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The descriptive epidemiology of gastric cancer in Central America and comparison with United States Hispanic populations

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Abstract

Purpose—Delineate the epidemiology of gastric adenocarcinoma in Central America and contrast it with Hispanic-Latino populations in the U.S.

Methods—Published literature and Central America Ministry of Health databases were used as primary data sources, including national, population-based and hospital-based registries. U.S. data was obtained from the NCI-SEER registry. Incident gastric adenocarcinoma cases were analyzed for available data between 1985–2011, including demographic variables and pathology information.

Results—In Central America, 19,741 incident gastric adenocarcinomas were identified. Two-thirds of cases were male, 20.5% were under age 55, and 58.5% were from rural areas. In the SEER database (n=7,871), 57.8% were male, and 28.9% were under age 55. Among the U.S. Hispanics born in Central America with gastric cancer (n=1,210), 50.3% of cases were male, and 38.1% were under age 55.

Noncardia gastric cancer was more common in Central America (83.3%), among U.S. Hispanics (80.2%), and Hispanics born in Central America (86.3%). Cancers of the antrum were more common in Central America (73.6%), whereas cancers of the corpus were slightly more common among U.S. Hispanics (54.0%). Adenocarcinoma of the diffuse subtype was relatively common,

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both in Central America (35.7%), and U.S. Hispanics (69.5%), although Lauren classification was reported in only 50% of cases.

Conclusions—A significant burden of gastric adenocarcinoma is observed in Central America based upon limited available data. Differences are noted between Central America and U.S. Hispanics. Strengthening population-based registries is needed for improved cancer control in Central America, which may have implications for the growing U.S. Hispanic population.

Keywords

Gastric Cancer; Cancer Epidemiology; Incidence Rate; Central America; Hispanic

1. Introduction

Gastric adenocarcinoma is the second most common cause of cancer mortality worldwide, and the leading infection-associated cancer [1,2]. Latin American countries have a particularly burden, with some of the highest reported mortality rates [2–4]. Gastric cancer has marked geographic and ethnic variability. In Latin America, the mountainous areas along the Pacific littoral have the highest incidence and mortality rates, an “altitude enigma”, including Honduras, Costa Rica, Guatemala and Colombia [5–7].

Gastric adenocarcinoma, in particular the intestinal subtype, is a multifactorial process, which progresses through a series of histopathology steps: normal mucosa, non-atrophic gastritis, multifocal atrophic gastritis, intestinal metaplasia, dysplasia and adenocarcinoma [8]. The early mucosal inflammation and chronic gastritis is driven by *H. pylori* infection, with modulation by host genotypes and responses, dietary and environmental factors [9]. Key influences, which are usually established in childhood, include host of *H. pylori* strain specific genetic factors (e.g., *cagA* and *vacAs1m1*), and host risk genotypes (cytokine SNPs, e.g., IL1 β -511T) [10,11]. These two key determinants may be “imported” at the time of immigration from high incidence areas, such as Central America, and therefore may be instructive for cancer control among U.S. Hispanics. In contrast, proximal cancers of the gastroesophageal junction and cardia cancer have been associated with gastroesophageal reflux and tobacco [12]. These two cancer groups are now considered separate entities.

In the U.S., due to significant differences in the median ages, the overall cancer rates are lower among Hispanics, with the exception of gastric and cervical cancer, important infectious entities [13]. Gastric cancer incidence rates for Hispanics in the U.S. are nearly double those of whites [13]. In addition, Hispanics have more distal type cancer than non-Hispanic Whites [14,15]. Interestingly, recent studies suggest an increase in diffuse cancer in foreign born Hispanic men and U.S. born Hispanic women [16]. Hispanic ethnicity has also been associated with diagnosis at a younger age, less differentiated tumors, and different metastasis pattern (more peritoneal and less hepatic metastases) [15,14].

