has been required by California State Law since 1988. CCR data meet all National Program of Cancer Registry and SEER standards for quality, timeliness, and completeness. The CCR achieves approximately 98% cancer ascertainment for individuals residing in California and includes patient demographics at the time of diagnosis. Detailed race and ethnicity data, including Asian American by country of origin, are available in the CCR.[20,21,22]

Based on the International Classification of Diseases for Oncology (ICD-O-3)[23], we identified all histologically confirmed cases of primary invasive GA diagnosed in individuals ≥20 years of age, with a focused primary analysis on individuals ≥50 years of age. The time interval for diagnosis was between January 1, 2011 through December 31, 2015. We intentionally selected the 2011–2015 interval since this is the most recent time interval for which there are complete data for both cancer cases (numerator) as well as race/ethnic-specific population counts (denominator), including Asian American ethnic groups. Restricting our analysis in this way ensured that our estimates reflected the most contemporary epidemiologic observations in order to maximize clinical relevance for future risk stratification, resource allocation, and guiding interventions. Only cases in which gastric cancer was the first primary or the first of two or more primary cancers were included. Thus, cases that represent recurrent gastric cancer were excluded. Also excluded were non-gastric adenocarcinomas—that is, poorly specified neoplasms (ICD-O-3 histologic subtypes: 8000–8004), nonepithelial gastric neoplasms (8800–9759), carcinoid tumors (8240), lymphoma, leukemia, mesothelioma, and Kaposi sarcoma (9050–9055, 9140, 9590–9989)—and any cases classified as carcinoma in situ.[6] GA cases were subdivided by anatomic location and categorized as cardia (C16.0), noncardia (C16.1–16.6), and overlapping/not otherwise specified (NOS) (C16.8–16.9), similar to prior studies.[6,18]

Age at diagnosis, sex, and race/ethnic group were recorded for each case and categorized as follows: NHW, NHB, Hispanic or Asian American. Asian Americans were further categorized according to 7 major ethnic groups: Chinese, Japanese, Filipino, Korean, Vietnamese, South Asians and Southeast Asians (Cambodians, Laotians, Hmong, and Thai). Race/ethnic data in the CCR are obtained from patient medical records and based primarily on self-report or caretaker-report.[24]

Population estimates were created using linear interpolation and extrapolation of decennial US Census data.

Statistical Analysis

The outcome for the primary analysis was incident GA categorized based on anatomic location—noncardia, cardia, and overlapping/NOS—among individuals ≥50 years old. A secondary analysis of incident GA in specific anatomic sites was also conducted among individuals ≥20 years old for comparison. We used SEER*Stat software version 8.3.6 to

calculate five-year (2011–2015) average cumulative incidence rates with 95% confidence intervals (95% CIs) using previously established methods.[25] Rates were calculated for each anatomic site for all race and ethnic groups and by sex.[26,27] All rates were per 100,000 and adjusted to the US 2000 standard population. As rates based on small counts tend to have poor reliability, they were not shown in tables if the case count was <15. Using SEER*Stat and Excel, we also calculated incidence rate ratios (IRRs) and 95% CIs for each GA anatomic site according to race and ethnic (reference: NHW) group for men and women combined, as well as separately among individuals ≥50 years old. We further reported IRRs for men and women combined and separately for individuals ≥20 years. Because some countries where GA is endemic initiate screening at age 40 years old (e.g. Japan, South Korea), we separately evaluated incident GA in specific anatomic sites according to race and ethnicity in the age group 40–49 years old as an exploratory analysis based on clinical relevance, acknowledging *a priori* that modest case counts might preclude strong conclusions.

