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Variation in the prevalence of gastric cancer in Perú

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Most cases of gastric cancers occur in non-industrialized countries but there is scarce information about the epidemiology of this illness in these countries. Our study examined whether there was a variation in the prevalence of gastric cancer in Lima, Perú over the last 2 decades. Subjects older than 29 years of age were included. They underwent an esophagogastroduedonoscopy at 3 socioeconomically different health facilities in Lima: a county hospital (7,168 subjects), a Peruvian-Japanese Clinic (14,794 individuals) and a private hospital (4,893 individuals). Birth cohort prevalence of gastric cancer was used. Regression models were calculated to predict the future prevalence of gastric cancer. It was found that the birth cohort prevalence of gastric cancer decreased in Perú from 22.7 to 2% ($p < 0.001$), from 12 to 0.5% ($p < 0.001$), and from 6.5 to 0.1% ($p < 0.001$) in the low, middle and high socioeconomic group, respectively. The prevalence of intestinal metaplasia decreased from 44.3 to 12.5% ($p < 0.001$), from 28.4 to 5% ($p < 0.001$), and from 19.4 to 2.2% ($p < 0.001$) in the low, middle and high socioeconomic status, respectively. These trends will likely persist over the future decades. Nevertheless, the prevalence of gastric cancer remains high in subjects older than 59 years of age in the low socioeconomic status. It is concluded that the prevalence of gastric cancer is decreasing in Perú, similar to the current trend undergoing in industrialized nations. However, there are still specific groups with high prevalence that might benefit from screening for early detection and treatment.

Key words: gastric cancer; epidemiology; intestinal metaplasia

Gastric cancer is one of the most important causes of cancer deaths worldwide, with more than 700,000 deaths annually.[1] It has been associated with several environmental and genetic factors: *Helicobacter pylori* infection, consumption of salted, smoked, or poorly preserved foods, low consumption of fruits and vegetables, cigarette smoking, low socioeconomic status, blood type A, family history of gastric cancer, and hereditary nonpolyposis colon cancer syndrome[2–8].

The incidence rate of gastric cancer has declined in industrialized countries,[9] some investigators suggesting this may be related to the decreasing prevalence of *H. pylori* infection,[10] the widespread use of refrigeration and improved methods for preserving foods,[11,12] and the reduction of nitrate and nitrite content of foods along the last century.[12]

There is a relative paucity of information about the epidemiologic trends of gastric cancer in non-industrialized countries. It is important to address this issue because most cases of gastric cancer and its associated deaths occur in these countries.[1,13]

In Perú, gastric cancer is the most frequent cancer in men and the third in women, and the first cause of cancer-associated mortality in both sex.[14] The age-adjusted incidence of gastric cancer in males and females is 37.5 and 30.6 per 100,000 habitants, respectively, one of the highest in the Americas.[15] This is probably related to the high prevalence of *H. pylori* infection: more than 90% of Peruvians from low socioeconomic status are infected,[16] and around 50% of those from middle to high socioeconomic status[17,18]. Poor sanitary conditions and dietary habits likely play a role as well.[11,12]

In our study, we collected information about the presence of intestinal metaplasia in the stomach because it is considered a premalignant condition for the development of gastric cancer[19,20]; thus, changes in the epidemiology of gastric cancer and intestinal metaplasia should be closely related. Socioeconomic status is another factor we decided to explore because it is associated with the development of gastric cancer as well.[2,3]

The study was carried out at 3 health facilities providing health services to populations from different socioeconomic status to determine whether there have been changes in the prevalence of gastric cancer over the last decades in Lima, Perú.

Material and methods

Setting

Lima, the capital of Perú, is divided by the Peruvian Ministry of Health into 3 classes of districts, according to the socioeconomic level of their population[21]: Class A represents the high socioeconomic status. Class B encompasses the middle socioeconomic status. Class C represents the poor socioeconomic status. This classification is based on recommendations made by the World Bank and it includes the following variables: level of education, annual income and employment status of the head of the household; characteristics of dwelling, access to tap water and number of persons living in the household among other variables. A standardized survey is carried out by the Ministry of Health yearly to update the information.[22]

Our study was carried out at 3 health facilities located in Lima: (*i*) Cayetano Heredia Hospital (HNCH) a county hospital of 200 beds located in a district classified as C. As a county hospital, it provides health services to a patient population from low socioeconomic status, including homeless and subjects without insurance. An upper endoscopy at HNCH costs between $10 and $25. It can be free when a patient cannot afford the cost. (*ii*) Peruvian-Japanese Center (PPJ), a clinic located in a district classified as B. Most of its patients have an income classified as B which allows them to afford the cost of an endoscopic study at PPJ ($60–$70). The clinic was established by Japanese residing in Perú but most

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of its patients are Peruvians. (3) Anglo-American Clinic (AAC), a private clinic with a high-income patient population located in a district classified as A where an upper endoscopy costs between $200 and $250 (Table I).

