



The burden of oesophageal cancer in Central and South America[☆]



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ABSTRACT

Rationale and objective: Oesophageal cancer shows marked geographic variations and is one of the leading causes of cancer death worldwide. We described the burden of this malignancy in Central and South America.

Methods: Regional and national level incidence data were obtained from 48 population-based cancer registries in 13 countries. Mortality data were obtained from the WHO mortality database. Incidence of oesophageal cancer by histological subtype were available from high-quality population-based cancer registries.

Results: Males had higher incidence and mortality rates than females (male-to-female ratios: 2–6:1 and 2–5:1). In 2003–2007, the highest rates were in Brazil, Uruguay, Argentina and Chile. Mortality rates followed the incidence patterns. Incidence of oesophageal squamous cell carcinoma (SCC) was higher than adenocarcinoma (AC), except in females from Cuenca (Ecuador). SCC and AC incidence were higher in males than females, except in the Region of Antofagasta and Valdivia (Chile), Manizales (Colombia) and Cuenca (Ecuador). Incidence and mortality rates tended to decline in Argentina, Chile, Brazil (incidence) and Costa Rica from 1997 to 2008.

Conclusion: The geographic variation and sex disparity in oesophageal cancer across Central and South America may reflect differences in the prevalence of tobacco smoking and alcohol consumption which highlights the need to implement and/or strengthen tobacco and alcohol control policies. Maté consumption, obesity, diet and *Helicobacter pylori* infection may also explain the variation in oesophageal cancer rates but these relationships should be evaluated. Continuous monitoring of oesophageal cancer rates is necessary to provide the basis for cancer prevention and control in the region.

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1. Introduction

Oesophageal cancer is the eighth most common malignancy diagnosed and the sixth leading cause of cancer death in the world [1,2]. Early diagnosis of oesophageal cancer is unusual and survival is very poor [3,4]. In 2012, approximately 456,000 new oesophageal cancer cases and 400,000 cancer deaths were estimated to occur

globally. More than 80% (370,000 new cases and 329,000 deaths) of all oesophageal cancer cases were estimated to occur in less-developed regions and less than 20% (86,000 new cases and 71,000 deaths) in more-developed regions of the world. Approximately 4% (20,000 new cases and 16,000 deaths) of the global burden of oesophageal cancer was estimated to occur in the Central and South American region [1].

There is a striking geographical variation in the incidence and mortality of oesophageal cancer and a noticeable difference between males and females [1,2]. For example, high-incidence areas can be identified in Iran and in some parts of China and Zimbabwe; intermediate-incidence areas in East Africa, South America, the Caribbean, most parts of China, Central Asia, northern India, and southern Europe; and low-incidence areas in North America, northern Europe, and western Africa [2]. Male-to-female ratios are between 1.2–9 for incidence and 2.3–13 for mortality [5].

Most oesophageal cancers can be classified into squamous-cell carcinoma (SCC) or adenocarcinoma (AC) [2,3] which have

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different etiologies and pathological characteristics [2,6,7]. The major risk factors for SCC are smoking and alcohol use, also thermal trauma caused by hot or very hot beverages; the main factors for AC are smoking, overweight/obesity and gastroesophageal reflux (GORD) [2,6,8,9]. There are considerable variations in the global distribution of esophageal SCC and AC. Both subtypes occur more frequently in men than women; however, SCC occurs more frequently among individuals in low-resource regions, while AC is more frequent in high-resource populations [2]. Recent estimates indicate that the global burden of esophageal SCC is located mainly in South-Eastern and Central Asia and Latin America (accounting for 79% and 4.1% of the SCC global burden, respectively), whereas the global burden of esophageal AC is located mainly in Northern and Western Europe, North America and Oceania (46% of the total global AC burden) [10].

Rapid increases in the incidence of esophageal cancer have been observed in some high-income countries over the last three decades [11–14]. Although a decline has also been reported in the United States in recent years [15], this is specifically in the incidence of SCC, and is thought to be due to declines in the prevalence of smoking. The rapid increase in AC incidence, observed in the United States and other Western countries, is probably related to increases in the prevalence of GORD and obesity [13,16–18]. However, the reasons for this remain poorly understood [10]. Mortality rates have stabilized or declined in several regions of the world [14], including Central and South America [14,19,20]. However, in Cuban and Mexican males, mortality has increased in recent decades [19,20]. Recent estimates revealed that the burden of esophageal cancer will increase in Central and South America by almost 80% by the year 2030 (35,000 new cases and 29,000 deaths) due to ageing and growth of the population [1].

