Comparison of the prevalences of gastric and colorectal cancer at two endoscopy units in different socioeconomic strata

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Abstract

Introduction: Based on the differences in incidence and mortality rates of gastric cancer (GC) and colorectal cancer (CRC) in the world, in the same country, and in the same cities, we compared the prevalence of these tumors into two endoscopy units serving different types of populations. **Materials and methods:** We conducted an analytical study of prevalence among patients over the age of 18 who had undergone upper endoscopy and colonoscopy between December 2006 and January 2011. All had been diagnosed with cancer through endoscopy and diagnoses of gastric or colorectal adenocarcinomas and sporadic tumors had been histologically confirmed. **Results:** Of 38,118 endoscopic procedures performed, 483 cases met the selection criteria. We found five times more occurrences of gastric cancer in the Hospital El Tunal than in the Clinica Fundadores (2.41% vs 0.47% (p <0.001). In contrast, we found 2.5 times more occurrences colorectal cancer at the Clinica Fundadores than we did at the Hospital El Tunal (1.02% vs 2.47% (p <0.001). Bivariate and multivariate analysis found statistically significant associations with the higher presence of GC in Strata 1 and 2 (59.7%) and CRC in strata 3 to 6 (79%) (*By law Colombia is divided into 6 strata according to income per capita. Stratum one has the lowest per capita income, and Stratum 6 has the highest)*. **Conclusions:** The prevalence of GC is five times higher in low income groups than in higher income economic groups while CCR prevalence is 2.5 times higher in the upper strata.

Keywords

Gastric cancer, colorectal cancer, prevalence, socioeconomic.

INTRODUCTION

Gastric cancer (GC) and colorectal cancer (CRC) are important diseases locally and globally because of their extensive impacts on incidence and mortality rates. This has generated interest among researchers in developing a deeper more detailed understanding of these diseases. Globally, gastric cancer is the fourth most common cancer and the second leading cause of death by cancer (1). It accounts for 10% of all deaths caused by cancer (2) and in Japan it is the leading cause of death by cancer (3). In Colombia it continues to be the leading cause of death from cancer among men and the third leading cause among women (4). In some regions of Colombia the incidence is about 10 times higher than in the United States (5). Globally, there are marked differences in GC rates with the highest incidence rates found in Eastern countries, Europe and the Andean regions of South America while the lowest rates occur in countries in North America and Oceania where its incidence has been dropping (5-7). This variability has been explained by the prevalence of Helicobacter pylori (H. pylori) infections and the virulent behavior of some of its genotypes (7). Although gastric cancer continues to be the leading cause of death from cancer among men and the third among women in Colombia (8), there is no consensus on its incidence and prevalence. These rates are higher

in the high mountain areas and lower in the eastern plains, coastal areas and watersheds of major rivers (9). There is no known reason for this disparity but some studies have documented low prevalences of the helminth infection in some areas. Helminths induce a strong Th2 response which modulates or decreases the inflammatory effect of the Th1 response that is triggered by H. pylori (9-12).

Over 90% of GCs are adenocarcinomas while the rest are less common tumors such as lymphomas, gastrointestinal stromal tumors (GIST) and carcinoid tumors (13). The main etiologic agent of distal GC, non-cardial lymphomas and MALT lymphomas is H. pylori. It is a necessary, but insufficient, condition as only 1% to 3% of those infected with H. pylori develop GC. This highlights the importance of individual genetic factors and environmental factors (14). Histologically H. pylori infections are classified into two types, intestinal and diffuse (15) which have clear differences from the epidemiological, histopathologic, endoscopic, clinical and pathogenic points of view (16). The intestinal type is a multifactorial disease that develops through a multistep process which is dependent on H. pylori, diet, genetic factors and socioeconomic stratum (17). Lower socioeconomic strata as measured by educational or income levels are associated with doubled risks (17). Since this association does not seem to be related to risk areas (18). it has been proposed that other related conditions such as overcrowding and limited use of antibiotics account for increased H. pylori transmission and reinfection. The risk of developing GC in countries with high socioeconomic levels is probably explained by the low prevalence of virulent strains of H. pylori (19). Currently there are no local statistics about the prevalence of GC in different socioeconomic strata.