Subjects

We reviewed the charts of all the subjects who underwent an upper esophagogastroduodenoscopy at the 3 health facilities between 1984 and 2004. All the patients complained of upper gastrointestinal symptoms. Patient records were available from 1995 to 2005 at the AAC, from 1984 to 2004 at HNCH and from 1985 to 2004 at the PPJ. Only a histological diagnosis of gastric adenocarcinoma was considered to be a proof of cancer. Excluded were subjects younger than 30 years, those with stomach tumors other than gastric cancer (*e.g.*, malignant lymphoma) according to the International Classification of Diseases (9th Edition), follow-up endoscopies of patients with gastric cancer, and those without a gastric biopsy report. The study was approved by the ethics board of each of the 3 hospitals.

Data collection

The following variables were collected: age, gender, endoscopic diagnosis, histological diagnosis and date of diagnosis.

TABLE I – COST OF SOME SERVICES AT 3 HEALTH FACILITIES IN LIMA, PERU, 2006

Cost ($)	AAC	PPJ	HNCH
Clinic visit	57	8	2
Echocardiogram	114	62	Not done
EKG	57	10	3
EGD	229	66	20
Colonoscopy	286	121	34
CBC	11	4	4

Birth cohort prevalence of gastric cancer

Birth cohorts were used because the risk for developing gastric cancer is most likely determined by factors in early life such as the acquisition of *H. pylori* infection.[23,24]

The birth cohort prevalence was calculated as the proportion of endoscopies with a histological diagnosis of gastric adenocarcinoma during a particular birth cohort over the total number of endoscopies with biopsy reports during the same cohort.

A particular cohort was assigned to an individual depending on what decade he/she was born. For example: the 1920 cohort included individuals born between 1920 and 1929. The 1930 birth cohort included subjects born between 1930 and 1939. The 1940 cohort encompassed persons born between 1940 and 1949. The subjects born before 1910 were included in the 1910 cohort.

Analysis

Microsoft Excel 2002 for Windows was used to design the database, collect the information and for the attrition process at each health facility (Fig. 1). Only the first endoscopy report was analyzed when a patient had 2 or more endoscopic evaluations.

We used the chi square for trends to analyze the temporal variation of the birth cohort prevalence of gastric cancer and intestinal metaplasia at each health facility. 95% confidence intervals were calculated for each birth cohort prevalence. To control an age effect, analysis was performed in 3 age groups: subjects younger than 40 years of age, subjects between 40 and 59 years old, and individuals of 60 years of age or older. Analysis was performed by gender as well.

A stepwise logistic regression model was employed to analyze the effect of the covariates sex, birth cohort and socioeconomic status on the prevalence of gastric cancer or intestinal metaplasia. Age was not included as covariate because it highly correlated with birth cohort (coefficient of Spearman $r > 0.8$), which prevented them from being included simultaneously in a regression model. This was expected since the variable birth cohort results from the difference between year of diagnosis and age. Therefore,