Results

Cohort characteristics

During 138,576,581 million person-years of follow up, 10,265 GAs were registered in the CCR between 2011–2015 for individuals age 20 years or older. A total of 6430 GAs (2851 noncardia, 2303 cardia, 1276 overlapping/NOS) occurred in men and 3835 (2258 noncardia, 602 cardia, 975 overlapping/NOS) occurred in women. Chinese, Korean, Japanese, Vietnamese, and Southeast Asian Americans together accounted for 23.4% of all noncardia GA cases, but only 8.2% of the total person-year time at risk. For cardia GA, the majority (68.1%) of cases occurred among NHW, followed by Hispanics (19.0%).

Noncardia

All non-white groups had significantly higher incidence rates of noncardia GA compared to the NHW population. The highest incidence rates were among Korean Americans ≥50 years old, with an overall incidence of 49.0 cases (95% CI, 43.9–54.6) per 100,000 (70.0 and 33.5 cases per 100,000 for men and women, respectively), while NHW had the lowest incidence with 3.7 cases (95% CI, 3.5–3.9) per 100,000 (4.8 and 2.8 cases per 100,000 for men and women, respectively). After Korean American men, the highest incidence groups among men ≥50 years old were Japanese, Southeast Asian, Vietnamese, and Chinese Americans, followed by Hispanics and NHB, and lastly Filipino and South Asian Americans. After Korean American women, the highest incidence groups among women ≥50 years old were Vietnamese, Southeast Asian, and Chinese Americans, followed by Hispanics, Japanese Americans, and NHB, and lastly South Asian and Filipino Americans (Table 1).

For comparison, the age- and sex-adjusted incidence rates of noncardia GA according to race and ethnic group among individuals age 20 years or older are detailed in Supplemental Table 1, along with the respective age-adjusted incidence rates stratified by sex. There were significant differences in noncardia GA incidence rates by race and ethnicity, particularly among Asian American ethnic groups. The pattern was overall similar to the population ≥50 years old, albeit of lower magnitude.

The IRRs for noncardia GA with NHW as the reference group are detailed in Table 1 (≥50 years old) and Supplemental Table 1 (≥20 years old), and illustrated in Figure 1a and Supplemental Figure 1a. Compared to NHW individuals, all non-white groups had significantly higher risk of incident noncardia GA, ranging from 1.8-fold to 14.5-fold higher. Among individuals ≥50 years old, Korean and Japanese American men had a respective 14.5-fold (95% CI, 12.5–16.9) and 7.0-fold (95% CI, 5.65–8.62) higher incidence risk compared to NHW men, while Korean and Vietnamese women had a respective 12.0-fold (95% CI, 10.0–14.6) and 7.3-fold (95% CI, 5.7–9.2) significantly higher incidence risk compared to NHW women of the same age. Hispanic and NHB men had a respective 3.6-fold and 2.9-fold higher, while Hispanic and NHB women had a respective 4.1-fold and 3.2-fold higher incidence risk compared to NHW men and women. Filipino and South Asian Americans had the lowest IRRs of all non-white groups compared to NHW ≥50 years old, albeit still significant.

Cardia

The highest cardia GA incidence rates were among NHW (9.85 cases per 100,000; 95% CI, 9.35–10.4) and Japanese American (9.72 cases per 100,000; 95% CI, 6.34–14.2) men ≥50 years old, followed by Korean American (6.32 cases per 100,000; 95% CI, 3.57–10.3), Filipino American (6.13 cases per 100,000; 95% CI, 4.55–8.09), and Hispanic (6.12 cases per 100,000; 95% CI, 5.42–6.88) men ≥50 years old (Table 1).

The age- and sex-adjusted incidence rates of cardia GA according to race and ethnic group for individuals ≥20 years old are detailed in Supplemental Table 1, along with age-adjusted incidence rates stratified by sex. The incidence rate of cardia GA was significantly higher in NHW men compared to men of all other racial/ethnic groups, except for Japanese Americans ≥20 years old.