The literature regarding gastric cancer epidemiology in Central America is limited, with the exception of the national cancer registries of Costa Rica and Panama. The northern nations of the region, the “Central American Four” (CA-4) are comprised of Guatemala, Honduras, El Salvador, and Nicaragua, with movement towards economic and health system

integration. The CA-4 represents the core low-middle income countries (LMICs) of Latin America, and population-based cancer registries (PBCRs) and hospital-based cancer registries (HBCRs) are limited. Importantly, after Mexico, Central America forms the second largest Latino immigrant population in the U.S., the majority of who are from the CA-4 nations, and may represent the largest at-risk group for gastric cancer. Our study aims to describe the epidemiology of gastric cancer in Central America based upon available data and with comparison to Hispanics living in United States.

2. Materials and methods

2.1 Central America data sources

We reviewed published data from available resources, including the published literature, International Agency on Cancer Research (IARC), hospital-based cancer registries and Ministry of Health (MOH) data. Different methods were used to record cancer cases in each country. For the most part, the available data encompassed 10–15 year periods between 1996 and 2011, with the exception of the national Costa Rica registry (1985–2005). Data from Costa Rica and Panama were obtained from their National Cancer Registries (Registro Nacional de Tumores de Costa Rica and the Registro Nacional de Cáncer de Panama, respectively), both of which are certified by IARC and have national coverage. Data from Guatemala were obtained from the National Cancer Institute (INCAN), which is a national referral center for cancer treatment with records of all new patient consultations in their hospitals and clinics. The National Radiotherapy Center in Nicaragua provided data for gastric cancer treatment in their national referral hospital. These latter registries are IARC-affiliated only. Data from Honduras was obtained from a prospective, population-based study, which utilized a combined endoscopy and pathology registry to assess gastric cancer incidence in the rural western region of the country [5]. Data from this study was considered high quality, given its geographic representativeness, complete information on histology and anatomical subsite, versus the limited data from the three IARC-affiliated hospital-based registries [5]. Finally, data from El Salvador was obtained from a targeted review of databases from the three largest public hospitals (Hospital Rosales, Hospital Zacamil, and Hospital General ISSS). This study focused on Spanish-speaking nations, and thus, Belize was not included in our analysis.

2.2 United States data sources

Data from the United States was obtained from the U.S. National Cancer Institute's Surveillance and Epidemiology End Results Program (SEER) 18 dataset for the period 1985–2009. All Hispanic patients defined by the Hispanic/Latino Identification Algorithm (HLIA) were included[17]. This group was further divided into foreign-born from Central America and Mexico, and U.S.-born Hispanics. The Central American group included patients born in Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panama or non-specified Central America. The U.S.-born group included patients born in the continental U.S. only. Cases with unknown site of birth were not included.

2.3 Data classification and coding

The aforementioned data sources were reviewed for incident gastric adenocarcinoma cases for the time periods of available data specific to each nation. The demographic variables (age, gender, ethnic group, year of diagnosis, residency setting rural/urban) and two pathological variables (anatomical subsite and histological type) were recorded. Cases with unknown gender, or less than 15 years at diagnosis were excluded from analysis. Two centers in our sample (Nicaragua and Panama) had already recorded age in groups subsets (15–44, 45–54, etc.) so data sets were collected to fit in the same age groups. Fifty five years was selected as the main age cut-off because it was the point estimate closest to 60 years, the cutoff used in the largest U.S. SEER reviews [18,19]. Anatomical subsite and histological type were grouped using the International Classification of Disease for Oncology 3 (ICD-O-3) codes [19].

The classification of urban and rural status followed the norms of each available nation's data. The cases in Guatemala were classified by their residency municipality (*municipio*) as rural or urban according to the National Statistics Institute (INE) Population and Habitat 2002 census [20]. In El Salvador, cases were classified as rural or urban by each hospital's database. In Costa Rica data, the National Cancer Registry records cases as urban, rural or semiurban according to the National Institute of Statistics and Census (INEC) criteria. Semiurban cases were included in the rural group. All cases in western Honduras, the region bordering Guatemala and El Salvador, were considered rural. Lastly, in the U.S. cases, classification was based on the 2003 Rural-Urban Continuum Codes for each county reported. All metropolitan areas were considered urban and the remaining counties were considered rural [17].

