Gastric Cancer (2012) 15:405–413
DOI 10.1007/s10120-011-0127-0

ORIGINAL ARTICLE

Descriptive epidemiology of gastric adenocarcinoma in the State of Texas by ethnicity: Hispanic versus White non-Hispanic

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Received: 13 October 2011 / Accepted: 3 December 2011 / Published online: 18 January 2012
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Abstract
Background We aimed to evaluate the clinicopathological and demographic characteristics of gastric adenocarcinoma in Hispanics and compare these trends with those found in non-Hispanic Whites in Texas.
Methods Records of patients with gastric adenocarcinoma found in the Texas Cancer Registry from 1995 to 2006 were reviewed. Four ethnic–geographic groups were formed: Hispanics residing in El Paso County (a county on the Texas–Mexico border), White non-Hispanics in El Paso County, Hispanics from the remaining counties of Texas combined, and White non-Hispanics from the remaining counties of Texas combined. Adjusted prevalence ratios (PRs) for the outcome of late stage at diagnosis were calculated.
Results Of 9949 patients, 561 patients were El Paso County residents, of whom 83% were Hispanics. Among the four ethnic–geographic groups, the age-adjusted incidence was the highest in Hispanics in El Paso County (15.5 cases/100000). Tumor pathobiology varied by ethnicity. White non-Hispanics were more likely than Hispanics to have a proximal tumor and less likely to have a poorly differentiated or undifferentiated tumor. In El Paso County, patients in each of the eight age groups under 75 years compared to patients aged $\geq$85 years were significantly more likely to be at late stage (adjusted PRs 1.44–1.71).
Conclusion The incidence of gastric adenocarcinoma is higher in Hispanics than in Whites in both El Paso County and the remaining portion of Texas. Hispanics have a higher grade of gastric adenocarcinoma. The prevalence of late stage at the time of diagnosis is higher in younger patients than in older patients.

Keywords Gastric adenocarcinoma · Hispanics · White non-Hispanics · Late stage

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Introduction

Cancer incidence and mortality vary by race and ethnicity. These racial and ethnic differences are of major concern to both clinicians and epidemiologists. Hispanics are the largest and fastest growing minority in the United States. The Hispanic population in the United States is projected to double by 2030 [1]. Studying the ethnic variation in cancer incidence and mortality is a worthwhile endeavor as it may identify genetic or behavioral factors, which in turn may

lead to preventive measures, early diagnosis, and appropriate treatment. It has been noted that the incidence and mortality rates of four malignant neoplasms (cancer of the stomach, liver, uterine cervix, and gallbladder) are higher in Hispanics and that this excess risk is, in part, due to greater exposure to specific infectious agents, dietary patterns, and possibly genetic factors [2, 3].

Gastric cancer is the 14th most common cancer and the 8th leading cause of cancer death in the United States [4]. Despite its decline in incidence in Western Europe and the United States [5], gastric cancer continues to have a negative impact on public health, and the incidence rates of proximal gastric cancer and gastroesophageal junction cancer are increasing [6–9]. Hispanics tend to be younger at the time of diagnosis of gastric cancer than non-Hispanic Whites or African-Americans [10]. Hispanic ethnicity has also been associated with a shift in gastric cancer localization and histology: distal tumors are more common than proximal tumors [11], and mucinous/signet ring pathology is more common in Hispanics [10]. Infection with *Helicobacter pylori* is more prevalent in Hispanic populations [12–14] and is associated with the development of gastric adenocarcinoma.

Although there have been studies of the prevalence and demographic patterns of gastric cancer among various ethnic/racial groups, the majority of these have focused on Asian patients and, hence, there is a paucity of information in Western ethnicities, especially the Hispanics. The population of El Paso County, Texas, in 2008 was estimated at 731496, of whom 81.4% were Hispanic or Latino [15]. The objective of this study was to elucidate the descriptive epidemiology of gastric adenocarcinoma in Texas Hispanics and White non-Hispanics after stratifying by county (El Paso County vs. the remaining Texas counties), using the Texas Cancer Registry.

Subjects, materials, and methods

The Institutional Review Board for the Protection of Human Subjects at Texas Tech University Health Sciences Center, El Paso, deemed this protocol exempt from formal review.