The IRRs with NHW as the reference group are provided in Table 1 (≥50 years old) and Supplemental Table 1 (≥20 years old), and illustrated in Figure 1b and Supplemental Figure 1b. Except for Japanese (IRR 0.99; 95% CI, 0.68–1.43) and Korean American (IRR 0.64; 95% CI, 0.40–1.03) men ≥50 years old, the risk of cardia GA was significantly lower among all non-white men ≥50 years old compared to NHW men ≥50 years old (Table 1). No significant differences in cardia GA risk were observed among women based on race and ethnic group, but small case counts precluded robust analysis.

Overlapping/NOS

GAs anatomically classified as overlapping or NOS accounted for up to 28% of all GAs depending on race and ethnicity (approximately 22% overall). The highest percentages of overlapping/NOS GAs were among Hispanics and NHB, and lowest among NHW and Korean Americans. Too few overlapping/NOS GA cases (<15) occurred among Southeast Asian Americans to calculate incidence. Otherwise, among the population ≥50 years old, NHW had the overall lowest incidence rate at 1.97 cases (95% CI, 1.82–2.14) per 100,000 (2.49 and 1.55 cases per 100,000 for men and women, respectively), while Korean Americans had the highest incidence rate with 12.1 cases (95% CI, 9.61–14.9) per 100,000 (17.4 and 7.93 cases per 100,000 for men and women, respectively) (Table 1). The IRRs

with NHW as the reference group are provided in Table 1 (≥50 years old) and Supplemental Table 1 (≥20 years old), and illustrated in Figure 1c and Supplemental Figure 1c. With respect to racial/ethnic differences, the patterns and trends generally mirrored noncardia GA for both men and women.

Early onset gastric cancer (exploratory analysis, ages 40–49 years)

As expected, the incidence rates for both cardia and noncardia GA were significantly lower among individuals aged 40–49 years old compared to those ≥ 50 years old. The magnitude of age differences varied based on anatomic site and race and ethnic group. Overall, rates of noncardia GA were still disproportionately significantly higher among non-white groups compared to NHW; however, small cell counts for several groups precluded robust interpretation (data not shown).

Discussion

While we identified significant differences in the risk of incident GA for each anatomic site according to race and ethnic group among individuals ≥50 years old, the magnitude of differential risk was particularly striking for noncardia GA where the risk among all non-white groups was several-fold (up to 14.5-fold) higher compared to the NHW population. The population ≥50 years old is clinically relevant since age 50 years old is when screening for colorectal cancer in average-risk individuals and esophageal cancer in selected high-risk individuals generally occurs in the US. We achieved the primary objectives of this study and addressed major knowledge gaps from the prior literature. In this population-based analysis of robust contemporary cancer registry data we, for the first time, report precise estimates of GA incidence based on specific anatomic site according to detailed ethnic and race group for men and women age 50 years or older. We further extended the literature by using comparative risk estimates to precisely quantify the uneven distribution of GA risk in specific anatomic sites among racial/ethnic groups in the US, including Asian Americans. The data presented here support recent Markov model-based analyses suggesting that age 50 years might be the optimal age for GA screening initiation among selected race and ethnic groups in the US from a cost-effectiveness standpoint.[11] Additionally, these data provide an evidence-based platform to guide the allocation of resources for GA prevention and early detection. Dedicated research is clearly needed to more completely define the biological and non-biological determinants that are operational within the context of cancer prevention and that drive the attributable risk profile unique to each population. Moving forward, it is imperative that we consider complete demography including country of origin when reporting on GA epidemiology and outcomes so that we do not inadvertently shroud relevant differences.