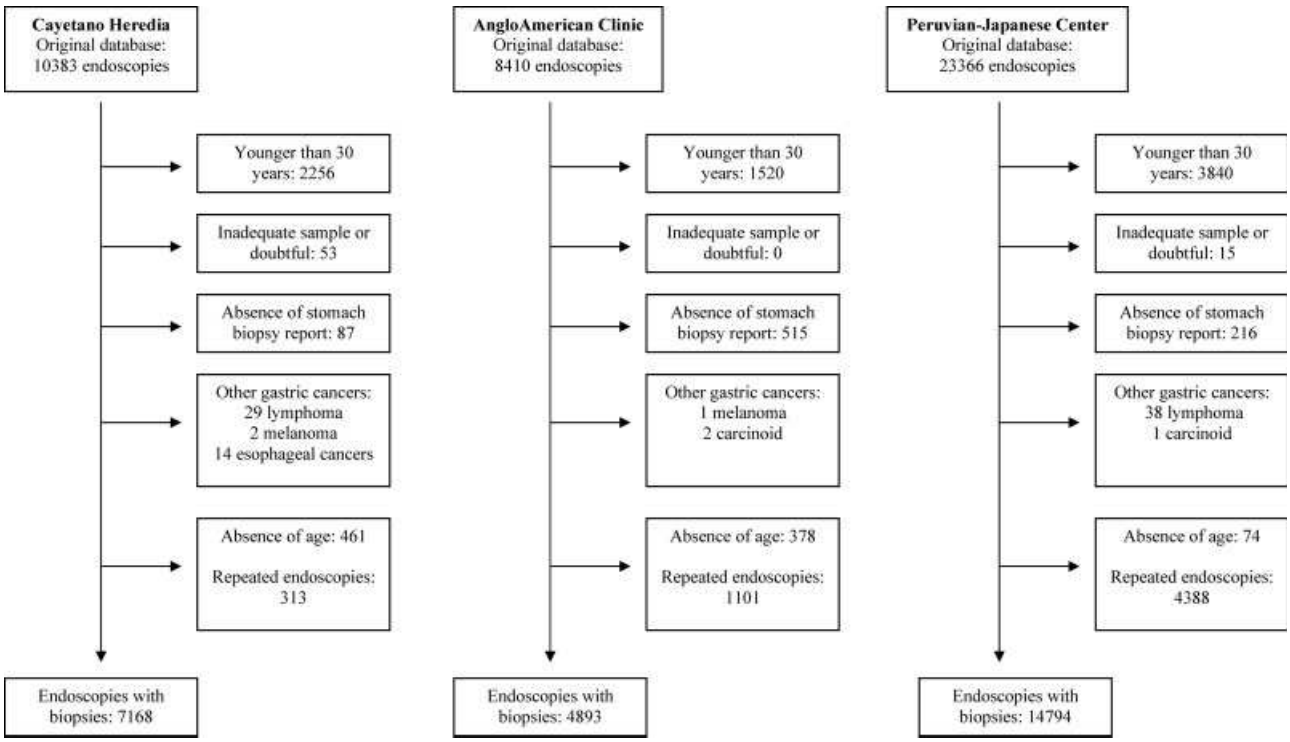

FIGURE 1 – Participant recruitment and attrition at the 3 hospitals.

TABLE II – NUMBER OF CASES OF GASTRIC CANCER AND INTESTINAL METAPLASIA BY BIRTH COHORT AND HOSPITAL

Birth cohort	HNCH		PPJ		AAC	
	Gastric cancer	Intestinal metaplasia	Gastric cancer	Intestinal metaplasia	Gastric cancer	Intestinal metaplasia
1910	102	141	72	142	6	18
1920	151	337	124	485	10	52
1930	150	452	116	716	6	103
1940	106	435	68	671	8	107
1950	58	291	37	352	4	81
1960	37	163	12	211	1	72
1970	5	27	3	32	0	8

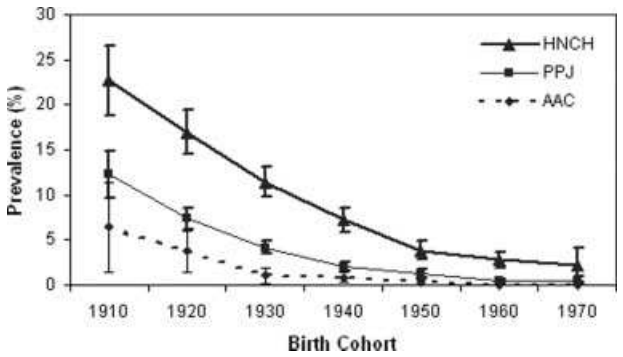

FIGURE 2 – Birth cohort prevalence of gastric cancer in Lima, Perú. Vertical lines represent 95% confidence intervals.

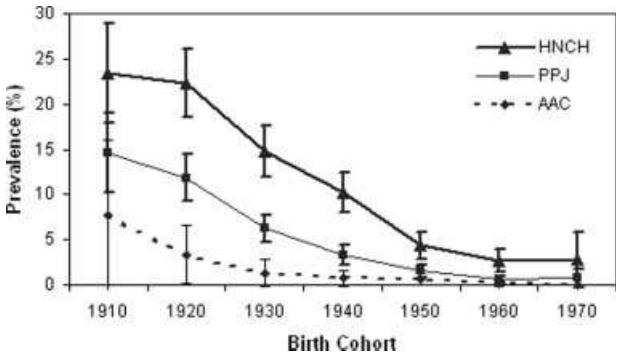

FIGURE 3 – Birth cohort prevalence of gastric cancer in males. Vertical lines represent 95% confidence intervals.

to adjust the effect of age on the prevalence of gastric cancer (or intestinal metaplasia), the analysis was performed in 3 groups: younger than 40 years, 40–59 years and 60 years of age or older. Odds ratio (OR) are shown with 95% confidence intervals.