Source population and inclusion criteria

The source of the data for this epidemiologic analysis was the 1995–2006 Texas Cancer Incidence file from the Texas Department of State Health Services (Austin, TX, USA). This electronic dataset contained 15 demographic and clinicopathological variables for patients with gastric adenocarcinoma who had been reported to the Texas Cancer Registry. The primary site and histology of each case in the database had been coded using topography and morphology codes, respectively, found in the International Classification of Diseases for Oncology, Third Edition (ICD-O-3) [16].

Cases were included if they were 15 years of age or older and their four-digit topography code began with C16, stomach, and their ICD-O-3 morphology code was 8140/3 (adenocarcinoma not otherwise specified), 8143/3 (superficial spreading adenocarcinoma), 8144/3 (adenocarcinoma, intestinal type), 8145/3 (adenocarcinoma, diffuse type), 8214/3 (parietal cell adenocarcinoma), 8310/3 (clear cell adenocarcinoma), 8480/3 (mucinous adenocarcinoma), 8481/3 (mucin-producing adenocarcinoma), or 8490/3 (signet ring cell adenocarcinoma). Because the focus of the study was to compare Hispanics of any race with White non-Hispanics, patients of other race/ethnic groups were excluded from our analyses.

Study design and statistical analysis

The first phase of the study was concerned with describing the clinicopathological and demographic features of the cases and calculating the incidence of gastric adenocarcinoma by Hispanic ethnicity and Texas region. Texas is divided into 254 counties. Cases who resided in El Paso County at the time of their diagnosis were compared to cases from the remaining 253 counties combined.

Ethnic differences in the detailed primary site and tumor grade were evaluated using the χ^2test. A result was considered statistically significant if the p value was 0.05 or less. Specifically, a binary (dichotomous) variable was created to identify patients with a proximal tumor, which was defined as adenocarcinoma of the gastroesophageal junction or the fundus of stomach. Five categories of tumor grade were coded in the registry: well differentiated (grade I), moderately differentiated (grade II), poorly differentiated (grade III), undifferentiated (grade IV), and grade not determined or stated. After excluding the latter group, a binary variable was created comparing patients whose tumor was either well or moderately differentiated with patients whose tumor was either poorly differentiated or undifferentiated.

Age-adjusted incidence rates of gastric adenocarcinoma were calculated by the Texas Cancer Registry (Texas Department of State Health Services). The 19 age groups of the 2000 United States Standard Population were used as the weights in these calculations.

In the second phase a cross-sectional prevalence study was conducted to examine the association between Hispanic ethnicity, patient sex, and age and the probability of being diagnosed at a late stage. The Texas Cancer Registry uses the following combined summary stage at diagnosis coding scheme: 0, in situ; 1, localized; 2, regional by direct extension; 3, regional to lymph nodes; 4, regional (direct extension and lymph nodes); 5, regional (not otherwise

specified); 7, distant metastasis/systemic disease; 9, unstaged, unknown, unspecified. Records with a value of 9 in their stage field were deleted for this portion of the analysis, and the following new binary outcome was created: Not diagnosed at late stage (values of 0 and 1), versus Late stage at diagnosis (2 or higher).

Binomial regression was performed using the SAS system, release 9.2 (SAS Institute, Cary, NC, USA) [17]. Binomial regression is similar to logistic regression; however, the former technique yields prevalence ratios (PRs) while the latter yields prevalence odds ratios when applied to cross-sectional data. A PR was considered to be statistically significant if $p \leq 0.05$.

Adjusted PRs for the outcome of a late stage at diagnosis were calculated from binomial regression models containing three independent variables: ethnicity (Hispanics compared to Whites), patient sex, and age at diagnosis (a categorical variable covering 11 age groups). These models were stratified by the patient's residence (El Paso County vs. rest of Texas). To determine whether the ethnicity, sex, and age PRs varied by the patient's residence, first-order interaction terms were created by multiplying the indicator variables used to define the three independent variables by a residence variable (El Paso County vs. rest of Texas). A likelihood ratio statistic was then calculated to determine whether there was a statistically significant ($p \leq 0.05$) interaction.

Finally, the prevalence of late stage was plotted against the age at diagnosis for the following three geographic–ethnic groups: El Paso County Hispanics, rest of Texas Hispanics, and rest of Texas White non-Hispanics. Due to the small number of White non-Hispanic cases who resided in El Paso County ($n = 88$) and the use of narrow age groups (nine of the 11 age groups were 5 years in width) we did not plot the prevalence rates for this group of patients (the resulting rates would have been erratic/unreliable).

