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Ethnic Disparities in Gastric Cancer Presentation and Screening Practice in US: Analysis of 1997–2010 Surveillance, Epidemiology and End Results-Medicare Data

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Abstract

Background: Chronic infection with *Helicobacter pylori* is the strongest risk factor for distal gastric cancer (GC). While GC incidence has decreased, variation by race and ethnicity is observed. This study describes GC presentation and screening services among Medicare patients by race/ethnicity, place of birth, and history of GC-related conditions.

Methods: Using demographic, location and disease staging information, extracted from the Surveillance, Epidemiology and End Results – Medicare gastric cancer database (1997–2010), we compared frequencies of GC-related conditions (e.g. peptic ulcer, gastric ulcer, gastritis) and screening (*H. pylori* testing and endoscopy) from inpatient and outpatient services claims by selected race/ethnicity and place of birth.

Results: Data included 47,994 incident GC cases with Medicare claims. The majority (48.0%) of Asian/Pacific Islanders (APIs) were foreign-born, compared to Non-Hispanic Whites (NHWs), Hispanics and Blacks (with 64.4%, 33.9%, and 72.9% US-born, respectively). For NHWs, the most frequently diagnosed GC site was the cardia (35.6%) compared to <15% (P<0.001) for APIs, Hispanics and Blacks. While more than 57% of all cases had a history of GC-related conditions, *H. pylori* testing was reported in only 11.6% of those cases. *H. pylori* testing was highest for APIs (22.8%) and lowest for Blacks (6.5%).

Conclusions: Non-cardia GC, associated with *H. pylori* infection, was diagnosed more frequently among APIs, Blacks, and Hispanics than NHWs. Testing for *H. pylori* was low among all GC cases despite evidence of risk factors for which screening is recommended. Studies are needed to increase appropriate testing for *H. pylori* among higher risk populations.

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Keywords

gastric cancer (GC); *Helicobacter pylori (H. pylori)* ; Surveillance; Epidemiology and End Results (SEER); Patient Entitlement and Diagnosis Summary File (PEDSF); American College of Gastroenterology (ACG)

Introduction

Gastric cancer (GC) is the fifth most diagnosed cancer and the third most common cancer-related death worldwide, with over one million cases diagnosed and 700,000 deaths[1]. In 2018, of the 1.7 million new cancer cases reported in the United States (US), 26,240 were GC[2]. Among the US elderly (those aged 65 years or older), cancer has an even larger impact as more than half of all new cancer cases and two-thirds of all cancer deaths occur in this group[3]. More specifically, of the incident GC cases in the US, 60% are diagnosed among individuals over age 65 years, representing 66% of all GC deaths in the US[4]. The median age at diagnosis is 68 years[4] and the highest incidence occurs at approximately 70 years of age[5].

Globally, more than 50% of all GC cases are diagnosed in Asia, specifically Japan, South Korea and China[6]. Similarly, within the US, GC incidence is highest among Asian/Pacific Islanders[6], a minority group that has seen more than 400% population growth in the US in the last 30 years[7]. Within this Asian-American population, Americans of East Asian and Southeast Asian (e.g. Vietnamese) descent have higher incidence and mortality rates when compared to Americans of Non-Hispanic White origin[8]. In addition, in the US, Hispanics and African-Americans are disproportionately affected compared to Caucasians[9].

Helicobacter pylori (*H. pylori*) infection is a risk factor for GC, with chronic infection often resulting in chronic gastritis which can lead to gastric atrophy, which in turn leads to intestinal metaplasia, dysplasia, and gastric cancer[10–12]. It has been estimated that 89% of non-cardia gastric cancer cases are attributable to *H. pylori* infection[13]. While the prevalence of *H. pylori* infection is lower in the US than in other places, such as Asia and South America[14], Hispanic Americans and African-Americans experience a higher prevalence than Non-Hispanic Whites[14]. Thus, the American College of Gastroenterology (ACG)[14,15] recommends testing for *H. pylori* infection in those at higher risk such as those taking long-term low-dose aspirin or initiating non-steroidal anti-inflammatory drug (NSAID) treatment, and in those with gastric cancer-related conditions such as peptic ulcer (to include gastric or duodenal ulcer) or a history of peptic ulcer[10–12].

In this paper, we describe ethnic variations in GC presentation among the elderly population (65 years and older) whose data are in the population-based Surveillance, Epidemiology and End Results (SEER)-Medicare database. Lui et al. identified GC differences in a general SEER population by ethnicity in incidence, stage of disease and survival[16]. Here, we extend this work with more recent data and describe differences in this population in screening services (*H. pylori* testing and endoscopy) by race/ethnicity, place of birth, and history of gastric cancer-related conditions.