CRC is a common and lethal entity. Globally, it is the third most common cancer diagnosed in men and the second in women with more than 1,200,000 new cases and 608,700 deaths in 2008 (20). It is the third leading cause of death by cancer in the world (21). According to Globoscan, 60% of these deaths occur in developed countries. There is wide variation in incidence rates: they are higher in the United States, Australia, and New Zealand and lowest in Africa, Central and South Asia (22). These differences are attributed to dietary factors, environmental exposures and genetic factors (23). In the United States, although there has been a slow and steady decline of 2% to 3% in the annual incidence and mortality rate over the last 15 years (24), CRC continues to be the second leading cause of death by cancer with 52,000 deaths annually accounting for 9% of all cancer deaths (25). Probably screening programs have influenced declining incidence and mortality rate of this tumor (26). In contrast, incidence rates have been increasing gradually in Spain and countries in Asia and Eastern Europe that historically have had low risks (24-26). In Colombia CRC is the fourth leading cause of death by cancer among both genders but occurs more frequently among men than among women. It rarely occurs before the age of 40 years (27). Sporadic CRC is multifactorial: genetic factors, age, gender, obesity and inflammatory bowel disease are among the factors that participate (28, 29). Some observational studies have found a higher prevalence of this tumor, although controversy still exists (30).

Traditionally it has been assumed that GC is the most common malignant tumor in Colombia, but unmeasured observations in several parts of the country indicate that there may be variability of the prevalences of both GC and CRC within the same country and even within the same cities. Taking into account appreciations from daily practice and the lack of studies on this subject, we decided to conduct this study on the prevalence of these two tumors based on socioeconomic strata. To achieve adequate selection two institutions whose patient populations are socioeconomically different were chosen. The main objective of this study was to determine and compare the prevalence of GC and CRC in two endoscopy units with different types of patient populations. Secondary objectives were to describe social and demographic variables of patients enrolled to determine the differences between anatomic location of tumors, to describe indications for procedures for patients with these tumors, and to establish statistically significant associations between the variables included in the study.

MATERIALS AND METHODS

This is an analytical study which compares the prevalence of histologically proven CRC and GC in two endoscopy units serving different socioeconomic populations. The study population consisted of all patients older than 18 years who underwent upper endoscopies or total colonoscopies in the endoscopy services of the participating institutions between January 2006 and December 2011 and who were diagnosed endoscopically and histologically with sporadic CRC or GC (Patients had no history of neoplastic syndromes inherited from families). The institutions participating in this study were the Hospital El Tunal, whose population consists primarily of patients from strata 1 and 2 with occasional patients from stratum 3, and the Clínica Fundadores whose population consists primarily of patients from strata 3, 4 and 5 with occasional patients from stratum 6. Many of the patients of the Clínica Fundadores are public employees and officials with higher levels of schooling (The majority are professional teachers).

The GCs found were classified endoscopically according to the Japanese classification and according to the

Borrmann classification for advanced GC (31). CRCs were classified according to the classification of Paris (32).

Exclusion criteria

Procedures were excluded for the following reasons:

1. Procedures to track previous disease (to avoid duplication of patients).
2. Patients with relapsed GC and/or CRC
3. Patients with extra institutional diagnosis of GC and/or CRC
4. Patients with a history of gastric or colonic surgical resection
5. Patients with familial syndromes of hereditary diffuse CRC or GC.
6. CRC patients with a history of inflammatory bowel disease which is considered a risk factor for this type of tumor (33)

Collection of Information

Information was obtained by reviewing endoscopic reports, pathology reports and the histories of patients who met the inclusion criteria. The information obtained was entered on a data collection form. Endoscopic procedures were performed by clinical gastroenterologists who are experts in high and low digestive endoscopies and who have more than 15 years of experience working as specialists and university professors (WO and MG). Olympus 145 and Exera II videoendoscopes were used with the usual techniques described for each test (34, 35). Data collection forms were not seen by the endoscopists. The information obtained from endoscopy and pathology reports was independently verified with medical records to monitor registry errors.

Statistical Analysis

Qualitative variables were expressed as percentages. Numerical variables were expressed as averages with standard deviations. Their minimum and maximum values were noted. The prevalences of GC and CRC were established for different socioeconomic strata and were then compared. An initial bivariate analysis between groups of variables and the occurrence of cancer was performed. Statistical significance was tested with Fisher's exact test and the chi-square test. The level of statistical significance was established at (p) less than 0.05. 95% confidence intervals (CI) and Odds Ratios were established. Gastric cancer was taken to be a dependent variable. Analysis of its behavior was performed with the Kolmogorov-Smirnov test, but for behaviors other than normal, nonparametric statistical tests such as Fisher's exact test were used. The analysis concluded with the completion of a logistic regression model in which all variables were included regardless of statistical significance in order to reduce colinearity and to control confusing variables.