Results

Patient demographics

Using Texas Cancer Registry data, 9949 patients with gastric adenocarcinoma were identified, of whom 561 were residents of El Paso County. The majority of the El Paso County cases were Hispanic (83%). In contrast, Hispanics comprised 37% of cases in the rest of Texas. The average age at the time of diagnosis was examined in four residence–ethnic groups and stratified by sex (Table 1). The lowest mean age was found in Hispanic men who were not residents of El Paso County (63.7 years), while the highest mean age was found in White women from El Paso County (72.9 years). Demographic and clinicopathological features are reported in Table 2.

Age-adjusted incidence rates for the period 1995 through 2006 are shown in Fig. 1. Of the four ethnic–geographic groups, El Paso County Hispanics experienced the highest risk (15.5 cases per 100000), followed by Hispanics from the rest of Texas (12.9 cases per 100000).

Proximal versus non-proximal location

After excluding 2457 patients with an unknown primary site recorded as stomach not otherwise specified (NOS), we found that proximal tumors, defined as adenocarcinoma of the gastroesophageal junction or the fundus of stomach, constituted 23% ($n = 77$) of the tumors in Hispanics and 52% ($n = 42$) of the tumors in Whites in El Paso County (p value for the difference in proportions <0.0001). Similarly, among the patients from the remaining counties of Texas combined, Whites were more than twice as likely as Hispanics to have a proximal tumor: 55% ($n = 2553$) in Whites versus 26% ($n = 633$) in Hispanics ($p < 0.0001$).

Histological grade of differentiation

Ethnic differences in tumor grade were explored. A total of 1468 patients were excluded from this portion of the analysis due to a lack of information on the grade (Table 2). In El Paso County, 79% ($n = 324$) of the Hispanic patients and 61% ($n = 51$) of the White patients had a tumor that was poorly differentiated (grade III) or undifferentiated (grade IV) ($p < 0.0002$). In the rest of Texas 74% of the Hispanics ($n = 2163$) and 68% ($n = 3451$) of Whites had poorly differentiated (grade III) or undifferentiated (grade IV) tumors ($p < 0.0001$).

Table 1 Mean age by sex, residence, and ethnicity of 9949 cases of gastric adenocarcinoma between 1995 and 2006

Residence–Ethnic Group	Male			Female		
	n	(%)	Mean age, years (SD)	*n*	(%)	Mean age, years (SD)
El Paso County, Hispanic	275	59	67.5 (13.2)	191	41	67.0 (15.4)
El Paso County, White	57	60	68.3 (13.6)	38	40	72.9 (13.7)
Rest of Texas, Hispanic	2053	60	63.7 (14.7)	1387	40	64.2 (15.8)
Rest of Texas, White	3925	66	67.6 (12.8)	2023	44	70.7 (13.9)

n is the total number of patients and % is the percentage in that group. *SD* standard deviation

Table 2 Demographic and clinical characteristics of 9949 gastric cancer patients in El Paso County and the rest of Texas between 1995 and 2006