Trendlines were calculated to estimate the birth cohort prevalence of gastric cancer and intestinal metaplasia through the birth cohort 2020 in Lima, Perú. The analysis was performed by socioeconomic level (low, middle and high). Three types of regressions were evaluated to estimate trendlines: linear, logarithmic and exponential. The model with the coefficient of determination (R^2) nearest to 1 was chosen. Based on this procedure, exponential regression models were the best fit for the temporal projections of intestinal metaplasia and gastric cancer in the 3 socioeconomic groups, except for gastric cancer in the high socioeconomic group where a logarithmic model had the highest R^2. The equation for the exponential models was: $y = ae^{bx}$, where y was the dependent variable (prevalence of gastric cancer or intestinal metaplasia), x was the independent variable (birth cohort), e the base of natural logarithms. The equation for the logarithmic model was $y = a + b \ln(x)$, where y was the dependent variable (prevalence of gastric cancer or intestinal metaplasia) and $\ln(x)$ was the logarithmic transformation of x, the independent variable (birth cohort). STATA v8.0 (STATA Corporation, TX) calculated the values of a and b that best fit the data for each equation. To predict the prevalence of gastric cancer and intestinal metaplasia, it was assumed that the birth cohort pattern of gastric cancer and intestinal metaplasia risk would persist in the future.

The relation between the prevalence of gastric cancer and intestinal metaplasia was analyzed using the correlation coefficient of Spearman. A $p < 0.05$ was considered significant. All p values are 2-sided. Statistical analyses were performed using STATA v8.0 (STATA Corporation, TX).

Results

Participant recruitment

The original database was composed of 10,383 endoscopies performed at HNCH, 8,410 performed at AAC and 23,366 at PPJ (Fig. 1: Participant recruitment and attrition at the 3 hospitals in Lima, Perú). Excluded were a total of 7,616 subjects younger than 30 years, 886 with inadequate, absent or doubtful biopsy report, 87 with other types of cancer (*e.g.*, lymphoma) and 5,802 repeated endoscopies. We found no data about age in 913 subjects. The final analysis was performed in 7,168 subjects at HNCH, 4,893 at AAC and 14,794 at PPJ. There were no subjects born in the 1980s or 1990s because persons younger than 30 years were excluded. The 1910 birth cohort also included those born before 1910. Table II shows the number of cases of gastric cancer and intestinal metaplasia by birth cohort at the 3 hospitals.

Birth cohort prevalence of gastric cancer

The overall prevalence of gastric cancer in subjects with upper gastrointestinal symptoms decreased significantly over the past century in Lima, Perú. This finding was consistent along the 3 socioeconomic groups (Fig. 2: Birth cohort prevalence of gastric cancer in Lima, Perú. Vertical lines represent 95% confidence intervals): from 22.7 to 2% at HNCH—low socioeconomic group ($p < 0.001$), from 12 to 0.5% at PPJ—middle socioeconomic group ($p < 0.001$) and from 6.5% to less than 0.1% at AAC—high socioeconomic group ($p < 0.001$).

The prevalence of gastric cancer was higher at HNCH—low socioeconomic status, and lower at AAC—high socioeconomic status (Fig. 2). The younger birth cohorts were associated with significantly lower risk of gastric cancer: HNCH: OR 0.95 (0.95–0.96, $\chi^2 = 3165.1$, $p < 0.0001$); PPJ: OR 0.94 (0.93–0.95, $\chi^2 = 364.7$, $p < 0.0001$); AAC: OR: 0.92 (0.90–0.94, $\chi^2 = 58.9$, $p < 0.0001$). This effect was independent of gender.

The prevalence of gastric cancer was higher in subjects from low socioeconomic status (HNCH) in both males and females (Figs. 3 and 4: birth cohort prevalence of gastric cancer in males and females, respectively. Vertical lines represent 95% confidence intervals). Male subjects had a higher prevalence of gastric cancer at HNCH (10.6% *vs.* 6.5% $p < 0.001$) and PPJ (4.2% vs. 2.2% $p < 0.001$), hospitals in the low-to-medium socioeconomic status. There was no gender difference at AAC—high socioeconomic status (0.8% vs. 0.7% $p = 0.74$).