Based on current trends, immigrants and their descendants will account for nearly 90% of US population growth through 2065.[28,29] In fact, by the year 2065, Asian and Hispanic populations are expected to surpass the NHW population, accounting for 38%, 31% and 20% of the entire US population, respectively.[28] A recent meta-analysis confirmed that immigrants from countries of high- to low-incidence retain an elevated risk of incident GA and related mortality.[5] In this context, our findings have important public health implications

when considering the projected future burden of GA in the US. To this end, ensuring racial/ethnic disaggregation by country of origin is imperative, as our data confirm that aggregation, especially for Asian American ethnic groups, obfuscates critical differences in anatomic site-specific GA epidemiology. Asian Americans encompass at least 30 different countries of origin with uniquely diverse lifestyles, cultural practices, health behaviors and beliefs, that exist on a background of genetic and gene-environment interaction heterogeneity, which collectively might differentially influence GA risk.[30–33] In addition to the specific host/native populations, the magnitude of retained risk and tempo of change over time appears to be influenced by several factors, including immigrant generation and level of acculturation.[5,34] Importantly, the relatively rapid rate of change in GA epidemiology over few generations implicates changing environmental exposures more so than shifting intrinsic genetic predisposition.[7,13–16] This observation further underscores the importance of analyzing disaggregated data so that racially/ethnically-focused interventions targeting modifiable determinants of GA risk achieve their maximal intended impact.

Disaggregating anatomic site-specific GA incidence according to race and ethnic group might also facilitate generation of hypotheses linking observed variations in GA incidence with group-specific variations in modifiable and non-modifiable risk determinants, which might also accelerate discovery of underlying mechanisms. Variability in the prevalence of certain modifiable exposures—such as smoking, *Helicobacter pylori (H. pylori)*, diet and lifestyle factors—and their unique contribution to GA risk based on non-modifiable intrinsic racial and ethnic differences (i.e. gene and gene-environment interactions) might explain much of the between-group variation we observed.[6,35] Level of acculturation also has different effects depending on race and ethnicity and further complicates our understanding.[5,35–38] *H. pylori* is a particularly relevant exposure, as it is the strongest known risk factor for noncardia GA, but it is inversely associated with cardia GA.[39–42] Non-white groups, especially those in the birth cohort primarily represented in this analysis, have significantly higher prevalence of *H. pylori* exposure compared to the NHW population.[43–45] Yet, differences in *H. pylori* prevalence *per se* among the non-white groups analyzed here are unlikely to fully account for the prominent differences in noncardia GA incidence that we observed. To this end, the differences in GA incidence reported here, particularly among the Asian American ethnic groups, are congruent with patterns observed globally and support the hypothesis that differences in genetic predisposition and gene-environment interactions are relevant. For example, native Filipinos and South Asians have significantly lower GA incidence compared to other Asian-Pacific groups, despite similar (or in some instances, higher) prevalence of *H. pylori* exposure.[1,43,44,46,47] Regarding anatomic cardia GA, while we confirmed that most Asian American ethnicities did in fact have a lower risk of cardia GA, we also demonstrated similar cardia GA incidence rates between NHW and Japanese and Korean American men ≥50 years. This pattern has been observed globally as well, with rising rates of cardia GA in native Japan and Korea at least partly attributed to rising obesity, metabolic factors, and possibly a more ‘Westernized’ diet and sedentary lifestyle.[48,49] Future investigations which are specifically designed to define the biological and non-biological etiologies underlying our observations, as well as their interactions and magnitude of impact, are warranted, as our study was not designed for this purpose.

Our finding that the incidence of noncardia GA in many Asian American ethnic groups approaches or even exceeds rates of colorectal cancer[50]—a cancer for which universal screening is recommended among average-risk individuals starting at age 50 years—is one that also deserves emphasis, particularly since our analysis is based on contemporary data from 2011–2015. GA screening does not routinely occur in the US. However, in the context of existing recommendations for routine screening in some Asian-Pacific regions[51] as well as a large body of data consistently demonstrating significantly reduced gastric cancer-related mortality associated with screening high-risk populations[52], the American Society for Gastrointestinal Endoscopy states that endoscopic screening for gastric cancer "may be considered" in first-generation US immigrants from high-risk regions.[53] There is precedent for non-universal, selected cancer screening in the US according to established risk factors, including upper endoscopy for esophageal adenocarcinoma screening among NHW men ≥50 years old with additional risk factors.[54–56] The data presented here clearly identify high-risk race and ethnic groups for whom GA screening may be beneficial, and are congruent with the US-based cost-effectiveness analysis cited above.[11] Notably, that study's model did not account for other 'off-target' benefits of earlier detection of esophageal or gastroesophageal junction cancer, a real consideration given some overlapping risk determinants for these racial/ethnic groups. Endoscopy also allows for the identification of preneoplastic lesions, which opens the discussion of endoscopic surveillance for early cancer detection.[12,57] Even though screening for GA occurs in Japan, Korea, and some regions in China starting at age 40 years old, our finding that the incidence of GA among individuals ≥50 years old is several magnitudes higher than GA incidence in 40–49-year-olds provides further evidence for the appropriateness of selecting age ≥50 years for GA screening in the US.