Ethical considerations

In accordance with Resolution 008430 of 1993, this study included no interventions that might endanger a patient's life. Data were collected through reviews of medical records and endoscopic reports. Therefore the research is classified as without risk and without any requirement of informed consent from patients. These conditions were presented to the medical ethics committee of the institutions which both authorized the study.

RESULTS

During the period between January 2006 and December 2011, a total of 28,406 upper digestive tract endoscopies and 9,712 colonoscopies were conducted in the two endoscopy units. 8,664 endoscopies and 4,886 colonoscopies were performed in the Hospital El Tunal (Institution 1) and 19,742 endoscopies and 5,126 colonoscopies were performed in the Clínica Fundadores (Institution 2). In total, 483 cancers were found: 303 were gastric (62.9%) and 179 (37.1%) were colorectal. The distribution of patients and cancers by institution is shown in Figure 1. 68.9% (n = 209) of GC was found in the Hospital El Tunal, and 31.1% (n = 94) of GC was found in the Clínica Fundadores, $p < 0.05$. Findings of CRC were diametrically opposed to those for GC: 26.2% (n = 47) of these cases were at the Hospital El Tunal while 73.7% (n = 132) were at the Clínica Fundadores with statistically significant differences ($P < 0.05$). The distribution of endoscopic procedures and the prevalences of GC and CRC by institution are shown in Figure 2. GC was more frequent among men (58.7%) and CRC was more frequent among (53.7%) ($p < 0.01$).

The average ages of patients with GC were similar in both institutions: 52.2 years ± 12.3 years (Range: 28 to 95 years) in the Hospital El Tunal and 55.7 ± 16 years (Range: 26 to 99 years) in the Clínica Fundadores. The average ages of patients with CRC were also similar in both institutions: 57.6 years ± 14.3 years (Range: 21 to 96 years) in the Hospital El Tunal and 58.1 ± 11.2 years (Range: 38 to 94 years) in the Clínica Fundadores (Figure 3). Figure 4 shows the symmetrical distribution of age for both genders. Figure 5 also shows a symmetrical distribution for age distribution for both types of cancer, although there is a small deviation to the right in the CRC data which probably indicates a higher concentration among patients over 66 years old than is indicated by the 50th percentile or median age of the group. The univariate analysis of socioeconomic strata

shows that the main socioeconomic strata with GC were 1 and 2 which accounted for 59.7% of cases (n = 181). This was followed by strata 3 and 4 (25%) and finally by strata 5 and 6 (14%). The primary strata involved with CRC were 3 and 4 (49.2%, n = 88) followed by strata 5 and 6 (29%) and finally by strata 1 and 2 (21%) (See Table 1). Logistic regression was found that the association of strata 1 and 2 with GC had an OR of GC of 5.7 (95% CI: 3.3 to 9.7) (Table 2) and that the association of GC with male gender had an OR of 1.5 ((95% CI: 1.07 to 2.38) (p <0.05). The risk of CRC in strata 3, 4, 5 and 6 increased 2.5 times (95% CI: 1.7 - 4.0) that of strata 1 and 2 (Table 3 and 4).

Table 1. Type of cancer according to socioeconomic strata

Type of Cancer	Colon		Gastric	
	n	%	n	%
Strata 1-2	38	21.20%	181	59.70%
Strata 3-4	88	49.20%	78	25.70%
Strata 5-6	53	29.60%	44	14.50%

Table 2. Bivariate analysis of gastric cancer.

	Yes		No		P	OR	IC 95%	
	n	%	N	%			Min.	Max.
Gender								
Male	178	68,20%	83	31,80%	0,011	1,647	1,135	2,390
Female	125	56,60%	96	43,40%				
Institution								
Hospital El Tunal	209	81,60%	47	18,40%	0,000	6,244	4,134	9,432
Clínica Fundadores	94	41,60%	132	58,40%				
Strata								
Strata 1 and 2	181	82,60%	38	17,40%	0,000	5,505	3,597	8,425
Other strata	122	46,40%	141	53,60%				
Strata								
Strata 3 and 4	78	47,00%	88	53,00%	0,000	0,358	0,243	0,530
Other strata	225	71,20%	91	28,80%				
Strata								
Strata 5 and 6	44	45,40%	53	54,60%	0,000	0,404	0,257	0,635
Other strata	259	67,30%	126	32,70%				

The most common indications during procedures were digestive tract bleeding (64%) and anemia (18%) for men and abdominal pain for women (Figures 5 and 6). GCs were most often located in the corpuses of male patients followed, and less often in the antrum. This relation was the reverse among women. Locations of CRCs were similar in both genders (Figure 7). They were most frequently found in the rectum, next most frequently in the sigmoid colon, then in the descending colon, less often in the ascending colon and the cecum, and least often (in both sexes) in the transverse colon.