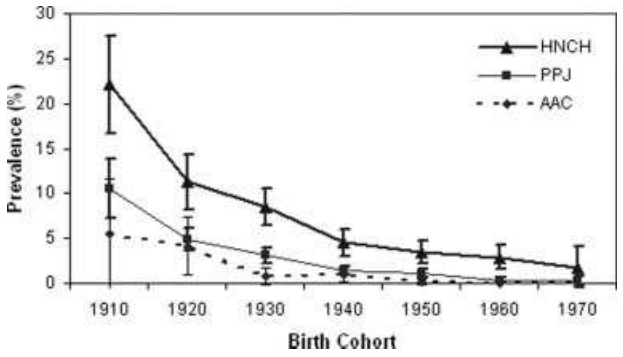

FIGURE 4 – Birth cohort prevalence of gastric cancer in females. Vertical lines represent 95% confidence intervals.

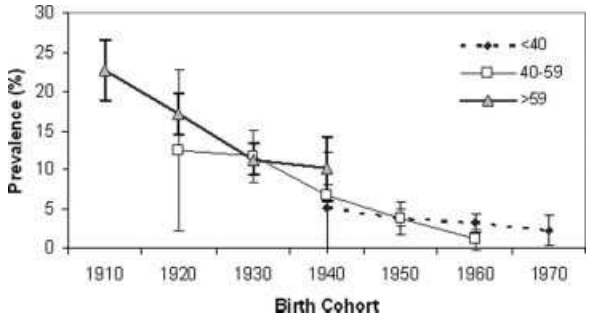

FIGURE 5 – Age-specific prevalence of gastric cancer by birth cohort in the low socioeconomic status. Vertical lines represent 95% confidence intervals.

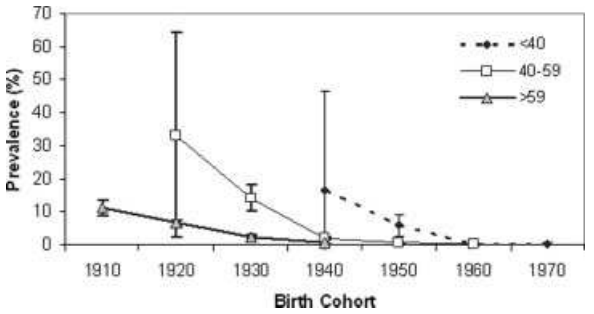

FIGURE 6 – Age-specific prevalence of gastric cancer by birth cohort in the middle-high socioeconomic status. Vertical lines represent 95% confidence intervals.

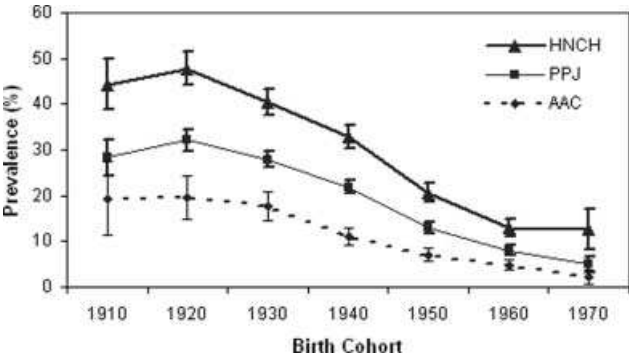

FIGURE 7 – Birth cohort prevalence of intestinal metaplasia at the 3 hospitals in Lima, Perú. Vertical lines represent 95% confidence intervals.

The decreasing prevalence of gastric cancer was statistically significant in the 3 age groups: subjects younger than 40 years of age at PPJ (χ^2 for trends 41.9, $p < 0.0001$); subjects between 40 and 59 years old at HNCH, PPJ and AAC (χ^2 for trends 43.7, 140.2 and 6.49, respectively; $p < 0.0001$, $p < 0.0001$ and $p = 0.01$, respectively); and individuals older than 59 years of age (χ^2 for trends 35.3, 115.5 and 20.8, respectively; $p < 0.0001$, $p < 0.0001$ and $p < 0.0001$, respectively). There was no statistically significant difference in subjects younger than 40 years of age at HNCH (χ^2 for trends 1.43, $p = 0.23$) and AAC (χ^2 was not calculated because there were no cases of gastric cancer). Figures 5 and 6 show the age-specific prevalence of gastric cancer by birth cohort in the low and middle-high socioeconomic status, respectively (vertical lines represent 95% confidence intervals).

Despite the decreasing trend, the birth cohort prevalence of gastric cancer remained high in subjects older than 59 years of age from low socioeconomic status: 22.7% in the 1910 birth cohort, 17.2% in the 1920 cohort, 11.3% in the 1930 cohort and 10.1% in the 1940 cohort.