Characteristics	El Paso Hispanic ($n = 466$), number (%)	El Paso White non-Hispanic ($n = 95$), number (%)	Rest of Texas Hispanic ($n = 3440$), number (%)	Rest of Texas White non-Hispanic ($n = 5948$), number (%)
Age (years)				
15–24	1 (0.2)	1 (1.0)	25 (0.7)	4 (0.6)
25–34	8 (1.7)	1 (1.0)	103 (3.0)	11 (1.5)
35–44	31 (6.7)	2 (2.1)	295 (8.6)	41 (5.7)
45–54	55 (11.8)	7 (7.37)	502 (14.6)	79 (11.1)
55–64	67 (14.4)	16 (16.8)	674 (19.6)	129 (18.1)
65–74	147 (31.6)	26 (27.4)	907 (26.3)	215 (18.1)
75–84	114 (24.5)	32 (33.7)	721 (21.0)	168 (23.5)
≥85	43 (9.2)	10 (10.53)	215 (6.3)	67 (9.4)
Detailed primary site				
Gastric NOS	132 (28.3)	14 (14.7)	973 (28.3)	1338 (22.5)
Gastroesophageal junction	64 (13.7)	37 (39)	473 (13.7)	2297 (38.6)
Fundus of stomach, gastric fundus	13 (2.8)	5 (5.3)	160 (4.6)	256 (4.3)
Body of stomach, gastric corpus	53 (11.4)	9 (9.5)	284 (8.3)	347 (5.8)
Anterior wall of stomach NOS, posterior wall of stomach NOS	48 (10.3)	4 (4.2)	275 (8)	309 (5.2)
Lesser curvature of stomach NOS	31 (6.6)	4 (4.2)	326 (9.5)	325 (5.5)
Greater curvature of stomach NOS	19 (4.0)	5 (5.3)	154 (4.5)	190 (3.2)
Pyloric canal, prepylorus	16 (3.4)	2 (2.1)	122 (3.5)	137 (2.3)
Gastric antrum, pyloric antrum	90 (19.3)	15 (15.8)	673 (19.5)	749 (12.6)
Histology				
Adenocarcinoma NOS	301 (64.6)	64 (67.4)	2204 (64.1)	4317 (72.6)
Signet ring cell adenocarcinoma	143 (30.7)	20 (21.1)	931 (27.1)	1210 (20.3)
Mucin-producing adenocarcinoma	10 (2.1)	6 (6.3)	69 (1.7)	89 (1.5)
Mucinous adenocarcinoma	6 (1.3)	3 (3.2)	57 (1.7)	110 (1.9)
Adenocarcinoma, intestinal type	3 (0.6)	1 (1.1)	125 (3.6)	166 (2.8)
Carcinoma/diffuse adenocarcinoma	3 (0.6)	0 (0.0)	57 (1.7)	51 (0.9)
Clear cell adenocarcinoma NOS	0 (0.0)	1 (1.1)	5 (0.2)	1 (0.1)
Superficial spreading adenocarcinoma	0 (0.0)	0 (0.0)	1 (0.1)	0 (0.0)
Stage				
Localized	106 (22.7)	24 (25.3)	608 (17.7)	1118 (18.8)
Regional by direct extension	55 (11.8)	10 (10.5)	334 (9.7)	544 (9.2)
Regional to lymph nodes	28 (6)	5 (5.3)	364 (10.6)	625 (10.5)
Regional (direct extension and lymph nodes)	73 (15.7)	14 (14.7)	627 (18.2)	788 (13.3)
Regional NOS	0 (0)	0 (0)	17 (0.5)	21 (0.4)
Distant metastasis	165 (35.4)	35 (36.8)	989 (28.7)	1862 (31.3)
Unstaged/unknown stage	39 (8.4)	7 (7.4)	501 (14.6)	990 (16.6)
Grade				
I: Well differentiated	12 (2.6)	5 (5.3)	85 (2.5)	183 (3.1)
II: Moderately differentiated	72 (15.5)	28 (29.5)	678 (19.7)	1429 (24.0)
III: Poorly differentiated	313 (67.2)	49 (51.6)	2094 (60.9)	3333 (56.0)
IV: Undifferentiated	11 (2.4)	2 (2.1)	69 (2.0)	118 (2.0)
Not determined or stated grade	58 (12.4)	11 (11.58)	514 (14.9)	885 (14.9)
Method of diagnostic confirmation				
Histology	460 (98.7)	93 (97.9)	3400 (98.8)	5840 (98.2)
Cytology	3 (0.6)	1 (1.1)	24 (0.7)	59 (1.0)

Table 2 continued

Characteristics	El Paso Hispanic ($n = 466$), number (%)	El Paso White non-Hispanic ($n = 95$), number (%)	Rest of Texas Hispanic ($n = 3440$), number (%)	Rest of Texas White non-Hispanic ($n = 5948$), number (%)
Microscopic confirmation NOS, not microscopically confirmed	0 (0.0)	0 (0.0)	2 (0.1)	2 (0.1)
Laboratory test/marker study	1 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)
Direct visualization	0 (0.0)	0 (0.0)	2 (0.1)	10 (0.2)
Radiography/imaging	1 (0.2)	0 (0.0)	5 (0.2)	12 (0.2)
Unknown	1 (0.2)	1 (1.1)	7 (0.2)	23 (0.4)