A summary analysis was also conducted for the “Central America Four” nations (CA-4) of Guatemala, Honduras, El Salvador and Nicaragua. The nations are interconnected by geography, history, ethnicity, language and culture. The CA-4 Border Control Agreement opened the borders in 2006, and in some respects, began the transition towards a union of many aspects of their infrastructures and health systems, suggesting that a regional approach to cancer control is necessary. The CA-4 comprises four of the seven LMICs in Latin America, along with Bolivia, Paraguay, and the Dominican Republic [21,22]. Importantly, the CA-4 constitutes the majority of Central American recent immigrants to the U.S., which overall make up the second largest U.S. Hispanic immigrant population after Mexico. Given the modest rates of gastric cancer in Mexico, immigrants from the CA-4 may represent those at highest risk for gastric cancer among Hispanics [21].

The four digit topography site codes (C16, stomach cancer) were used to extract and analyze the incident cases of gastric cancer. For the subsite analysis, pylorus C16.4 and fundus C16.1 locations were grouped as fundus, and corpus C16.2, lesser curvature C16.5, and greater curvature C16.6 were grouped as corpus. Histology was classified per the Lauren system, and considered intestinal, diffuse or other based on ICD-O 3 codes using the same classification as Anderson et al.[19].

2.4 Statistical analysis

Raw frequencies and percentage of cases for available data from each nation are reported. Overall incidence rates were not calculated due to lack of population-at-risk data for most countries. IARC country cancer incidence rates (GLOBOCAN 2008) are presented for comparison purposes [6]. Because data sources are heterogeneous and methodology for cases registration is non-uniform, no statistical tests were used to compare differences between countries. Data was summarized using Excel (Microsoft Office 2007) and Stata (Stata SE11.2). Institutional Review Board approval (exempt status) was obtained from a national independent ethics committee in Guatemala (ZUGUEME). All data had been de-identified by the participating institutions prior to receipt by the authors (JEC, JDH) for analysis.

3. Results

In Central America, a total of 19,741 incident gastric adenocarcinomas were identified from the available data sources of variable intervals during the 1985–2011 period. (Table 1). Fourteen and 15 cases of foreign nationality were excluded from the Guatemala and Costa Rica groups, respectively. Two-thirds of cases were male (12,369, 62.7%), 20.5% were under age 55, and 58.5% were from rural areas. As expected, nearly three-fourths (14,539) of cases in our analysis were from Costa Rica, attributed to their longstanding national cancer registry. There were no evident differences in gender, age, anatomical distribution, or histologic subtype in the comparison of Costa Rica cases with those of the other Central America countries.

In the U.S. SEER database 1985–2009, 7,871 incident gastric cancer cases were identified among Hispanics (Table 2). Twenty seven cases were excluded from analysis due to potentially contradictory race (14 American Indian/Alaska Native, 13 Asian), despite being classified as Hispanic per the HLIA algorithm. Overall among U.S. Hispanics, 57.8% were male, and 28.9% were under age 55 (Table 3). For the U.S. Hispanics born in Central America with gastric cancer (n= 1,210), 50.3% of cases were male, and 38.1% were under age 55.

The information on anatomic location and histology was somewhat limited in the Central America databases (53% and 67% unspecified) and SEER database (19% and 58% unspecified). For reported data, noncardia gastric cancer was far more common in Central America (83.3%, n= 6,904/8,285), among U.S. Hispanics (80.2%, n= 4,413/5,501), and among Hispanics born in Central America (86.3%, n= 746/864). Cancers of the antrum were more common in Central America (73.6%, n= 4,495/6,105), whereas cancers of the corpus were slightly more common among U.S. Hispanics (53.9%, n= 2,383/4,413). We observed that in Central America, adenocarcinoma of the intestinal subtype was more common. Diffuse type was more common in the U.S. Hispanics sample (Table 3). Specifically, the intestinal type accounted for 64.3% of gastric cancers in Central America (n= 4,200/6,530), but only 30.5% among U.S. Hispanics (n= 1,001/3,285) [19]. Of note in Honduras, the country with highest-quality gastric cancer registry, the diffuse type was more common (Table 1).