Table 3. Bivariate analysis of colorectal cancer.

	Yes		No		P	OR	95% CI	
	n	%	N	%			Min.	Max.
Gender								
Male	83	31,80%	178	68,20%	0,011	0,607	0,418	0,881
Female	96	43,40%	125	56,60%				
Institution								
Hospital El Tunal	47	18,40%	209	81,60%	0,000	0,160	0,106	0,242
Clínica Fundadores	132	58,40%	94	41,60%				
Strata								
Strata 1 and 2	38	17,40%	181	82,60%	0,000	0,182	0,119	0,278
Other strata	141	53,60%	122	46,40%				
Strata								
Strata 3 and 4	88	53,00%	78	47,00%	0,000	2,790	1,888	4,121
Other strata	91	28,80%	225	71,20%				
Strata								
Strata 5 and 6	53	54,60%	44	45,40%	0,000	2,476	1,574	3,894
Other strata	126	32,70%	259	67,30%				

Table 4. Logistic regression for gastric and colorectal cancer.

	P.	95% IC	
		Min.	Max.
Male gender GC	1,599	1,07	2,388
Strata 1 and 2 GC	5,709	3,338	9,764
Strata 3, 4, 5 and 6 CRC	2,633	1,73 1	4, 007

DISCUSSION

This investigation found that the prevalence of gastric cancers in the Hospital El Tunal was more than five times that found in the Clínica Fundadores. From 8,664 endoscopies, 209 cases of GC (2.4%) were found at Hospital El Tunal. In contrast, 19,742 upper endoscopies performed at Clínica Fundadores, there were only 94 cases of GC (0.47%), p <0.001. This result is so dissimilar that our hypothesis was that it could be attributable to differences in the populations related to age, more specifically to the

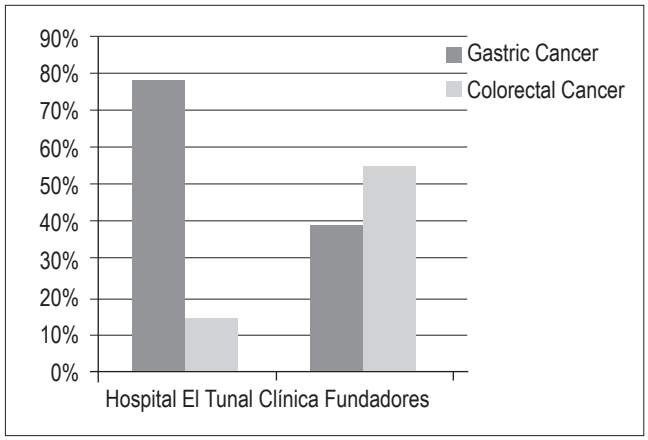

Figure 1. Distribution of cases GC and CRC cases by institutions.

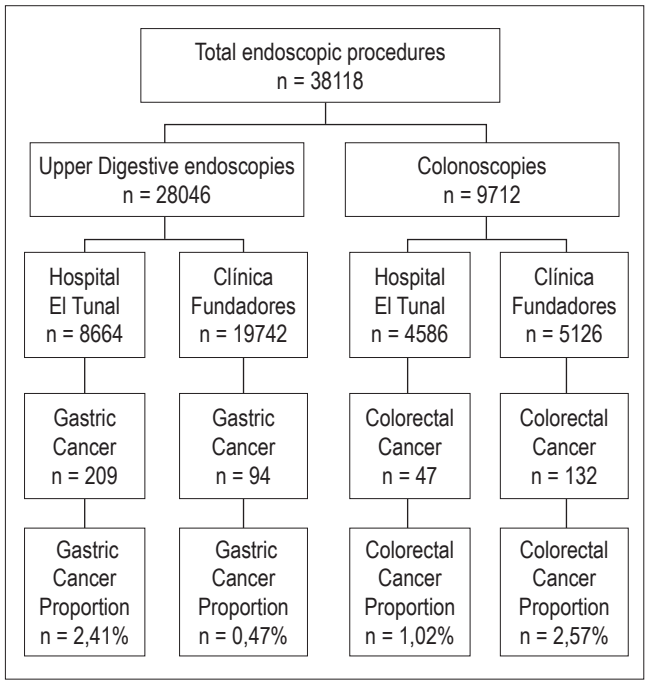

Figure 2. Distribution of endoscopic procedures and cancer by institution.