NOS not otherwise specified

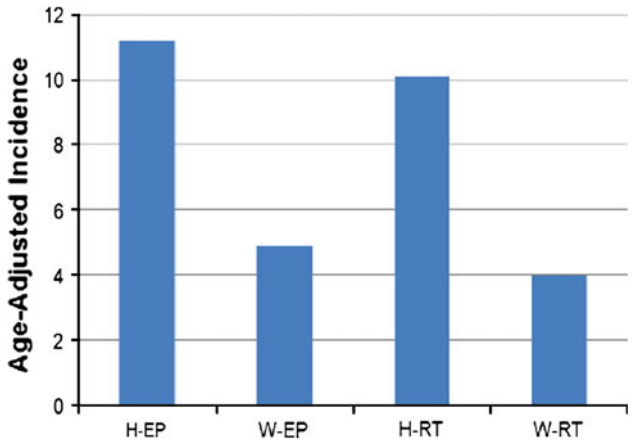

Fig. 1 Age-adjusted incidence rates of gastric adenocarcinoma per 100000 population by ethnicity and county/region of residence, Texas, for the period 1995–2006. *H-EP* Hispanics from El Paso County, *H-RT* Hispanics from the rest of Texas, *W-RT* White non-Hispanics from the rest of Texas, *W-EP* White non-Hispanics from El Paso County

Late stage at diagnosis

Of the 9949 cases, 1537 had an unknown or missing value for stage at diagnosis (Table 2). Late stage was defined as any stage other than in situ or localized stage. After excluding cases with an unknown stage, a prevalence of late stage of 78% was noted (6556/8412). Adjusted PRs for late stage at diagnosis are reported in Table 3. Ethnicity and sex were not associated with the outcome of late stage (Table 3); however, El Paso County patients in each of the eight age groups representing patients under 75 years were significantly more likely than patients aged ≥85 years to have a late stage at diagnosis (Table 3). For example, patients who were less than 40 years of age were 71% more likely than patients ≥85 years of age to be at late stage at the time of diagnosis ($p = 0.001$). Among the larger group of cases from the remaining portion of Texas, patients from each of the 10 younger age groups (<85 years) were more likely than the referent group (≥85 years) to have a late-stage tumor (Table 3).

The ethnicity, sex, and age PRs for residents of El Paso County reported in Table 3 are similar to their respective PRs for residents in the remaining Texas counties combined. This observation is supported by a formal test of interaction which found that the association between ethnicity and late stage, sex and late stage, and age and late stage did not vary by the county of residence ($p = 0.9995$).

The prevalence of late stage at diagnosis according to the patient's age group is shown in Fig. 2. Younger patients were more likely than older patients to be at late stage at the time of diagnosis. Due to the small number of White non-Hispanic cases from El Paso County ($n = 88$), prevalence estimates for this group are not shown.

Discussion

Evaluating the clinicopathological features of gastric adenocarcinoma in patients diagnosed in the state of Texas over a 12-year period we found significant diverse outcomes in different ethnicities by area of residence. Our study showed that the age-adjusted incidence rate was higher among Hispanics than White non-Hispanics both in El Paso County and in the rest of Texas between the years 1995 and 2006. This correlates with the results released by the American Cancer Society [18, 19]. The incidence of various diseases, and their outcomes, differs by race and ethnicity, as does access to screening and treatment [20]. Evaluation of these differences is important because it can help us differentiate biologic from environmental and socioeconomic risk factors. Knowing the biologic and molecular basis of gastric adenocarcinoma can guide the oncologist to a specific therapy based on the unique characteristics of a patient's tumor.

Dietary habits, including high intake of salt and pickled foods containing high levels of nitrates and low intake of

Table 3 Adjusted prevalence ratios (PRs) from binomial regression model for the outcome of late stage at diagnosis in 8412 cases in El Paso County and the rest of Texas diagnosed between 1995 and 2006