4. Discussion

This is the first study to describe the epidemiology of gastric adenocarcinoma in each of the Central America countries. We observed that two-thirds of incident cases were male, and half of the patients came from rural areas. In comparison to U.S., the patients were significantly younger [19]. Gastric cancer in developing countries tend to present at younger ages. This finding is likely explained by earlier lifelong *H. pylori* infection, along with other host and environmental factors.

Noncardia gastric cancer was more common in all three groups (Central America, Hispanics born in Central America, and U.S. Hispanics). Studies with data from U.S. hospitals and SEER reviews show that in general, Hispanics have more distal type cancer than non-Hispanic Whites [14,15,18]. In addition, most distal incident cases were found in the antrum in Central America, whereas cancer of the corpus was slightly more frequent among U.S. Hispanics. The intestinal subtype was relatively more common in Central America (64.3%), but less so in U.S. Hispanics (30.5%), with the caveat that about 50% of the data from the registries did not report the Lauren classification. This distribution among U.S. Hispanics is similar to the U.S. overall distribution reported since 1977 (37.7%, n= 9,707/25,752) [19]. These findings are consistent with global observations: as countries progress through the epidemiologic transition, there is a drop in gastric carcinoma incidence primarily due to the decrease in the intestinal-type gastric cancer, which is in turn likely related to the decline in *H. pylori* infection rates and other environmental factors [23,24]. Epidemiologic studies comparing the gastric cancer incidence in Asians and Asian immigrants to the U.S. support this transition [25,26].

The global cancer burden is expected to nearly double by 2030, with an increase from 7.6 million to 13.2 million annual deaths, and with the majority of the burden in LMICs. Population-based cancer registries (PBCRs) are important for cancer control, yet nearly one fifth of countries lack PBCRs, and nearly all are LMICs [22]. Our study highlights the burden of gastric adenocarcinoma in Central America, and also underscores the critical need for cancer registry capacity building in the region. The LMICs of Central America, Guatemala, Honduras, Nicaragua, and El Salvador, lack longitudinal cancer registries with population-based data. For example, Guatemala with a population of 14.8 million, has only one hospital-based cancer registry (INCAN) with over 6,000 new cancer patients annually, but without the geographic delineation of the at-risk population.

A number of hurdles exist to advance PBCRs in low resource settings. These include the traditional Ministry of Health priorities, budget constraints, and pathology service limitations. For instance, in many of the district hospitals in Central America, the central government is unable to fund pathology services, thereby making a standard cancer registry impossible. Studies have proposed alternative approaches to improve national cancer data for LMICs. In Nigeria, information provided by a network of eleven hospital-based cancer registries proved effective to determine the most frequent cancer types and subtypes presenting to the health care system, prioritize resource allocation and improve cancer care delivery [27]. Clinical information systems which supplement inconsistent pathology services may improve cancer registry data in the LMIC setting. For example, longitudinal

endoscopy registries can provide reliable information on gastric cancer incidence and temporary trends and identify risk factors to design and implement targeted prevention efforts [5]. Registry standardization (e.g. IARC CANREG5) may also help improve missing and incomplete data on anatomical subsite and histology, which is common, even in the high quality Costa Rica and U.S. SEER databases.

Our study has a number of methodologic limitations. As noted, different diagnostic criteria and recording methodologies were used in each country. Incidence rates could only be calculated for Costa Rica, Panama, and western Honduras. In addition, under-reporting is expected to be common in the CA-4 countries with sizeable rural populations: 1) Pathology services are often not available; 2) Patients often present with advanced disease, particularly older patients, and often receive minimal or palliative local care [28]. As noted, nearly three fourths of reported cases in Central America came from the Costa Rica, which only accounts for 11% of the region's population. We did not observe significant differences in gender, age, anatomical distribution, or histologic subtype between Costa Rica and the other nations. Lastly, regarding the U.S. SEER data, studies have shown that identification algorithms can misidentify Hispanic groups, especially U.S. born Hispanics [29]. Furthermore, information on birthplace on SEER has not been validated, and its accuracy as an indicator of migrant status remains unknown [30].