Birth cohort prevalence of intestinal metaplasia

The prevalence of intestinal metaplasia consistently decreased at the 3 hospitals: from 44.3 to 12.5% ($p < 0.001$) at HNCH, from 28.4 to 5% at PPJ ($p < 0.001$), and from 19.4 to 2.2% ($p < 0.001$) at AAC. Intestinal metaplasia was more prevalent in the low socioeconomic group (HNCH) (Fig. 7: birth cohort prevalence of intestinal metaplasia at the 3 hospitals in Lima, Perú. Vertical lines represent 95% confidence intervals).

Regression models for the prevalence of gastric cancer and intestinal metaplasia

The regression model revealed that the reduction of the birth cohort prevalence of gastric cancer and intestinal metaplasia was independent of gender and socioeconomic status in each of the 3 age groups (Table III: logistic regression models to explain the reduction of the prevalence of gastric cancer and intestinal metaplasia in Lima, Perú). The area under the ROC curve in the 3 age groups was greater than 0.7 and 0.6, respectively, indicating that the models had a fair accuracy to classify the cases of gastric cancer and intestinal metaplasia correctly.

A low socioeconomic status was an independent factor associated with the presence of gastric cancer and intestinal metaplasia (Table III: logistic regression models to explain the reduction of the prevalence of gastric cancer and intestinal metaplasia in Lima, Perú). Male gender was a risk factor associated significantly with gastric cancer, except in subjects younger than 40 years of age. Gender was not an independent risk factor associated with intestinal metaplasia in any age group.

One confounding factor was further explored: the number of endoscopies performed each year, based on the potential bias that a very high or low number of endoscopies performed during some years might affect the rate of detection of gastric cancer and intestinal metaplasia. The associated factors remained independent after including the annual number of endoscopies in the regression models (data not shown).

Trendlines were calculated for the 3 socioeconomic groups (Figs. 8–10: projections of the prevalence of gastric cancer and intestinal metaplasia by socioeconomic status: high, middle and low socioeconomic status, respectively). All the models showed a persistent reduction of the prevalence of both pathologies through the birth cohort 2020. There was a very strong correlation between the decreasing prevalence of gastric cancer and intestinal metaplasia in the high, middle and low socioeconomic status (Spearman's rho 0.96, 0.93, 0.96 and $p < 0.001$, $p < 0.03$, $p < 0.001$, respectively).

TABLE III – LOGISTIC REGRESSION MODELS TO EXPLAIN THE REDUCTION OF THE PREVALENCE OF GASTRIC CANCER AND INTESTINAL METAPLASIA IN LIMA, PERÚ

	OR	95% CI	*p*	Area under ROC curve
Gastric cancer				
Younger than 40 years				0.82
Birth cohort	0.91	0.87–0.94	<0.001	
Gender	1.15	0.74–1.8	0.53	
Low socioeconomic status	3.39	2.23–5.17	<0.001	
40–59 Years				0.78
Birth cohort	0.91	0.89–0.92	<0.001	
Gender: male	1.91	1.51–2.4	<0.001	
Low socioeconomic status	2.28	1.87–2.77	<0.001	
Older than 59 years				0.76
Birth cohort	0.95	0.94–0.95	<0.001	
Gender: male	1.85	1.57–2.18	<0.001	
Low socioeconomic status	2.73	2.36–3.16	<0.001	
Total				0.79
Birth cohort	0.95	0.94–0.95	<0.001	
Gender: male	1.81	1.6–2.06	<0.001	
Low socioeconomic status	2.76	2.47–3.09	<0.001	
Intestinal metaplasia				
Younger than 40 years				0.64
Birth cohort	0.98	0.96–1	0.02	
Gender	0.9	0.73–1.09	0.28	
Low socioeconomic status	1.84	1.59–2.14	<0.001	
40–59 Years				0.65
Birth cohort	0.97	0.96–0.98	<0.001	
Gender	1.03	0.93–1.15	0.57	
Low socioeconomic status	1.9	1.75–2.06	<0.001	
Older than 59 years				0.61
Birth cohort	0.99	0.99–1	0.05	
Gender	1	0.9–1.1	0.91	
Low socioeconomic status	1.92	1.77–2.08	<0.001	
Total				0.64
Birth cohort	0.96	0.96–0.96	<0.001	
Gender	0.97	0.9–1.03	0.31	
Low socioeconomic status	1.83	1.74–1.93	<0.001	

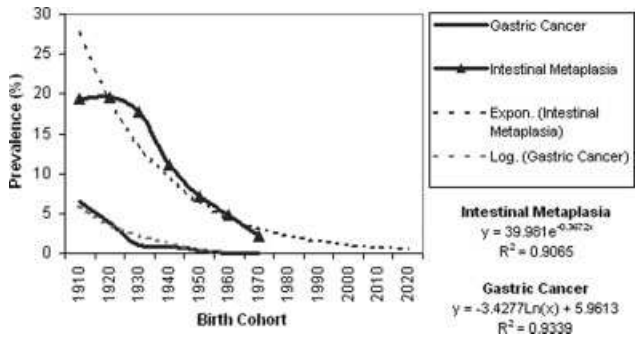

FIGURE 8 – Projections of the birth cohort prevalence of gastric cancer and intestinal metaplasia in the high socioeconomic status.