Materials and Methods

Data Sources

We used the National Cancer Institute's population-based SEER-Medicare cancer database for gastric cancer. This database includes SEER identifiers for GC cases matched with identifiers contained in Medicare's master enrollment file (for detailed description of this matching process see Warren et al.[17]). The linked database included medical outcomes of GC cases among the elderly (65 or older) who received fee-for-service Medicare benefits, as well as information regarding costs and utilization[3]. In addition, the GLOBOCAN 2012 Fact Sheet[1] (accessed October 1, 2017 at: http://globocan.iarc.fr/old/FactSheets/cancers/stomach-new.asp) and the SEER Stat Facts[4] (accessed October 1, 2017 at: https://seer.cancer.gov/statfacts/html/stomach.html) web-sites were used to obtain updated incidence and mortality data.

Study Sample

The study sample comprised of the SEER data file and the Patient Entitlement and Diagnosis Summary File (PEDSF), which included patients with a diagnosis of gastric cancer from 1997 to 2010 (n=48,377) for whom Medicare data were available. We excluded those whose race was marked as either American Indian or Other/Unknown (n=383) due to the small sample size; 0.8% of the sample. These SEER records for the 47,994 gastric cancer cases were then merged with the inpatient hospital (Medicare Provider Analysis and Review – MEDPAR) and physician/outpatient services (National Claims History – NCH) claims in order to examine healthcare utilization.

Measures

We extracted demographic information: age at diagnosis, sex, marital status, place of residence, income, place of birth, SEER region, and race/ethnicity. Race/ethnicity was grouped into four categories: Non-Hispanic White, Asian American/Pacific Islander, Hispanic, and Black. The SEER regions included: the Northwest (Connecticut, New Jersey), South (Kentucky, Louisiana, Georgia), Midwest (Detroit, Iowa) and West (Hawaii, New Mexico, Seattle, Utah, California). Place of birth was categorized as US- or foreign-born or unknown; those born in any US territory (e.g. Puerto Rico, Guam) were classified as US-born. Income was based on census tract of residence using the 2000 Census from the PEDSF file, and classified by quartiles (<$35,149; $35,150-$43,348; $46,349-$60,306; >$60,307) as previously classified in other SEER-Medicare analyses[18]. Place of residence was classified as urban or rural; urban was defined as counties in metro areas (from fewer than 250,000 population to more than 1 million as described in the PEDSF data dictionary). Marital status was classified as married or not married.

Disease presentation factors (location and staging) were assessed. The location of the gastric cancer tumor was classified as cardia or non-cardia; non-cardia was further broken down into body & fundus, pyloric antrum, pylorus, lesser & greater curvature, and other (classified as other, specified sites of stomach and stomach unspecified) using ICD-9 codes in the dataset. Stage of tumor at diagnosis was classified as unstaged, in situ, local, regional, and

distant using the historical SEER staging system[7]. Those with no information on location and stage of tumor were classified as missing.

Lastly, from the inpatient hospital and physician/outpatient services claims, we obtained information on presence of various gastric cancer-related conditions (i.e. peptic ulcer [ICD533], gastric ulcer [ICD531], duodenal ulcer [ICD532], gastrojejunal ulcer [ICD534], gastritis [ICD535], disorders of function, such as achlorhydria, persistent vomiting, and gastroparesis [ICD536], disorders-other, such as gastric diverticulum, chronic duodenal ileus, and gastroptosis [ICD537]), and screening services received (*H. pylori* testing [urease activity in blood: CPT83009; or breath: CPT78267, CPT78268, CPT83013, CPT83014; or antibody testing: CPT86677; or enzyme immunoassay: CPT87338 or CPT87339] and endoscopy [Berenson-Eggers Type of Service (BETOS) code: P8B – upper gastrointestinal endoscopy]). The dates for these conditions' claims were queried to investigate when they were filed in relation to the gastric cancer diagnosis occurring between 1997 and 2010. The gastric cancer diagnosis dates were subtracted from the claims dates. The median time in months was calculated with a negative value indicative of claim being filed before the diagnosis, and a positive value indicative of claim being filed after the diagnosis.

Statistical Analysis

Frequencies of characteristics of cases were calculated for various subgroups. Two-sided chi-square tests (and two-sided ANOVA test on age at diagnosis) were used to assess differences in demographic and disease presentation factors, and to assess differences in gastric cancer-related conditions and screening (*H. pylori* testing, endoscopy) across race/ethnicities. Kruskal-Wallis tests were used to assess differences in the median number of months between date of claim and date of diagnosis across race/ethnicities.

Results

Of the 47,994 eligible gastric cancer cases, 62% were Non-Hispanic White (NHW) (n=29,614), 13% were Asian/Pacific Islander (API; n=6,240), 12% were Hispanic (n=5,630), and 14% were Black (n=6,510). These records were merged with the inpatient hospital and physician/outpatient services claims. Among the 42,952 unique subjects with claims filed, 62% were NHW (n=26,707), 13% were API (n=5,529), 11% were Hispanic (n=4,783), and 14% were Black (n=5,933).