fact that patients at the institution with the highest prevalence rate came in for consultations very belatedly which resulted in the discovery of a larger number of tumors. Nevertheless, the average age at consultation was very similar and was even slightly higher at the Clínica Fundadores. That hospital's average patient age in this study was 55.7 ± 16 years (Range: 26 to 99 years) while the average age at the Hospital El Tunal was 52.2 ± 12.3 years (Range: 28 to 95 years). The average ages of the entire populations of patients who had undergone endoscopy at each institutions were also similar:

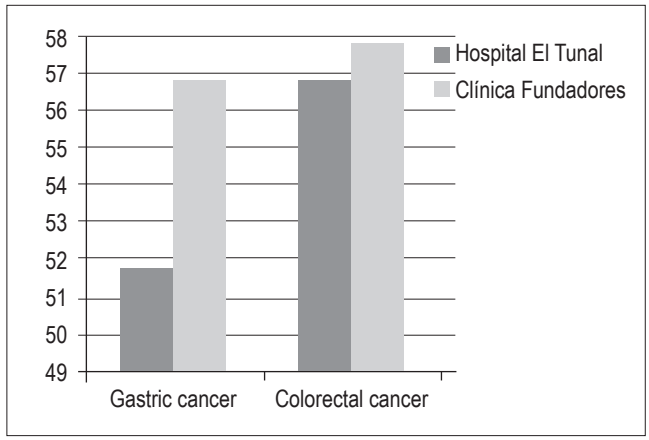

Figure 3. Distribution of average age in years by type of cancer and institution.

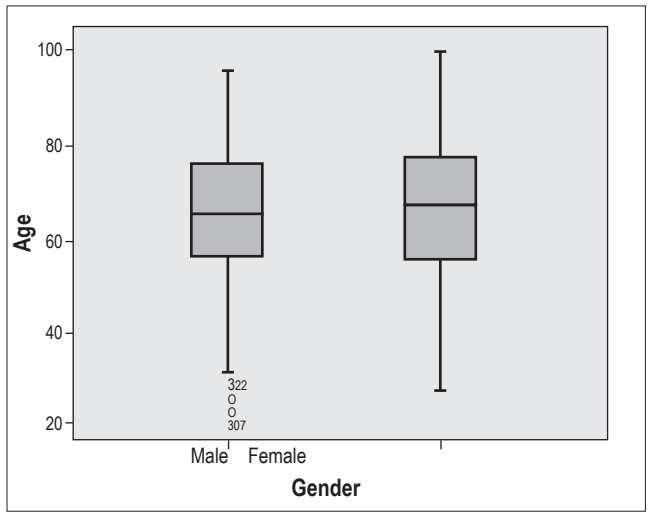

Figure 4. Distribution of ages by gender.

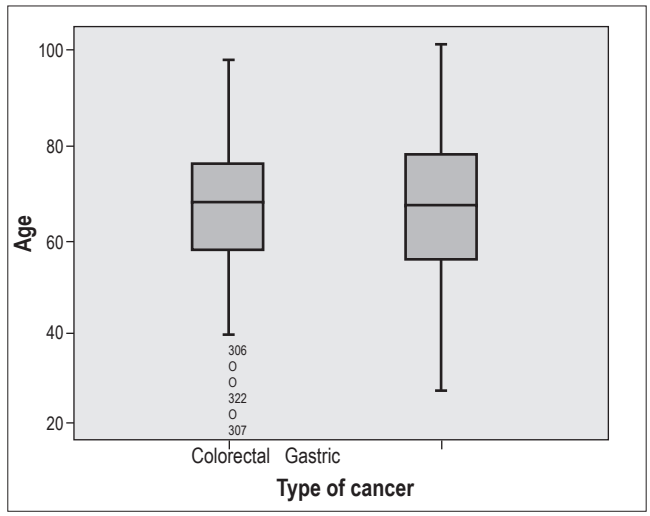

Figure 5. Distribution of ages by type of cancer.