4.1 Conclusion

A significant burden of gastric adenocarcinoma is observed in Central America based upon the available registry data, and in spite of probable under-reporting for the LMICs in the areas. Differences are noted between Central America and U.S. Hispanics, although a younger population appears to be affected in both regions. As seen in similar studies, there was a high prevalence of non-cardia and intestinal type of cancer in Central America. Despite the lack of population-based data, our results are consistent with the observation of a decrease in the intestinal-type gastric cancer incidence after migration, which is potentially related to the decline in *H. pylori* infection rates and other environmental and dietary exposures. Strengthening population-based cancer registries is critical for improved cancer control in Central America, and which has implications for the growing U.S. Hispanic population.

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Abbreviations

CA-4	Central American four countries (Guatemala, Honduras, El Salvador and Nicaragua)
LMIC	low-middle income countries

PBCR	population-based cancer registry
HBCR	hospital-based cancer registry
IARC	International Agency for Research on Cancer
MOH	Ministry of Health
SEER	Surveillance and Epidemiology End Results Program

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Table 1

Descriptive epidemiology of gastric cancer in Central America.^a

	Guatemala	El Salvador	Honduras	Nicaragua	Costa Rica	Panama
Country population (in millions) ^b						
	14.8	6.2	7.8	5.9	4.7	3.6
Estimated immigrant population (in millions)						
	1.2	1.9	0.7	0.4	0.1	0.2
IARC estimated country incidence rate ^c						
Male	27.3	15.9	31.4	17.8	28.5	14.3
Female	25.9	13.6	22.3	11.4	15.6	9
Cancer registry summary						
Registry type (number)	Hospital based (1)	Hospital based (3)	Population based (1)	Hospital based (1)	National (IARC)	National (IARC)
Years included	1996–2010	1997–2010	2000–2009	2000–2010	1985–2005	2008–2009
Incident cases	1,709	1,900	670	232	14,539	691
Calculated incidence rate ^d						
Male	NA	NA	30.8	NA	31.9	10.9
Female			13.9		17.4	7.8
Gender n(%)						
Male	926 (54.2)	1096 (57.6)	439 (65.5)	131 (56.5)	9,360 (64.4)	417 (60.4)
Female	783 (45.8)	804 (42.4)	231 (34.5)	101 (43.5)	5,179 (35.6)	274 (39.6)
Age n(%)						
15–44	282 (16.5)	NA ^e	67 (10.0)	20 (8.6)	1,323 (9.1)	77 (11.1)
45–54	334 (19.5)		98 (14.6)	54 (23.3)	1,714 (11.8)	80 (11.6)
55–64	431 (25.2)		177 (26.4)	82 (35.4)	2,827 (19.4)	124 (17.9)
65	662 (38.7)		328 (49.0)	76 (32.7)	8,675 (59.7)	410 (59.3)
Setting n(%)						
Urban	817 (47.8)	148 (7.8)	0 (0)	NA	4,094 (28.2)	NA
Rural	890 (52.1)	51 (2.7)	670 (100)		9,935 (68.3)	
Unknown	2 (0.1)	1,701 (89.5)	0 (0)		510 (3.5)	