Demographic data and clinical characteristics are summarized in Table 1. The mean age at diagnosis for all cases was 74.1 years with NHWs the oldest (74.6 y. ± 10.5), and Hispanic and Black cases the youngest (both 72.5 y.). Overall, 60% of the sample was male and 93% lived in an urban community. Within this sample, the highest percentages of subjects in the lowest-income quartile were among Black and Hispanic cases (57.6% and 39.8%, respectively), almost double NHW and API (22% in the lowest-income quartile). Over 60% of NHW and Black subjects were born in the US (64.4% and 72.9%, respectively), whereas Hispanics were almost evenly split (34% US-born vs. 32% foreign-born) and the majority of APIs were foreign-born (48%). Across all races/ethnicities, over 24% had an unknown place of birth, with Hispanics having the highest percentage at 34%. The above observed differences across races/ethnicities were statistically significant ($P<0.001$).

Cardia was the most diagnosed specific cancer site among all gastric cancer cases (26.5%), although there was variation by race/ethnicity. For NHWs, 35.6% of tumors were diagnosed in the cardia compared to 10% for APIs, 15% for Hispanics and 11% for Blacks. The most common site among APIs was the pyloric antrum (31.4%), while the other/unspecified stomach sites were more frequently reported among Hispanics and Blacks (26.6% and 29.3%, respectively), followed by the pyloric antrum (22.8% and 25.8%, respectively) (Table 1). For stage at diagnosis, over 55% of NHWs, Hispanics and Blacks were diagnosed at the regional or distant stage, compared with 63% of APIs diagnosed at the local or regional stage. While only about 30% of non-cardia gastric cancer (ncGC) was diagnosed while still localized (31% in APIs, 29% in Blacks and NHWs, and 27% in Hispanics), almost also 30% was not diagnosed until distant spread occurred (30% in NHWs, 29% in Blacks and Hispanics, and 25% in APIs). Furthermore, when APIs and Hispanics were stratified by place of birth, foreign-born cases had a higher percentage of GC diagnosed in non-cardia as compared to US-born cases (90.9% vs. 87.7% in APIs, respectively and 86.2% vs. 82.7% in Hispanics, respectively) (Table 2). The majority of both foreign- and US-born API cases had the ncGC diagnosed at regional stage (33% for both groups) compared to 35% for foreign-born Hispanic cases; majority of US-born Hispanic cases were diagnosed at the distant stage (30%). The differences across the races/ethnicities for the disease presentation factors were statistically significant ($P<0.001$).

The most common gastric cancer-related conditions are summarized in Table 3. In the total sample, 46.1% of cases had a claim related to gastritis, followed by gastric ulcer (27.8%), with similar ordering when stratified by race/ethnicity. In addition, across all races/ethnicities, over 20% had a “disorder other”; the ICD9 code encompassed other disorders of stomach and duodenum such as gastric diverticulum, gastroptosis, and pylorospasm. Within those with an established gastric condition of a peptic ulcer, gastric ulcer, duodenal ulcer or a history of gastritis (over 55% across all cases), APIs had the highest percentage of *H. pylori* testing (22.8%) and Black cases had the lowest (6.5%). Within API cases, 72% of foreign-born cases had an established condition compared to 50% of US-born cases (Supplementary Table 2). Furthermore, foreign-born cases had higher frequency of *H. pylori* testing (26%). Similarly, for Hispanics, foreign-born cases had a higher percentage of established conditions (62% vs. 52% in US-born), with those foreign-born cases having double the *H. pylori* testing (24% vs. 12% in US-born). Endoscopy percentages within those with established conditions ranged from 86.2% in Hispanics to 90.9% in NHWs (Table 3). Overall, within those with an established condition, the *H. pylori* testing occurred 4.9 (33.0) months before the gastric cancer diagnosis, while the endoscopy occurred 0.3 (2.10) months after the diagnosis (Supplementary Table 3). A similar pattern was observed across all races/ethnicities with APIs having *H. pylori* testing occurring the furthest out at 7.10 (38.9) months before diagnosis and Black cases having the testing occur 3.15 (30.7) months before diagnosis. Within US-born subjects, APIs had the highest *H. pylori* testing frequency (7.5%) followed by Hispanics (7.3%). Among foreign-born cases, the testing frequency was highest for APIs (19.7%), followed by 16.6% for Hispanics, 14.3% for NHWs, and 7.3% for Blacks. And within those with an unknown place of birth, APIs also had the highest testing frequency (16.8%) followed by Hispanics (11.6%) (Figure 1). Comparing US-born versus foreign-born cases, endoscopy testing was generally higher in foreign-born than

US-born across race/ethnic groups (aside from Blacks) with the biggest difference for APIs (75% in foreign-born vs. 56% in US-born). The differences across races/ethnicities for these conditions were statistically significant ($P<0.001$).

Discussion

Currently, gastric cancer is the fifth most diagnosed cancer in the world and the third most common cause of cancer-related deaths[1]. Although the incidence of gastric cancer has decreased over time, racial and ethnic differences in both incidence and survival have remained throughout the US. For example, even though Asians have the highest gastric cancer incidence, survival in this group is the highest overall[16]. Whereas previous work[16] identified gastric cancer differences by ethnicity in incidence, stage of disease and survival, we expanded the work by using more recent data and describing gastric cancer differences in screening (*Helicobacter pylori* (*H. pylori*) testing and endoscopy) among the SEER-Medicare population by ethnicity, place of birth, and gastric cancer-related conditions.