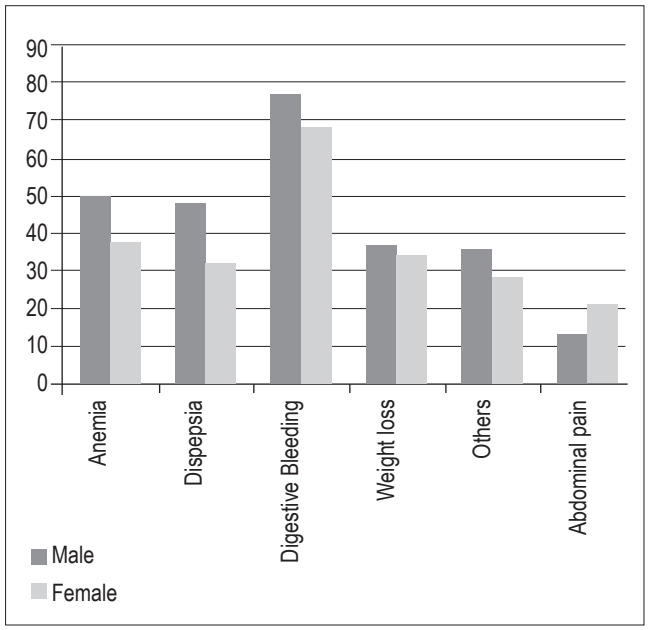

Figure 6. endoscopic indications by gender

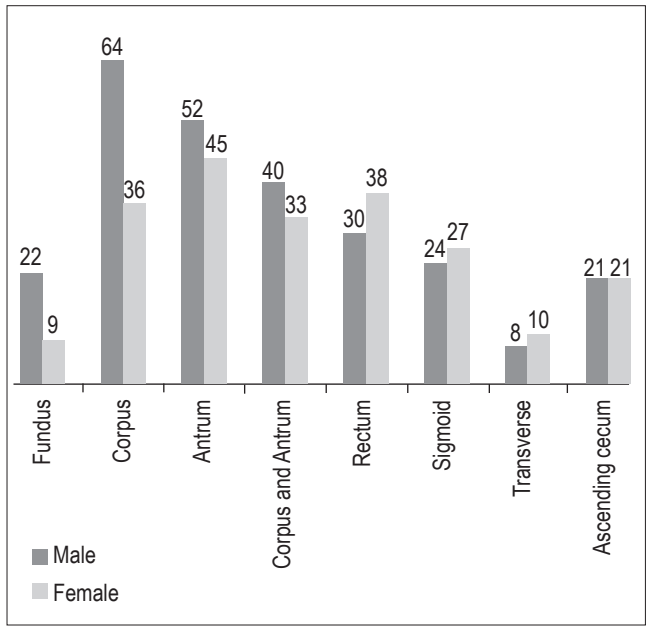

Figure 7. Tumor locations by gender.

at the Hospital El Tunal it was 47.3 years, and at the Clínica Fundadores it was 52.5 years. While there is no information on the prevalence of H. pylori at these institutions, H. pylori was found in 79.3% of a sample of 402 recent patients studied at the Clínica Fundadores. Infections were identified with rapid urease tests, histology or cultivation (manuscript in preparation). A different study at the Hospital El Tunal which used histology to find the prevalence of this infection in patients with dyspepsia, found 89.7% were infected with H. pylori (manuscript in preparation).

Other data not shown in this investigation are also statistically similar and do not explain the differences in the prevalence of GC. They do, however, support the hypothesis that even though H. pylori is a necessary factor for GC, it is not sufficient for it to develop. Other factors may determine the final outcome (36). In these two populations other possible factors might be dietary, environmental, or any other factors not investigated.