	Guatemala	El Salvador	Honduras	Nicaragua	Costa Rica	Panama
Anatomic site n(%)						
Cardia	171 (10.0)	52 (2.7)	67 (10.0)	65 (28.0)	1,002 (6.9)	24 (3.5)
Non-cardia	474 (27.7)	605 (31.8)	603 (90.0)	147 (63.4)	5,026 (34.6)	49 (7.1)
Corpus (and fundus) ^f	170 (9.9)	171 (9.0)	NA	120 (51.7)	1,269 (8.7)	15 (2.2)
Antrum ^g	304 (17.8)	434 (22.8)	NA	27 (11.6)	3,757 (25.8)	34 (4.9)
Overlapping lesion	295 (17.3)	0 (0)	0 (0)	13 (5.6)	647 (4.5)	1 (0.2)
Unspecified	769 (45.0)	1,243 (65.4)	0 (0)	7 (3.0)	7,864 (54.1)	617 (89.3)
Histology n(%)						
Intestinal	696 (40.7)	462 (24.3)	178 (26.6)	NA	2,864 (19.7)	NA
Diffuse	290 (16.9)	195 (10.3)	296 (44.2)		1,549 (10.6)	
Other or unspecified	723 (42.3)	1,243 (65.4)	196 (29.2)		10,126 (69.6)	

^aThis study focused on Spanish speaking countries, Belize was not included in our sample.

^bPopulation for 2011, The World Bank [21].

^cRates are age-standardized per 100,000 persons-years for 2008. International Agency for Research on Cancer [6].

^dLast available incidence rate, per 100,000 person-years. In Honduras and Costa Rica rates are age-adjusted using world standard population, in Panama crude rates are shown.

^eIn El Salvador: 15 cases (0.8 %) were less than 30 years, 484 (25.5%) were 30 to 50 years and 1,401 (73.7%) were 50 years or older.

^fCorpus includes fundus, lesser curvature and greater curvature.

^gAntrum includes pylorus.

IARC: Member of the International Agency for Research on Cancer, NA: Data not available or could not be calculated with available information.

Table 2

Comparative epidemiology of gastric cancer in Central America and U.S. Hispanics.

	Central America ^a			United States ^b		
	CA-4	Costa Rica	Central America	Hispanics born in Central America	Hispanics born in Mexico	Hispanics born in United States
Population (in millions) ^c						
	34.7	4.7	43.0	2.4	11.6	27.4
Cancer registry summary						
Registry type (number)	Hospital based (6)	National (IARC)	variable	Population based (SEER 18)	Population based (SEER 18)	Population based (SEER 18)
Years included	variable	1985–2005	variable	1985–2009	1985–2009	1985–2009
Incident cases	4,511	14,539	19,741	1,210	3,066	3,595
Calculated incidence rate^d						
Male	NA	31.9	NA	14.8	14.8	14.8
Female		17.4		8.2	8.2	8.2
Gender n(%)						
Male	2,592 (57.5)	9,360 (64.4)	12,369 (62.7)	609 (50.3)	1,773 (57.8)	2,168 (60.3)
Female	1,919 (42.5)	5,179 (35.6)	7,372 (37.4)	601 (49.7)	1,293 (42.2)	1,427 (39.7)
Age n(%)						
15–44	369 (8.2)	1,323 (9.1)	1,769 (9.0)	225 (18.6)	563 (18.4)	317 (8.8)
45–54	486 (10.8)	1,714 (11.8)	2,280 (11.5)	236 (19.5)	536 (17.5)	394 (10.9)
55–64	690 (15.3)	2,827 (19.4)	3,641 (18.4)	241 (19.9)	593 (19.4)	639 (17.8)
65	1,066 (23.6)	8,675 (59.7)	10,151 (51.4)	508 (42.0)	1,374 (44.8)	2,245 (62.5)
Unknown	1,900 (42.2)	0 (0)	1,900 (9.6)	0 (0)	0 (0)	0 (0)
Setting n(%)						
Urban	965 (21.4)	4,094 (28.2)	5,059 (25.6)	1,205 (99.6)	3,004 (98.0)	3,090 (85.9)
Rural	1,611 (35.7)	9,935 (68.3)	11,546 (58.5)	5 (0.4)	61 (1.9)	505 (14.1)
Unknown	1,935 (42.9)	510 (3.5)	3,136 (15.9)	0 (0)	1 (0.1)	0 (0)
Anatomic site n(%)						
Cardia	355 (7.9)	1,002 (6.9)	1,381 (7.0)	118 (9.7)	366 (11.9)	604 (16.8)
Non-cardia	1,829 (40.5)	5,026 (34.6)	6,904 (34.9)	746 (61.7)	1,727 (56.3)	1,940 (54.0)