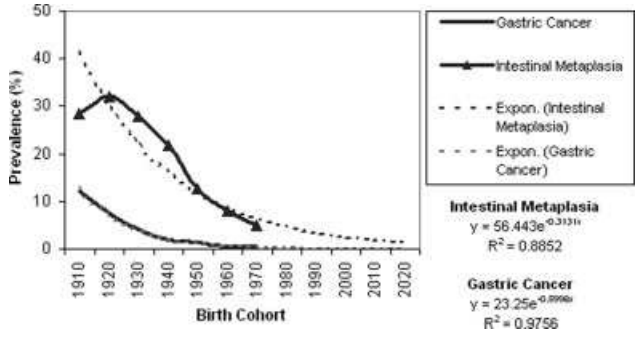

FIGURE 9 – Projections of the birth cohort prevalence of gastric cancer and intestinal metaplasia in the middle socioeconomic status.

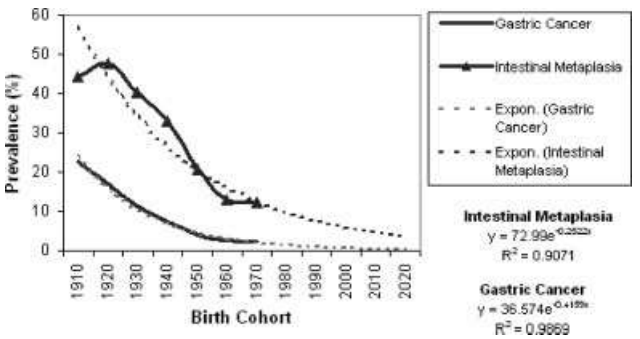

FIGURE 10 – Projections of the birth cohort prevalence of gastric cancer and intestinal metaplasia in the low socioeconomic status.

Discussion

The key finding of our study is that the birth cohort prevalence of gastric cancer has decreased over the last decades in subjects with upper gastrointestinal symptoms from low, middle and high socioeconomic status in Perú. This reduction is independent of gender and age and parallels a decreasing prevalence of intestinal metaplasia of the stomach. To our knowledge, this is the first report of a decreasing prevalence of both intestinal metaplasia and gastric cancer in different socioeconomic groups in a developing country.

The results are concordant with previous studies carried out in developed countries[11,24,25] and with a recent report published by our group in Perú.[26] The risk of gastric cancer has consistently decreased about 5% (4–5%) with each birth cohort of low socioeconomic status (HNCH), 6% (5–7%) of middle socioeconomic

status (PPJ) and 8% (6–10%) of high socioeconomic status (AAC) along the past century in Lima, Perú.

The finding that the rate of both intestinal metaplasia and gastric cancer are decreasing in Perú suggests a common causal factor and that both pathologies are highly related. Intestinal metaplasia is considered a premalignant lesion for the development of gastric cancer.[19,20] According to Correa's model of gastric carcinogenesis, there is a progressive sequence of gastric lesions from chronic gastritis, gastric atrophy, intestinal metaplasia, dysplasia, and finally, gastric adenocarcinoma.[19] The relationship between the 2 pathologies is supported by our study, because both are becoming less prevalent and they share similar risk factors such as age and low socioeconomic status.

An interesting candidate to be the common causal factor for intestinal metaplasia and gastric cancer is *H. pylori* infection. In Perú, the prevalence of *H. pylori* infection has decreased over the last decades[17,18,27] and it might explain the reduction of the prevalence of both pathologies because this infection is highly associated with them.[28–31] *H. pylori* infection is mostly acquired during childhood in Perú and more than 90% of the strains in Lima are cagA+,[16] which are strongly associated with an increased risk of developing chronic inflammation and gastric cancer. The rate of *H. pylori* infection in children younger than 5 years of age decreased from 55 to 60% in 1990[17] to 25% in 2001[32] in Perú. Another important phenomenon is that Peruvians are becoming infected at older ages: the mean age to acquire the infection changed from 12 to 18 months of age in 1990[18] to 2.4 years in 2002.[33] This phenomenon might be resulting in a shorter duration of the infection, leading to a reduced risk for developing intestinal metaplasia and gastric cancer later in life.[34] The relationship between *H. pylori* infection and both pathologies is highlighted by 2 large prospective studies showing that gastric adenocarcinoma develops in persons infected with *H. pylori* and not in uninfected persons.[35,36] One of these studies found that intestinal metaplasia was the only independent factor predicting subsequent development of gastric malignancies in *H. pylor*i infected persons.[36]