The primary strengths of this analysis include our use of the CCR, which has the largest concentration of Asian American and Hispanic ethnicities of any state registries. We also provided comparative risk estimates using contemporary anatomic site-specific data according to sex and detailed race and ethnic group specifically for individuals ≥50 years old, which uncovered and more concretely quantified clinically relevant differences. The internal validity of our methodologic approach is supported by the observation that our calculated incidence rates are congruent with those from prior but limited studies.[7] The primary limitations of our study are those inherent to cancer registry analyses in general and include the lack of certain relevant exposures, such as smoking, family history and *H. pylori* infection. We were unable to examine incidence differences by birthplace or immigration status due to increasing and nonrandom missingness of registry birthplace data,[58,59] nor was it feasible to impute nativity for cases with missing birthplace data, which we have done previously.[17,60,61] This said, the majority of Korean Americans residing in California were born in Korea, with only an estimated 15% of adult Korean Americans born in the US based on data from 2014.[62] By comparison, because Japanese American migration occurred much earlier than Korean American migration, an estimated 70% of Japanese Americans in California are US-born, which is in part reflected in their lower GA incidence compared to Korean Americans.[34] We cannot definitively rule out detection bias related to lower provider threshold for endoscopic evaluation in some groups compared to others, which might contribute at least in small part to a higher observed incidence. This is supported by data demonstrating earlier stage of GA diagnosis in some, but not all Asian American groups.[7]

Another limitation is that disaggregated data for Hispanic ethnic subgroups are not available for nearly 50% of Hispanics in the CCR and this remains a similarly important area of investigation. Small counts for some groups due to likely lower GA risk and also smaller population size limited robust analyses for some ethnic subgroups including South and Southeast Asian Americans. Misclassification of race and ethnicity is another consideration, but based on prior studies from the CCR, this is expected to be minimal. Similarly, errors in the population estimates, while possible, are expected to be minimal as well as nondifferential.[13,63] Lastly, because the CCR only represents California residents, generalizability to other areas of the US cannot be confirmed.

In conclusion, we demonstrated significant differences in GA incidence, especially noncardia GA, according to race and ethnic group among individuals ≥ 50 years old, which is the age group where cancer screening, including screening for other gastrointestinal cancers, is most often initiated. The US is projected to become only more diverse and enriched for high-risk populations. Our findings highlight several points of not only needed investigation—for example, defining non-biological and biological etiologies underlying the observed variability—but even more so, the immediate need for action. Delineating etiologies for these differences would catalyze the identification of modifiable clinical disease determinants and barriers to implementation and uptake of GA prevention/risk reducing behaviors (e.g. smoking cessation, *H. pylori* eradication) and early detection efforts (e.g. endoscopic screening) among high-risk groups. GA prevention and early detection programs occur in some high-incidence countries and are consistently associated with reduced GA incidence and related mortality. Despite the success of these programs and despite the demonstrated cost-effectiveness of targeted GA screening in the US, programs focused on GA prevention and early detection have not yet been systematically implemented among high-risk US populations. We are hopeful that this comprehensive population-based analysis of contemporary CCR data will serve as a strong impetus for racially/ethnically-focused interventions targeting GA reduction.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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What You Need to Know

Background and Context:

There are racial and ethnic differences in the incidence of gastric adenocarcinoma. The lack of contemporary, precise information on gastric adenocarcinoma incidence in specific anatomic sites among race, ethnic, and age groups might impede prevention and early detection programs in the United States.