Possible risk factor	El Paso County ($n = 515$)			Remaining Texas counties combined ($n = 7897$)		
	Adjusted PR[a]	95% Confidence interval	p value	Adjusted PR[a]	95% Confidence interval	p value
Ethnicity						
Hispanic	1.00	0.87–1.15	0.99	0.99	0.97–1.02	0.61
White	1	Referent	–	1	Referent	–
Sex						
Male	0.99	0.89–1.09	0.79	0.99	0.97–1.01	0.48
Female	1	Referent	–	1	Referent	–
Age at diagnosis (years)						
<40	1.71	1.24–2.37	0.001	1.48	1.37–1.60	<0.0001
40–44	1.65	1.19–2.29	0.003	1.42	1.31–1.54	<0.0001
45–49	1.65	1.19–2.29	0.003	1.41	1.30–1.52	<0.0001
50–54	1.44	1.02–2.03	0.04	1.37	1.27–1.48	<0.0001
55–59	1.49	1.06–2.11	0.02	1.36	1.27–1.47	<0.0001
60–64	1.56	1.14–2.14	0.01	1.34	1.24–1.44	<0.0001
65–69	1.52	1.12–2.07	0.01	1.31	1.21–1.41	<0.0001
70–74	1.44	1.06–1.97	0.02	1.21	1.12–1.31	<0.0001
75–79	1.33	0.96–1.83	0.08	1.22	1.13–1.32	<0.0001
80–84	1.39	1.00–1.93	0.053	1.12	1.03–1.22	0.01
≥85	1	Referent	–	1	Referent	–

Of the 9949 cases described in Table 3 and the sample size available for the binomial regression, 1537 cases had an unknown stage at diagnosis

[a] Each PR is adjusted for the remaining variables shown in the Table

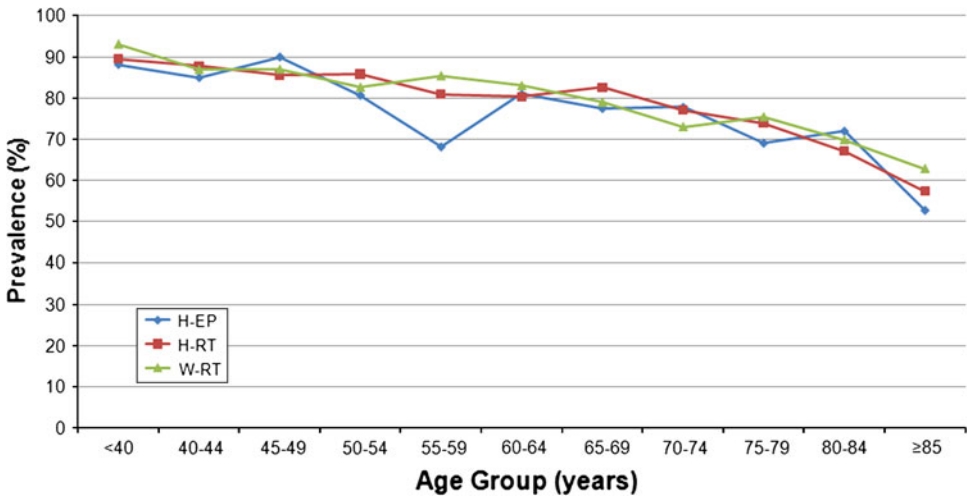

Fig. 2 Prevalence of late stage at diagnosis by age group for Hispanics from El Paso County (*H-EP*), Hispanics from the rest of Texas (*H-RT*), and White non-Hispanics from the rest of Texas (*W-RT*)

vegetables and fruits, and also tobacco smoking and obesity, are among the known risk factors for gastric cancer [21–25]. The infection rate with *H. pylori* in Hispanics is two to three times that of Whites in the United States [26], and because chronic infection with this bacterium, which is transmitted through the oral–oral or fecal–oral route, is one of the strongest risk factors for stomach cancer [27–30], we can postulate that one of the reasons that Hispanics are more prone to develop gastric adenocarcinoma is the higher rate of infection with *H. pylori*.

Among Hispanics, and also among Whites, gastric adenocarcinoma was more common in El Paso County than in the rest of Texas. These geographical differences might be due to a higher *H. pylori* infection rate in El Paso County or differences in dietary habits which need to be investigated. Refrigeration can reduce the bacterial burden of food, thereby lessening the production of nitrates and nitrites, which in turn may reduce the incidence of gastric cancer. Refrigeration can also lead to decreased usage of smoked, cured, and salted foods. Galanis et al. [31] noted

the correlation between increased consumption of fresh fruits and a lower rate of gastric cancer. Also Mills et al. [32] reported an association between agricultural exposures and gastric cancer in Hispanic farmers in California, a hypothesis which can be tested in El Paso County Hispanic farmers in the future.