Within this SEER-Medicare gastric cancer population, the average age at diagnosis was 74 years old, similar to other studies[5]. Of note, Hispanic and Black cases were diagnosed at a younger age. The majority of NHWs, Hispanics and Blacks were US-born, in contrast to APIs. Foreign-born NHWs were diagnosed at the oldest age, while foreign-born Hispanic and Black cases were diagnosed at younger ages. The majority of the cases was male, as seen in global non-cardia gastric cancer rates where the male-to female ratio is approximately 2:1[19]. The majority of Hispanic and Black cases presented in the lowest-income quartile, which is of interest as lower socioeconomic status has been associated with lifestyle behaviors that increase cancer risk[20].

We observed notable racial and ethnic variation in both screening practices and disease presentation. Non-cardia gastric cancer is strongly associated with *H. pylori* infection[21]. While, overall, the majority of all cases were diagnosed in the non-cardia area, there were important variations by race/ethnicity. Over 35% of NHWs were diagnosed in the cardia region versus less than 15% for Blacks, Hispanics and APIs. For Hispanics, the majority of cases was diagnosed as either regional tumor, meaning the cancer extended beyond organ of origin into surrounding organs, or with distant tumor (metastatic disease). When stratified by place of birth, the majority of foreign-born Hispanic non-cardia tumor cases were diagnosed at regional stage, while US-born Hispanics were diagnosed as distant. On the other hand, majority of NHW and Black cases were diagnosed as either local or distant; and majority of API cases diagnosed as either local or regional. While 50% of patients with localized gastric cancer can be cured, the 5-year survival rate for disseminated gastric cancer is lower than 20%[22]. Additionally, the majority of Hispanics and Blacks had the location of their non-cardia tumor as “other”. Thus, either their tumor was located in areas of the stomach that could not be classified as body & fundus, pyloric antrum, pylorus and the curvatures; or location could not be determined; or location was not completely evaluated.

Screening for *H. pylori* is recommended by the American College of Gastroenterology (ACG) among individuals with gastric cancer-related conditions such as peptic ulcer, gastric ulcer, duodenal ulcer or a history of peptic ulcer[14,15]. Despite a high proportion of non-

cardia gastric cancer with late staging (~30% regional), in the SEER-Medicare population, testing for *H. pylori* was low (7.7%) even among those with GC-related conditions (11.6%). However, the *H. pylori* testing both overall and for those with established conditions, occurred about 4 months before gastric cancer diagnosis. This is indicative that screening did occur before diagnosis. Furthermore, testing was particularly low among Black GC cases with established conditions (6.5%), though this testing occurred within the shortest time period before GC diagnosis at 3.2 months. *H. pylori* testing was highest in APIs with established conditions (23%), but occurred about 7 months before GC diagnosis. A large proportion of foreign-born API cases also had established conditions (72%), but only 26% were tested for *H. pylori*. Lastly, an important disparity became apparent among Hispanics with established conditions, who had the second highest *H. pylori* testing (17.9%), but the lowest endoscopy testing (86.2%); Hispanics also had the lowest endoscopy frequency across all individuals (62.5%). Endoscopy rates were highest in NHWs with established conditions (91%), and unlike *H. pylori* testing, endoscopies were performed, both overall and for those with established conditions, 0.3 months after gastric cancer diagnosis. This low level of testing and potential screening is contrary to the findings of a recent survey of gastroenterologists which indicated that 97% of practitioners regularly test for *H. pylori* infection among patients with established conditions and 85% of practitioners report testing patients with gastritis[10]. If these SEER-Medicare data are representative of broader testing and reporting practices, they indicate a potential source for intervention. Crew et al.[19] reported decreased mortality in high-risk *H. pylori* areas as a result of regular screening and early detection; for example, a 50% reduction in mortality in men in Japan due to implementation of mass screening programs.

Others have also suggested that individuals who migrate from high-risk areas (such as Japan) to low-incidence regions experience a decreased risk in developing gastric cancer[19]. This finding is borne out in the current study, where API cases, the majority of whom were foreign-born, were the only group with a majority of cases diagnosed at local or regional stage of non-cardia tumor. In addition, *H. pylori* testing was higher in foreign-born than US-born cases; cases with unknown place of birth had higher testing rates than US-born cases as well.

Among gastric cancer cases, Lui et al. found the incidence of localized cancer had increased for Black cases and stayed the same for Hispanics between 1992 and 2009[16]. Our results showed that the most common stages at diagnosis in this elderly population were regional (28.3%) and local (29.1%). The top two stages for Black cases were distant (28.2%) and local (29.2%), which is consistent with other cancer studies showing that African-Americans experience the highest mortality and shortest survival[20]. Similar to the findings of Torre et al.[23], which stated that APIs in a non-Medicare sample were more likely to be diagnosed with gastric cancer at localized or regional stage than NHWs, we found the majority of APIs (63%) were diagnosed at the local or regional stage.