However, there are other important factors that might explain the evolving epidemiology of gastric cancer in this country: a more widespread use of refrigeration, better methods for preserving foods or some dietary changes such as the consumption of less-salted food and more vegetables.[11,12] The older birth cohorts were likely more exposed to improper preserved food and poorer sanitary conditions during childhood. There was also a large migratory movement from the mountains to Lima owing to several economic crises in Perú over the last century. This is noteworthy because people from the mountains have dietary habits based on large amounts of vegetables, potatoes and tubers which might affect their risk for developing gastric cancer.[37]

We found that a low socioeconomic status was independently associated with the prevalence of gastric cancer and intestinal metaplasia, with an OR of 2.8 (2.5–3.1) and 1.8 (1.7–1.9), respectively. A low socioeconomic status is an indicator of poor hygiene and high rates of fecal contamination which can result in high rates of *H. pylori* infection early in life.[18,24] It can also reflect long-term exposure to food not well preserved or drinking water not properly chlorinated.[38] Our study also revealed that males were more affected by gastric cancer in the low and middle socioeconomic groups. This finding might reflect exposure to less protected sources of food and water.[18]

A statistical model was developed to predict the prevalence of gastric cancer and intestinal metaplasia in subjects with upper gastrointestinal symptoms from different socioeconomic status in the future birth cohorts. In subjects from high socioeconomic status, the prevalence of gastric cancer has been consistently less than 3% in the cohorts born after 1930 in Lima, and according to our estimation, it is going to be less than 0.5% over the next generations. In subjects from middle socioeconomic status, the prevalence has decreased from around 13% in the cohort born in 1910 to about 3% in 1970 and it is going to be less than 2% in the cohort born in 2020. Likewise, the prevalence of gastric cancer in individuals from low socioeconomic status has trended down from around 20% in the cohorts born more than 50 years ago to around 5% in 1970 and it is going to stay around 2–3% in the incoming decades. Similarly, the prevalence of intestinal metaplasia in the 3 socioeconomic groups will decrease to less than 5% by the cohort born in 2020.

Despite these findings, gastric cancer remains a highly prevalent disease in some groups in Lima: subjects over 60 years of age with upper gastrointestinal symptoms from low socioeconomic status were found to have a prevalence ranging from 25 to 10%. A similar evolving picture is occurring in the United States: the prevalence of gastric cancer has declined in the general population but it remains high in some subgroups, including African Americans, Hispanics and Native Americans with incidences up to 3-fold higher than in the general population.[4,39] It is noteworthy that these subgroups are frequently associated with a low socioeconomic status. These high-risk groups might become a convenient target for gastric cancer screening as done in Japan[40] but further studies are needed to address this issue.

Some limitations of our study are the following: this is a retrospective study, and it is subject to selection bias: it is likely that there has been a tendency to perform endoscopies at earlier age in the most recent years. We ruled out this effect by showing a decreasing prevalence of gastric cancer along 3 different age groups. Likewise, the effect of gender was controlled by showing a decreasing prevalence in both males and females. Fewer endoscopies were done during the first years of the study which could have affected the rate of detection of gastric cancer and intestinal metaplasia. This effect was controlled by including the annual number of endoscopies in the regression model. Our prediction models had an R^2 more than 0.9, good enough to provide a fair idea of the prevalence of gastric cancer in the near future in Lima. Our results cannot be extrapolated to the general population because we included subjects with upper gastrointestinal symptoms. Despite these limitations, the results found are consistent with a previous study carried out in Perú where we found that the prevalence of gastric cancer decreased from 8.5 to 0.9% over the last 20 years.[26]

In summary, the prevalence of gastric cancer in subjects with upper gastrointestinal symptoms across different socioeconomic groups in Lima, Perú has decreased significantly over the last decades, independently of age and gender. The epidemiology of gastric cancer is changing in Perú and probably in other developing countries, likely related to the decreasing prevalence of *H. pylori* infection and other environmental factors. Despite the reduction of the prevalence of gastric cancer in Perú, our study suggests that specific groups are at high risk for suffering gastric cancer, particularly individuals in the low socioeconomic status and those older than 60 years of age, suggesting that public health interventions such as gastric cancer screening targeted to these populations might be highly cost-effective in some developing countries.

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