New Findings:

This population-based cancer registry analysis found several-fold differences in the incidence of gastric adenocarcinoma in specific anatomic sites among different racial and ethnic groups in the United States, with significant age and sex differences.

Limitations:

It was not feasible to examine differences in incidence according to immigrant generation, age of immigration, nor other potentially relevant factors such as *Helicobacter pylori* exposure, family history of gastric cancer, and culturally specific diet or lifestyle factors.

Impact:

These findings can be used to develop targeted risk reduction programs for gastric adenocarcinoma.

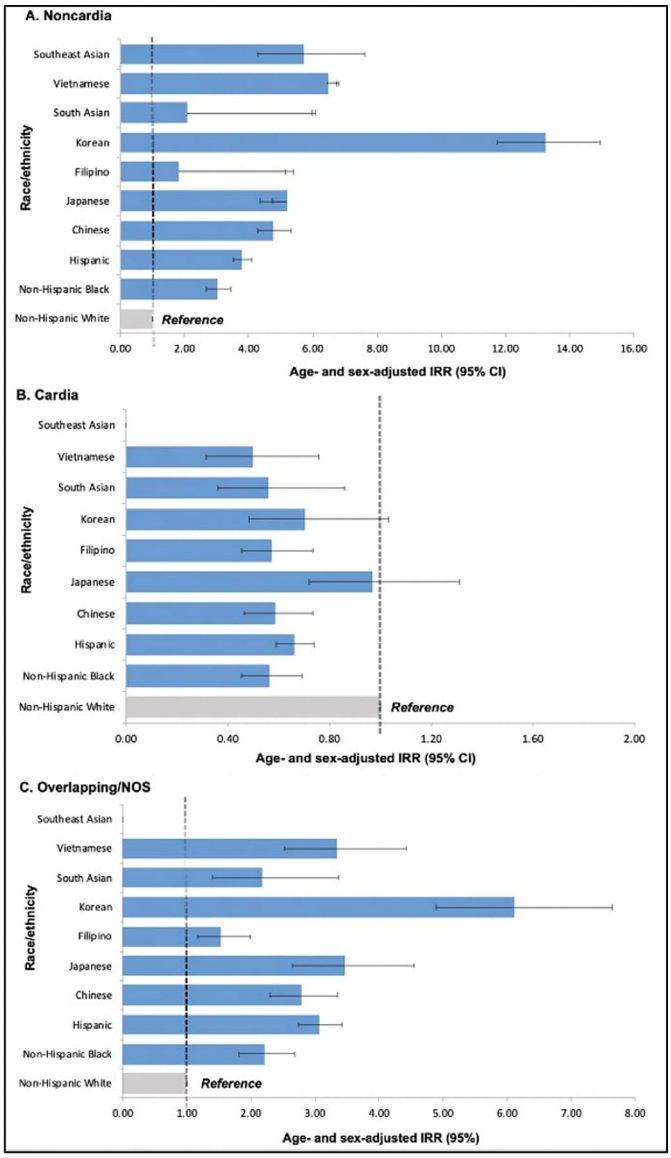

Figure 1. Age- and sex-adjusted incidence rate ratios (IRR) of anatomic site-specific gastric adenocarcinoma (GA) according to race and ethnicity among individuals age ≥50 years old.

IRR and corresponding 95% CIs are illustrated as horizontal bars, with the reference group NHW for each anatomic site (**1A**: noncardia; **1B**: cardia; **1C**: overlapping/NOS). IRR could not be calculated for cardia and overlapping/NOS GA among Southeast Asians due to too few cases.

Table 1.