CRCs behavior was the mirror image of that of GC: from 5,126 colonoscopies at the Clínica Fundadores there were 132 cases (2.5%) while from the 4,886 colonoscopies at the Hospital El Tunal there were only 47 cases (1.02%). In other words, CRC was 2.5 times more common at the Clínica Fundadores. Average ages and age ranges for populations of patients who underwent endoscopies at both institutions were similar as were the average ages of patients with CRC at both institutions. At the Hospital El Tunal, the average age of the patients who underwent colonoscopies was 50.1 ± 14.2 years (Range: 18 to 99 years) while at the Clínica Fundadores the average age was 53.5 years (Range: 18 to 99 years). The average age of patients with CRC in the Hospital El Tunal was 57.6 (Range: 21 to 96 years) while at the Clínica Fundadores it was 58.1 ± 11.1 (Range: 38 to 94 years). Logistic regression analysis confirmed that patients from lower strata are most frequently associated with GC while in contrast, patients from higher socioeconomic strata are more frequently associated with CRC. We do not know the reasons for the marked difference in prevalences at each institution. Moreover, those reasons cannot be inferred from the information available to this study.

In conclusion, in a population of low socioeconomic strata, GC prevalence is five times higher than that found in higher strata. Prevalence rates of CRC were the reverse: in higher socioeconomic strata, the frequency of this tumor is 2.5 times that in lower strata. Interpreting results differently, you might say that for every GC found at Clínica Fundadores, 5 cases are found at the Hospital El Tunal, but for each case of CRC found at Hospital El Tunal, 2.5 cases are found at the Clínica Fundadores. These findings highlight variations of prevalences of CRC and GC within one city. This deserves to be investigated in this country because of the possibility that the prevalences of CRC and GC may vary. We already know that the prevalence of GC for example, is greater in Pasto than on the Atlantic coast (12). A risk factor for CRC that is gaining increasing attention, and that has a consistently demonstrated association with CRC, is obesity (37-39). This parameter was not investigated among the patients at the two centers studied, although one could speculate that in the higher strata there is a possibility of a higher prevalence of obesity.

The most common location of GC among men was in the gastric corpus, whereas in women the most common location was in the antrum. We have no explanations for these findings.

CRCs were most frequently located in the rectum and the sigmoid in all patients, men and women, at both institutions. These locations have poorer prognoses and lower five-year survival rates than do those located on the right side (40, 41). CRCs were found less frequently in the right colon, from the splenic angle of the transverse to the cecum. This contrasts with the current trend in the United States and many other countries in which right colon tumors occur more frequently than do left colon tumors (42-46). 72% of CRC patients at the Hospital El Tunal (34 of 47) had rectum or sigmoid locations while 64% of CRC patients at the Clínica Fundadores (85 of 132) had tumors in the most common location in the distal colon. This implies that the sigmoidoscopy alone could have detected 64% to 72% of the CRCs in these two institutions.

The higher prevalence of CRC among patients from higher strata than those in lower strata resembles the relations of prevalences in the developed world and the developing world. Curiously, the most frequent location of these tumors in both higher and lower strata in our research was rectosigmoid which is different from what is found in the developed world. We have no explanation for this location although it is possible that the endoscopists who participated in this study had more difficulty finding tumors in the right colon than elsewhere. Nevertheless, among the quality parameters in the continuous improvement of quality in colonoscopy at both institutions, more than 95% of diagnostic and screening colonoscopies reach the cecum. In addition, the polyp detection rate is over than 25% for men and over 20% for women (manuscript in preparation). Symptoms of CRC depend on the growth of the tumor in the lumen of the colon or in adjacent structures. Therefore, w symptoms become evident when these tumors have reached advanced stages. Among the most frequent manifestations are hematochezia, melena, abdominal pain, anemia due to iron deficiency, and changes in bowel habits (47, 48). This investigation was found that at both institutions the most common reason for request of colonoscopy was rectal bleeding. The message of these results to the medical community and the general population should be that rectal bleeding should not be attributed to "hemorrhoids" and these patients should be referred for at least one sigmoidoscopy.

CONCLUSIONS

Comparatively, gastric cancers were found six times more frequently in socioeconomic strata 1 and 2 than in strata 4 and 5, and colorectal cancer was found 2.5 times more frequently in higher strata than in lower strata. Colon cancers in the study population are more frequently found in the rectum and the sigmoid in contrast to what happens in many developed countries. This distal location has a worse prognosis and therefore requires timely diagnosis. Given the location diagnosis can be done with a test as simple as sigmoidoscopy: in theory more than two-thirds of these tumors could be detected. In our environment rectal bleeding is an ominous sign. Therefore, any patient with rectal bleeding deserves a lower endoscopic examination. When available appointments for colonoscopies are very far in the future, these patients should at least undergo provisional sigmoidoscopy. If its results are negative, the patient should undergo total colonoscopy.

We consider that these two neoplasms have great impacts on our country and deserve further study in all regions of Colombia.

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