Similar to several other studies, we observed a higher incidence of proximal gastric adenocarcinoma in Whites compared to Hispanics, with an excess risk of 29% in both El Paso County and the rest of Texas [10, 33]. Wu and colleagues [34] found a higher incidence of cardia adenocarcinoma in male White non-Hispanics compared to male Hispanics, but among females the relationship was reversed, with a higher incidence in Hispanics. Yao et al. [11] observed the same results for the proximal cancer localization among male patients, but they reported for females that there was not a statistically significant difference among the various ethnic-racial groups. One of the most striking epidemiologic observations has been the increasing incidence of proximal stomach cancer in the past few decades [6, 35–37]. Patients with proximal gastric cancer have a poorer prognosis than those with non-proximal tumors [38, 39] and hence it is important to clarify its association with different ethnicities. In our study the excess risk of a having a proximal tumor in Whites in both regions (El Paso County and the rest of Texas) may be secondary to genetic, lifestyle, or dietary differences in these residence areas.

We found that Hispanic gastric adenocarcinoma patients were more likely than the White patients to have a high-grade tumor at the time of diagnosis. This result agrees with the findings of Al-Refaie et al. [33], who conducted a regional-based study in the United States, which included material from the M.D. Anderson Cancer Center in 2007. Because gastric adenocarcinoma with a grade of III or IV predicts a poorer prognosis than a tumor with a grade of I or II, further investigations of the possible link between ethnicity–race and histological presentation of this cancer are warranted.

A limitation of our study is the inability to verify the race and ethnicity of the cases. However, tumor registrars in Texas are issued detailed instructions on the coding of race and ethnicity [40]. For example, the Cancer Reporting Handbook issued by the Texas Cancer Registry informs registrars that: "Race is defined by specific physical, hereditary and cultural traditions or origins, not necessarily by birthplace, place of residence, or citizenship" [40]. The Handbook further instructs registrars that a Spanish name alone may not be used to determine the race code.

Another limitation is the unavailability of a TNM staging variable in the electronic dataset. Our analyses used a combined summary stage variable. According to the Texas Cancer Registry Cancer Reporting Handbook, the Collaborative Staging (CS) Task Force was created in 1998 to address discrepancies among the major staging systems, including TNM [41]. The Texas Cancer Registry collects the CS data items needed to derive the Surveillance Epidemiology and End Results (SEER) summary stage.

However, our study has several strengths. It explored the descriptive epidemiology of a malignancy of public health importance in a large county on the Texas–Mexico border rather than report on the experience of a single institution. It is also the first to report that the prevalence of late stage was higher in younger patients than in older patients in both of the Texas residence areas examined. The lack of defined risk factors and specific symptoms and the relatively low incidence in Western countries have no doubt contributed to the high proportion of gastric cancers which present with a late stage at diagnosis [42]. Our late stage at diagnosis results are in agreement with the findings of a recent Japanese study which found a higher rate of advanced-stage gastric cancer in patients less than 34 years of age compared to those 34 years of age or older [43]. Nonetheless, other studies, including the study by Koea et al. at Memorial Sloan-Kettering Cancer Center, did not show any significant difference in the stage of young patients at the time of diagnosis when compared to middle-aged or older patients [44–49].

Our novel finding on the presentation of gastric cancer opens the door for investigators to further examine the association between specific age groups and the stage of gastric cancer at the time of diagnosis in larger populations and to determine whether this relationship is modified by race and ethnicity. We found that younger patients were more likely to present with advanced disease than older patients. This information is of value to clinicians and justifies the need for physicians to elicit a detailed history from young patients along with a close evaluation of their signs and symptoms.

Though many risk factors have been evaluated in regard to the risk of developing gastric adenocarcinoma, it is still not clear which factors, genetic or otherwise, contribute to the different presentations of this disease. More research needs be conducted to assess these associations, with a focus on different ethnic groups, including Hispanics, in various locations. The results gleaned from these investigations can lead to better cancer control and even prevention.

Acknowledgments The authors thank David R. Risser, PhD, MPH, Epidemiologist, with the Texas Cancer Registry, Texas Department of State Health Services, Austin, for calculating age-adjusted incidence rates. We are also grateful for the technical feedback from Mark L. Francis, MD, and the editorial assistance of Parand Mansouri Rad, MSIE. The departments of Internal Medicine, Pathology, and Obstetrics and Gynecology at TTUHSC, El Paso, Texas supported us through funding, time, and scientific resources to perform and complete our research.There was no grant for this study from any source including the NIH.

Conflict of interest No financial disclosure or conflict of interest exists between our authors and any company or organization.

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