The present study had several strengths. First, it utilized fourteen years of incidence data from the large population-based SEER cancer registry data that had been merged with Medicare claims data. The results of this study would likely be generalizable to the elderly US population which receives Medicare benefits. Second, the findings described disparities

in screening and gastric cancer precursor conditions. This study also expanded upon the classic race/ethnicity categorizations by classifying race/ethnicity by place of birth. There were also several limitations. The SEER-Medicare dataset included only cases whose data (or healthcare) was in the fee-for-service Medicare claims data. As the data only capture the time a person was enrolled in Medicare, it is possible that *H. pylori* testing could have occurred before that person was eligible for Medicare. The current analysis did not analyze, in-depth, the time interval between testing for *H. pylori* and endoscopy services, and GC diagnosis. Future analyses will focus more on determining screening and diagnostic testing both in relation to the various conditions, such as ulcers, and by race/ethnicity. In addition, these future analyses will also investigate socio-demographic factors and relevant conditions to determine what might predict whether individuals receive an endoscopy. Another limitation of our study is related to the information on race/ethnicity and place of birth. The information on race/ethnicity came from medical records, death records, and registration information,[24] which may be more subject to misclassification, especially for Hispanic and Non-Hispanic Whites.[7] Furthermore, we used a combination of the Hispanic origin variable as determined by the North American Association of Central Cancer Registries (NAACR) Hispanic/Latino Identification Algorithm (NHIA), and the SEER race/ethnicity variable. The Hispanic surname algorithm that is part of the NAACR tool may not distinguish between Hispanic/Latino and Portuguese, Italian or Filipino.[25] Additionally, responses to Hispanic/Latino origin questions have been inconsistent in self-report which may be problematic with medical records that use patient self-report.[25] Lastly, place of birth information also came from medical records, as well as death records[26] and was missing from 28% of the cases. As a result, because of more complete data on death certificates, the information on place of birth might be more complete for deceased patients[7,26,27].

The current study is the first to describe demographic differences among gastric cancer cases in the SEER-Medicare population by race/ethnicity. Tumor location suggests that *H. pylori* infection still plays a potential causal role for many GC cases. Importantly, location and stage of tumor at diagnosis differed by race/ethnicity and *H. pylori* testing was higher in foreign-born than US-born cases. *H. pylori* testing was low despite a high proportion of cases exhibiting gastric conditions for which *H. pylori* testing is recommended. Future studies can investigate the reasons for the low *H. pylori* testing rates in elderly patients with gastric cancer-related conditions.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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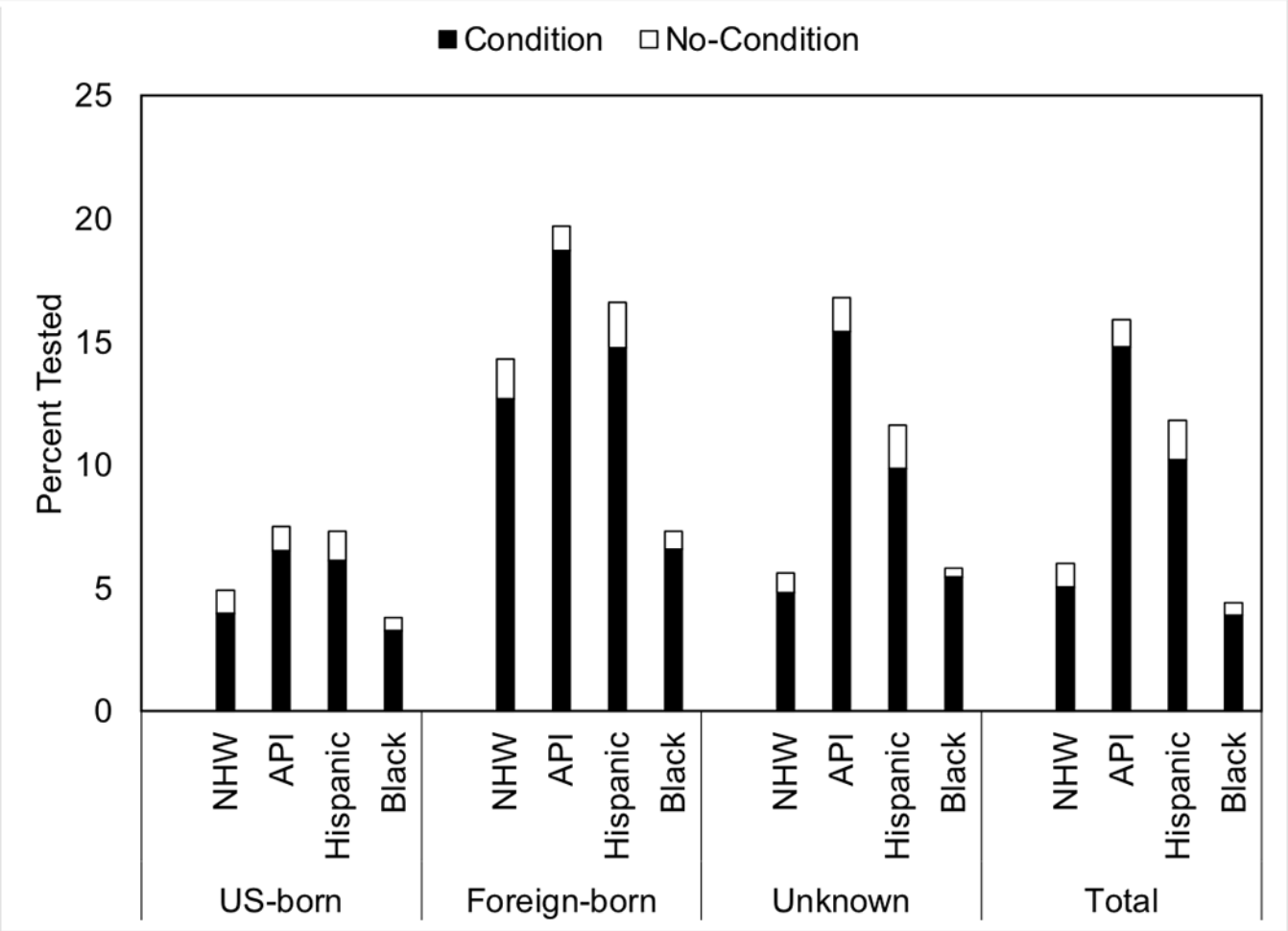