	Central America ^a			United States ^b		
	CA-4	Costa Rica	Central America	Hispanics born in Mexico	Hispanics born in Central America	Hispanics born in United States
Corpus (and fundus) ^e	NA	1,269 (8.7)	NA	934 (30.5)	359 (29.7)	1,090 (30.3)
Antrum ^f	NA	3,757 (25.8)	NA	793 (25.9)	387 (31.9)	850 (23.6)
Overlapping lesion	308 (6.8)	647 (4.5)	956 (4.8)	384 (12.5)	133 (11.0)	388 (10.8)
Unspecified	2,019 (44.8)	7,864 (54.1)	10,500 (53.2)	589 (19.2)	213 (17.6)	663 (18.4)
Histology n(%)						
Intestinal	1,336 (29.6)	2,864 (19.7)	4,200 (21.3)	419 (13.7)	211 (17.4)	371 (10.3)
Diffuse	781 (17.3)	1,549 (10.6)	2,330 (11.8)	1,028 (33.5)	412 (34.1)	844 (23.5)
Other or unspecified	2,394 (53.1)	10,126 (69.6)	13,211 (66.9)	1,619 (52.8)	587 (48.5)	2,380 (66.2)

^aCentral America includes all countries from the CA-4 (Guatemala, Honduras, El Salvador and Nicaragua), Costa Rica and Panama. Data from Panama is not shown but is included in the third column.

^bIncludes Hispanics according to the NAACCR Hispanic Identification Algorithm. United States born Hispanics includes only those born in continental United States.

^cPopulation for 2011, The World Bank [21].

^dIn Costa Rica rates are age-adjusted using world standard population, in United States rates are age-adjusted using the 2000 U.S. standard population. United States rates are calculated for all Hispanic population, regardless of place of birth.

^eCorpus includes fundus, lesser curvature and greater curvature.

^fAntrum includes pylorus.

IARC: Member of the International Agency or Research on Cancer, NA: Data not available or could not be calculated with available information, SEER: Surveillance and Epidemiology End Results Program (SEER) 18 dataset.

Table 3

Comparative epidemiology of gastric cancer in Central America and U.S. Hispanics.

	Central America	United States Hispanics
Population (in millions) ^c		
	43.0	4.7
Cancer registry summary		
Registry type (number)	variable	National (IARC)
Years included	variable	1985–2005
Incident cases	19,741	7,871
Calculated incidence rate^d		
Male	NA	14.8
Female	NA	8.2
Gender n(%)		
Male	12,369 (62.7)	4,550 (57.8)
Female	7,372 (37.3)	3,321 (42.2)
Age n(%)		
15–44	1,769 (8.9)	1,105 (14.1)
45–54	2,280 (11.5)	1,166 (14.8)
55–64	3,641 (18.4)	1,473 (18.7)
65	10,151 (51.4)	4,127 (52.4)
Unknown	1,900 (9.6)	0 (0)
Setting n(%)		
Urban	5,059 (25.6)	7,299 (92.7)
Rural	11,546 (58.5)	571 (7.2)
Unknown	3,136 (15.9)	1 (0.1)
Anatomic site n(%)		
Cardia	1,381 (7.0)	1,088 (13.8)
Non-cardia	6,904 (35.0)	4,413 (56.1)
Overlapping lesion	956 (4.8)	905 (11.5)
Unspecified	10,500 (53.2)	1,465 (18.6)
Histology n(%)		
Intestinal	4,200 (21.3)	1,001 (12.7)
Diffuse	2,330 (11.8)	2,284 (29.0)
Other or unspecified	13,211 (66.9)	4,586 (58.3)