Gastric adenocarcinoma incidence rates per 100,000 person-years by anatomic site according to race/ethnicity and sex among individuals age≥50 years old (California Cancer Registry, 2011–2015)

	Noncardia			Cardia			Overlapping/NOS			
Race and Ethnicity	**Case Count**	**Incidence Rate (95% CI)**	**IRR (95% CI)**	**Case Count**	**Incidence Rate (95% CI)**	**IRR (95% CI)**	**Case Count**	**Incidence Rate (95% CI)**	**IRR (95% CI)**	***Population****
					Men and Women (Combined)					
Non-Hispanic white	1197	3.70 (3.49–3.92)	*Reference*	1833	5.61 (5.35–5.87)	*Reference*	634	1.97 (1.82–2.14)	*Reference*	32638954
Non-Hispanic black	344	11.2 (10.0–12.5)	3.03 (2.67–3.43)	102	3.16 (2.56–3.86)	0.56 (0.45–0.69)	137	4.36 (3.64–5.18)	2.21 (1.81–2.68)	3546618
Hispanic	1588	14.0 (13.3–14.8)	3.79 (3.5–4.09)	436	3.70 (3.35–4.08)	0.66 (0.59–0.74)	723	6.05 (5.60–6.53)	3.07 (2.74–3.43)	13715323
Chinese American	404	17.6 (15.9–19.5)	4.77 (4.26–5.34)	76	3.29 (2.58–4.13)	0.59 (0.47–0.74)	127	5.47 (4.54–6.52)	2.78 (2.29–3.36)	2533915
Japanese American	162	19.2 (16.2–22.6)	5.18 (4.33–4.75)	43	5.45 (3.86–7.47)	0.97 (0.72–1.31)	57	6.84 (5.08–9.01)	3.47 (2.65–4.55)	734735
Filipino American	128	6.69 (5.55–8.0)	1.81 (5.16–5.41)	72	3.22 (2.50–4.09)	0.57 (0.45–0.73)	58	3.01 (2.26–3.92)	1.53 (1.17–2.00)	2269380
Korean American	347	49.0 (43.9–54.6)	13.3 (11.8–14.9)	27	3.95 (2.58–5.79)	0.7 (0.48–1.03)	88	12.1 (9.61–14.9)	6.12 (4.89–7.64)	789555
South Asian American	39	7.75 (5.34–10.8)	2.09 (5.99–6.07)	21	3.14 (1.87–4.98)	0.56 (0.36–0.86)	21	4.29 (2.56–6.68)	2.18 (1.41–3.36)	721240
Vietnamese American	183	23.9 (20.4–27.8)	6.46 (6.82–6.73)	21	2.79 (1.69–4.32)	0.5 (0.32–0.76)	53	6.58 (4.86–8.70)	3.34 (2.52–4.42)	949045
Southeast Asian American	48	21.1 (15.2–28.5)	5.71 (4.28–7.62)	^	^	^	^	^	^	338505
					Men only					
Non-Hispanic white	701	4.82 (4.46–5.20)	*Reference*	1502	9.85 (9.35–10.4)	*Reference*	363	2.49 (2.24–2.76)	*Reference*	15537061
Non-Hispanic black	195	14.1 (12.1–16.4)	2.92 (2.46–3.46)	69	4.73 (3.61–6.09)	0.48 (0.36–0.62)	86	6.25 (4.92–7.81)	2.51 (1.93–3.22)	1635759
Hispanic	869	17.4 (16.1–18.6)	3.60 (3.24–4.00)	319	6.12 (5.42–6.88)	0.62 (0.54–0.71)	416	7.78 (7.0–8.63)	3.13 (2.69–3.63)	6421688
Chinese American	223	21.9 (19.1–25.0)	4.54 (3.91–5.28)	51	4.94 (3.66–6.51)	0.50 (0.38–0.66)	69	6.74 (5.23–8.55)	2.71 (2.09–3.50)	1148640