Figure 1.

H. pylori testing by place of birth and race/ethnicity.

Abbreviations: NHW: Non-Hispanic White; API: Asian/Pacific Islander

The black bar indicates the percent tested among those with a diagnostic code for guideline-based established conditions (peptic ulcer or gastric ulcer or duodenal ulcer or a history of gastritis), while the white bar indicates testing among those without.

Table 1.

Demographic and Clinical Characteristics of Non-Hispanic White, Asian/Pacific Islander, Hispanic and Black Gastric Cancer Medicare Cases (n=47,994) – 1997–2010

Characteristic[a]	Total (n=47,994)	NHW (n=29,614)	API (n=6,240)	Hispanic (n=5,630)	Black (n=6,510)
	Number (%) or Mean ± SD				
Demographic Factors					
Age at Diagnosis	74.1±10.7	74.6±10.5	74.5±9.9	72.5±10.8	72.5±11.7
Male sex	28,840 (60.1)	18,304 (61.8)	3,608 (57.8)	3,336 (59.3)	3,592 (55.2)
Married at diagnosis	26,406 (55.0)	16,827 (56.8)	4,015 (64.3)	3,078 (54.7)	2,486 (38.2)
Lived in urban community	44,784 (93.3)	27,040 (91.3)	6,231 (99.9)	5,436 (96.6)	6,077 (93.4)
Lowest-income quartile	13,342 (28.6)	6,165 (21.5)	1,309 (21.5)	2,206 (39.8)	3,662 (57.6)
Place of Birth					
US-Born	27,340 (56.9)	19,078 (64.4)	1,606 (25.7)	1,911 (33.9)	4,745 (72.9)
Foreign-Born	7,390 (15.4)	2,433 (8.22)	2,995 (48.0)	1,812 (32.2)	150 (2.3)
Unknown	13,264 (27.6)	8,103 (27.4)	1,639 (26.3)	1,907 (33.9)	1,615 (24.8)
SEER Region					
Northeast	9,139 (19.0)	7,068 (23.9)	292 (4.7)	654 (11.6)	1,125 (17.3)
South	8,238 (17.2)	5,370 (18.1)	120 (1.9)	105 (1.9)	2,643 (40.6)
Midwest	5,090 (10.6)	3,957 (13.4)	73 (1.2)	83 (1.5)	977 (15.0)
West	25,527 (53.2)	13,219 (44.6)	5,755 (92.2)	4,788 (85.0)	1,765 (27.1)
Disease Presentation					
Location of Tumor					
Cardia	12,305 (26.5)	10,195 (35.6)	624 (10.4)	809 (14.7)	677 (10.9)
Non-Cardia					
Body & Fundus	6,411 (13.8)	3,688 (12.9)	857 (14.2)	945 (17.2)	921 (14.9)
Pyloric Antrum	9,086 (19.6)	4,344 (15.2)	1,895 (31.4)	1,250 (22.8)	1,597 (25.8)
Pylorus	1,429 (3.1)	680 (2.4)	213 (3.5)	255 (4.6)	281 (4.5)
Lesser & Greater Curvature	5,659 (12.2)	2,917 (10.2)	1,061 (17.6)	774 (14.1)	907 (14.6)
Other[**]	11,469 (24.7)	6,815 (23.8)	1,377 (22.9)	1,459 (26.6)	1,818 (29.3)
Missing[b]	1,635 (3.4)	975 (3.3)	213 (3.4)	138 (2.5)	309 (4.7)
Stage of Tumor at Diagnosis in All (Cardia & Non-Cardia) Cases					
Unstaged	3,485 (13.2)	2,203 (13.7)	375 (10.8)	404 (12.2)	503 (13.8)
In Situ	449 (1.7)	295 (1.8)	57 (1.6)	46 (1.4)	51 (1.4)
Local	7,707 (29.1)	4,661 (29.0)	1,085 (31.2)	894 (26.9)	1,067 (29.2)
Regional	7,488 (28.3)	4,320 (26.9)	1,122 (32.2)	1,043 (31.4)	1,003 (27.5)
Distant	7,377 (27.8)	4,576 (28.5)	841 (24.2)	931 (28.1)	1,029 (28.2)
Missing[b]	21,488 (44.8)	13,559 (45.8)	2,760 (44.2)	2,312 (41.1)	2,857 (43.9)
Stage of Tumor at Diagnosis in Non-Cardia[C]Cases					
Unstaged	2,657 (14.4)	1,536 (15.9)	325 (10.9)	356 (12.9)	440 (14.3)