Although a few studies of incidence and (mainly) mortality from esophageal cancer conducted in the Central and South American region have shown an important geographic variation across countries, with some declines in mortality rates [14,19–25], a detailed description of the patterns of esophageal cancer incidence by histological subtype is lacking. In this paper we describe the geographic and temporal trends in incidence and mortality of esophageal cancer in the Central and South American region, including a distinction by histology. We also review the epidemiology of this disease and focus on tobacco and alcohol consumption, the two major risk factors, and briefly discuss the current status of tobacco and alcohol control policies.

2. Methods

The present analysis includes esophageal cancer (C15), as coded by the 10th edition of the International Classification of Diseases for Oncology (ICD-10). The data sources and methods are described in detail in an earlier article in this issue. In brief, from the 22 countries located in Central and South America (including Cuba), we obtained regional- and national-level incidence data from 48 population-based cancer registries in 13 countries and cancer deaths from the World Health Organization mortality database for 18 countries. Age-standardized incidence rates (ASRs) and mortality rates (ASMRs) per 100,000 person-years were

calculated using the direct method and the World standard population [26,27]. National ASRs were estimated by data aggregation from the available cancer registries using a weighted average of local rates. To describe incidence and mortality time trends, estimated annual percentage change (EAPC) was calculated using the method proposed by Esteve et al. [28]. Registries that provided formal consent to use data by individual year of diagnosis for ≥ 10 -years were included in the time-trend analysis. Trends in incidence and mortality and EAPCs were estimated for four countries (Table 1). All of the EAPCs were tested for equality to zero by using the corresponding standard errors. EAPC was considered statistically significant if the P -value ≤ 0.05 . Data analyses were performed in Stata version 12.1 (StataCorp) [29].

Histological subtype information was extracted from ICD-O-3 codes from each registry. However, due to the large proportion of cases classified as “other” and “unspecified” (range 0–30%) we decided to present the incidence rates by histological subtype from high-quality population-based cancer registries published in Cancer Incidence in Five Continents (CI5) volume X [30].

3. Results

3.1. Age-standardized incidence and mortality rates

Although esophageal cancer is still a relatively rare diagnosis in Central and South America, it is one of the five most frequent causes of death due to cancer among males in Brazil, Belize, Paraguay, and Uruguay (Table 2). Overall, males had incidence and mortality rates 3 times higher than those in females (male-to-female ratios ranging from: 2 to 6:1 and 2 to 5:1, respectively).

During the most recent period (i.e. 2003–2007), the highest incidence rates of esophageal cancer among males and females were observed in the Southern Cone of South America: Brazil (10.1 and 2.3, respectively), Uruguay (8.8 and 2.7), Argentina (7.5 and 2.5) and Chile (6.1 and 3.1). The lowest incidence rates in both sexes were in Bolivia, El Salvador and Mexico (rates ≤ 1.1 for males and ≤ 0.4 for females) (Tables 2 and 3). Mortality rates closely followed the incidence patterns, with the highest rates observed in males and females in Uruguay (8.3 and 2.2), Argentina (7.5 and 1.8), Brazil (6.6 and 1.6) and Chile (5.2 and 2.3). Nicaragua had the lowest mortality rates in the region (0.76 for males and 0.26 for females).

3.2. Time trends

Declines in esophageal cancer incidence and mortality rates were observed among males and females in Argentina (1998–2007), Chile (1997–2008) and Costa Rica (1985–2007) since the mid-1990s (Fig. 1). In the most recent 10-year period, the largest declines in incidence of esophageal cancer were observed in males in Chile, Argentina and Brazil (EAPCs: -3.0 , -2.3 , and -2.1 , respectively, $P > 0.05$) whereas the highest declines in mortality were in Chile and Argentina (EAPCs: -3.8 and -2.1 , respectively, $P > 0.05$). In females, the largest declines in incidence were in Argentina, Chile, and Costa Rica (EAPCs: -10.6 , -5.8 , and -5.7 , respectively, $P > 0.05$) while the highest declines in mortality were

Table 1
Countries included in the analysis of time trends.

Country	Name of registries included	Period	% of the population covered
Argentina	Bahia Blanca	1993–2007	0.8
Brazil	Aracaju, Fortaleza, Goiania, Sao Paulo	1997–2006	8.0
Chile	Valdivia	1993–2008	2.2
Costa Rica	National registry	1985–2007	100.0

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