Race and Ethnicity	Noncardia Case Count	Noncardia Incidence Rate (95% CI)	Noncardia IRR (95% CI)	Cardia Case Count	Cardia Incidence Rate (95% CI)	Cardia IRR (95% CI)	Overlapping/NOS Case Count	Overlapping/NOS Incidence Rate (95% CI)	Overlapping/NOS IRR (95% CI)	*Population* *
Japanese American	98	33.6 (27.0–41.4)	6.98 (5.65–8.62)	28	9.72 (6.34–14.2)	0.99 (0.68–1.43)	24	7.57 (4.75–11.5)	3.04 (2.01–4.60)	307495
Filipino American	61	8.58 (6.44–11.2)	1.78 (1.37–2.31)	56	6.13 (4.55–8.09)	0.62 (0.48–0.81)	31	4.36 (2.87–6.31)	1.75 (1.21–2.53)	919705
Korean American	211	70.0 (60.5–80.5)	14.5 (12.5–16.9)	17	6.32 (3.57–10.3)	0.64 (0.40–1.03)	55	17.4 (13.0–22.8)	6.98 (5.26–9.27)	340185
South Asian American	19	8.68 (4.93–13.9)	1.80 (1.14–2.84)	17	4.93 (2.72–8.30)	0.50 (0.31–0.81)	^	^	^	373710
Vietnamese American	103	27.8 (22.5–34.0)	5.77 (4.69–7.10)	16	4.11 (2.27–6.84)	0.42 (0.25–0.68)	32	8.03 (5.39–11.5)	3.22 (2.25–4.63)	444600
Southeast Asian American	28	29.1 (18.6–43.2)	6.04 (4.14–8.82)	^	^	^	^	^	^	146935
Women only										
Non-Hispanic white	496	2.78 (2.53–3.04)	*Reference*	331	1.89 (1.69–2.11)	*Reference*	271	1.55 (1.37–1.75)	*Reference*	17101893
Non-Hispanic black	149	8.94 (7.54–10.5)	3.22 (2.65–3.89)	33	1.97 (1.35–2.77)	1.04 (0.70–1.50)	51	2.94 (2.18–3.89)	1.90 (1.37–2.58)	1910859
Hispanic	719	11.5 (10.6–12.4)	4.13 (3.66–4.65)	117	1.81 (1.49–2.18)	0.96 (0.76–1.19)	307	4.70 (4.17–5.27)	3.03 (2.56–3.60)	7293635
Chinese American	181	14.2 (12.2–16.5)	5.12 (4.32–6.07)	25	1.96 (1.26–2.91)	1.04 (0.69–1.56)	58	4.42 (3.34–5.73)	2.85 (2.15–3.79)	1385275
Japanese American	64	11.4 (8.54–14.8)	4.08 (3.15–5.30)	15	2.55 (1.33–4.49)	1.35 (0.80–2.26)	33	6.45 (4.29–9.33)	4.16 (2.90–5.97)	427240
Filipino American	67	5.66 (4.36–7.22)	2.04 (1.58–2.63)	16	1.27 (0.72–2.09)	0.67 (0.41–1.11)	27	2.28 (1.49–3.35)	1.47 (0.99–2.18)	1349675
Korean American	136	33.5 (28.0–39.7)	12.0 (9.96–14.6)	^	^	^	33	7.93 (5.42–11.2)	5.12 (3.56–7.34)	449370
South Asian American	20	7.18 (4.24–11.3)	2.58 (1.65–4.04)	^	^	^	^	^	^	347530
Vietnamese American	80	20.2 (15.9–25.2)	7.26 (5.73–9.19)	^	^	^	21	5.11 (3.10–7.90)	3.30 (2.11–5.14)	504445
Southeast Asian American	20	14.7 (8.69–23.2)	5.29 (3.39–8.28)	^	^	^	^	^	^	191570

* Population estimates were created using linear interpolation and extrapolation of decennial US Census data

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^ Indicates case count less than 15

NOS, not otherwise specified; IRR, incidence rate ratio