Characteristic[a]	Total (n=47,994)	NHW (n=29,614)	API (n=6,240)	Hispanic (n=5,630)	Black (n=6,510)
In Situ	77 (0.4)	57 (0.6)	9 (0.3)	6 (0.2)	5 (0.2)
Local	5,348 (28.9)	2,779 (28.8)	940 (31.4)	742 (26.9)	887 (28.9)
Regional	5,122 (27.7)	2,422 (25.1)	983 (32.8)	857 (31.1)	860 (28.0)
Distant	5,280 (28.6)	2,865 (29.7)	738 (24.6)	796 (28.9)	881 (28.7)
Missing[b]	15,570 (32.4)	8,785 (29.7)	2,408 (38.6)	1,926 (34.2)	2,451 (37.6)

[a] Statistical significance tests (age at dx – ANOVA; all others – chi-sq) yielded p-values<0.001

[b] Missing: no information on location of tumor or stage of tumor; not included in totals used for frequency calculations

[c] Total number diagnosed with non-cardia gastric cancer sample sizes: Total – 34,054; NHW – 18,444; API – 5,403; Hispanic – 4,683; Black: 5,524

Abbreviations: NHW: Non-Hispanic White; API: Asian/Pacific Islander

Northeast: CT and NJ; South: KY, LA, GA; Midwest: Detroit, Iowa; West: Hawaii, NM, Seattle, Utah, CA

[**] Other: Other, specified sites of stomach & stomach unspecified

Table 2.

Demographic and Clinical Characteristics of US-Born and Foreign-Born Asian/Pacific Islander and Hispanic Gastric Cancer Medicare Cases (n=11,870) – 1997–2010

Characteristic[a]	API[‡] (n=6,240)		Hispanic[‡] (n=5,630)	
	US-Born (n=1,606)	Foreign-Born (n=2,995)	US-Born (n=1,911)	Foreign-Born (n=1,812)
	Number (%) or Mean ± SD			
Demographic Factors				
Age at Diagnosis	75.5±9.7	73.7±10.2	73.1±10.4	71.7±11.0
Male sex	988 (61.5)	1,690 (56.4)	1,157 (60.5)	1,104 (60.9)
Married at diagnosis	988 (61.5)	1,974 (65.9)	1,001 (52.4)	1,057 (58.3)
Lived in urban community	1,604 (99.9)	2,991 (99.9)	1,769 (92.7)	1,807 (99.7)
Lowest-income quartile	233 (15.3)	750 (25.5)	798 (42.6)	739 (41.2)
SEER Region				
Northeast	6 (0.4)	165 (5.5)	250 (13.1)	209 (11.5)
South	10 (0.6)	60 (2.0)	37 (1.9)	28 (1.6)
Midwest	4 (0.3)	32 (1.1)	43 (2.3)	12 (0.7)
West	1,586 (98.8)	2,738 (91.4)	1,581 (82.7)	1,563 (86.3)
Disease Presentation				
Location of Tumor				
Cardia	192 (12.3)	264 (9.1)	322 (17.3)	246 (13.8)
Non-Cardia				
Body & Fundus	252 (16.1)	372 (12.9)	307 (16.5)	303 (17.1)
Pyloric Antrum	407 (26.0)	969 (33.5)	388 (20.8)	444 (24.9)
Pylorus	37 (2.4)	117 (4.0)	83 (4.5)	84 (4.7)
Lesser & Greater Curvature	256 (16.4)	537 (18.6)	244 (13.1)	259 (14.6)
Other[**]	421 (26.9)	635 (21.9)	522 (27.9)	441 (24.8)
Missing[b]	41 (2.6)	101 (3.4)	45 (2.4)	35 (1.9)
Stage of Tumor at Diagnosis in All (Cardia & Non-Cardia) Cases				
Unstaged	71 (9.3)	200 (11.6)	151 (14.3)	127 (11.6)
In Situ	13 (1.7)	24 (1.4)	11 (1.0)	14 (1.3)
Local	194 (25.5)	542 (31.3)	265 (25.1)	274 (24.9)
Regional	245 (32.2)	574 (33.1)	316 (29.9)	381 (34.6)
Distant	237 (31.2)	392 (22.6)	315 (29.8)	304 (27.6)
Missing[b]	846 (52.7)	1,263 (42.2)	853 (44.6)	712 (39.3)
Stage of Tumor at Diagnosis in Non-Cardia[c] Cases				
Unstaged	60 (9.5)	177 (11.7)	135 (15.6)	108 (11.7)
In Situ	4 (0.6)	4 (0.3)	1 (0.1)	2 (0.2)
Local	159 (25.0)	481 (31.7)	211 (24.3)	235 (25.4)
Regional	210 (33.1)	509 (33.6)	257 (29.6)	320 (34.6)

Characteristic[a]	API[‡] (n=6,240)		Hispanic[‡] (n=5,630)	
	US-Born (n=1,606)	Foreign-Born (n=2,995)	US-Born (n=1,911)	Foreign-Born (n=1,812)
Distant	202 (31.8)	346 (22.8)	263 (30.3)	261 (28.2)
Missing[b]	738 (45.9)	1,113 (37.2)	677 (35.4)	605 (33.4

[‡]Total sample size includes US-born, Foreign-born and Unknown place of birth

[a]Statistical significance tests (age at dx – ANOVA; all others – chi-sq) yielded p-values<0.05

[b]Missing: no information on location of tumor or stage of tumor; not included in totals used for frequency calculations

[c]Total number diagnosed with non-cardia gastric cancer sample sizes: API US-Born – 1,373; API Foreign-Born – 2,630; Hispanic US-Born – 1,544; Hispanic Foreign-Born – 1,531

Abbreviations: NHW: Non-Hispanic White; API: Asian/Pacific Islander

Northeast: CT and NJ; South: KY, LA, GA; Midwest: Detroit, Iowa; West: Hawaii, NM, Seattle, Utah, CA

[**]Other: Other, specified sites of stomach & stomach unspecified

Table 3.

Medical Services Claims for Specific Gastrointestinal Disorders and Screening History Among Gastric Cancer Cases by Race/Ethnicity (n=42,952) – 1997–2010

Characteristic[a] (ICD9 Codes)	Total (n=42,952)	NHW (n=26,707)	API (n=5,529)	Hispanic (n=4,783)	Black (n=5,933)
	Number (%)				
Gastric Cancer-Related Conditions					
Peptic Ulcer[b] [ICD533]	6,116 (14.2)	3,281 (12.3)	1,241 (22.5)	757 (15.8)	837 (14.1)
Gastric Ulcer [ICD531]	11,919 (27.8)	6,927 (25.9)	1,899 (34.4)	1,321 (27.6)	1,772 (29.9)
Duodenal Ulcer [ICD532]	1,681 (3.9)	1,020 (3.8)	288 (5.2)	168 (3.5)	205 (3.5)
Gastrojejunal Ulcer [ICD534]	874 (2.0)	509 (1.9)	155 (2.8)	117 (2.5)	93 (1.6)
Gastritis [ICD535]	19,820 (46.1)	11,899 (44.6)	2,918 (52.8)	2,231 (46.6)	2,772 (46.7)
Disorders Function [ICD536]	10,416 (24.3)	6,162 (23.1)	1,762 (31.9)	1,134 (23.7)	1,358 (22.9)
Disorders Other [ICD537]	10,165 (23.7)	5,961 (22.3)	1,501 (27.2)	1,128 (23.6)	1,575 (26.6)
Mucositis	17 (0.04)	11 (0.04)	1 (0.02)	3 (0.06)	2 (0.03)
Established Conditions[c]	24,907 (57.9)	15,067 (56.4)	3,581 (64.8)	2,722 (56.9)	3,537 (59.6)
H. pylori Testing[d]	2,878 (11.6)	1,344 (8.9)	816 (22.8)	488 (17.9)	230 (6.5)
Endoscopy[d]	22,280 (89.5)	13,694 (90.9)	3,189 (89.1)	2,346 (86.2)	3,051 (86.3)
Medical Services & Testing					
H. pylori Testing	3,306 (7.7)	1,605 (6.0)	877 (15.9)	564 (11.8)	260 (4.4)
Endoscopy	30,045 (69.9)	19,241 (72.0)	3,834 (69.3)	2,987 (62.5)	3,983 (67.1)

[a] Statistical significance tests of chi-sq yielded p-values<0.001 except for Mucositis (cells had expected counts <5; statistical test not valid)

[b] Includes history of peptic ulcer

[c] Established conditions: combined count of those with peptic ulcer or gastric ulcer or duodenal ulcer or a history of gastritis which are indicator conditions for *H. pylori* testing

[d] Frequencies are of total number with an established condition

Abbreviations: NHW: Non-Hispanic White; API: Asian/Pacific Islander