Pancreatic cancer incidence and mortality trends: a population-based study

Incidencia de cáncer pancreático y tendencias de mortalidad: un estudio basado en la población

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ABSTRACT

Objectives To analyze trends in pancreatic cancer incidence and mortality in Latin American countries.

Methods An ecological study with incidence data from the International Agency for Research on Cancer and mortality data from the World Health Organization. The trend of incidence by Joinpoint regression, the variation of the annual average and the 95% confidence interval were analyzed.

Results There were increasing trends in incidence in Brazil, in males, aged 40-59 years, and reduction in Costa Rica. In females, there was stability in all age groups. The mortality rates increased in the elderly in Brazil (AAPC: 1.09%; 95% CI: 0.76; 1.42), Peru (AAPC: 1.76%; 95% CI: 0.36; 3.17) and El Salvador (AAPC: 2.88%; 95% CI: 0.38; 5.43), while in Mexico, there was a reduction. In females, this rate increased in Brazil (AAPC: 1.38%; 95% CI: 1.07; 1.69), Peru (AAPC: 2.25%; 95% CI: 0.68; 3.85), Chile (AAPC: 3.62%; 95% CI: 1.96; 5.31), Nicaragua (AAPC: 2.51%; 95% CI: 0.36; 4.71) and Paraguay (AAPC: 1.17%; 95% CI: 0.37; 1.98) and a downward trend was observed in Colombia and Ecuador.

Conclusions Pancreatic cancer had a higher incidence in the elderly population of both sexes and an increase of the mortality trend in females was noted.

Key Words: Neoplasms; pancreatic neoplasms; mortality; incidence; Latin America; epidemiology (*source: MeSH, NLM*).

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RESUMEN

Objetivo Analizar las tendencias en la incidencia y mortalidad por cáncer de páncreas en los países latinoamericanos.

Método Se realizó un estudio ecológico con datos de incidencia de la Agencia Internacional de Investigación sobre Cáncer y datos de mortalidad de la Organización Mundial de la Salud. Se analizó la tendencia de incidencia por regresión de Joinpoint, la variación del promedio anual y el intervalo de confianza del 95%.

Resultados Hubo tendencias crecientes en la incidencia en Brasil en varones entre 40 y 59 años, y una reducción en Costa Rica. En las mujeres, hubo estabilidad en todos los grupos de edad. Las tasas de mortalidad aumentaron en los ancianos en Brasil (AAPC: 1,09%; IC 95%: 0,76; 1.42), Perú (AAPC: 1,76%; IC 95%: 0,36; 3,17) y El Salvador (AAPC: 2,88%; 95% IC 0,38; 5,43), mientras que en México hubo una reducción. En las mujeres, esta tasa aumentó en Brasil (AAPC: 1,38%; IC 95%: 1,07; 1.69), Perú (AAPC: 2,25%; IC 95%: 0,68; 3.85), Chile (AAPC: 3,62%; IC 95%: 1,96; 5,31), Nicaragua (AAPC: 2,51%; IC 95%: 0,36; 4,71) y Paraguay (AAPC: 1,17%; IC 95%: 0,37; 1,98) y se observó una tendencia a la baja en Colombia y Ecuador.

Conclusiones El cáncer de páncreas tuvo una mayor incidencia en la población anciana de ambos sexos; cabe también señalar que debido a este aumentó su mortalidad en las mujeres.

Palabras Clave: Neoplasias; neoplasias pancreáticas; mortalidad; incidencia; América Latina; epidemiología (*fuente: DeCS, BIREME*).

Pancreatic cancer is one of the most lethal among the different types of cancer (1), being considered the seventh most common cause of cancer death in both sexes in the world, and most cases and deaths occur in more developed regions (2).

The overall incidence rate is 5.5 and 4.0 cases per 100.000 inhabitants, for males and females respectively. The worldwide mortality rate is of 5.1 for males and 3.8 deaths per 100.000 inhabitants for females. Europe has the highest incidence rates, with 9.9 cases/100.000 inhabitants for males and 7.2 cases/100.000 inhabitants for females (2). In Latin America, considering the incidence rate, it is highlighted Uruguay (9.2 and 6.5 cases per 100.000 inhabitants) and Argentina (7.2 and 5.5 new cases per 100.000 inhabitants), for males and females respectively (3). Moreover, a study points out that the incidence variation will continue to increase until 2030, and the north and northeast regions will present for both sexes, the highest cancer mortality rates in Brazil (4).

Pancreatic cancer is predominantly a cancer of the elderly population, considered rare before an age of 40 years, and less than 20% of cases are diagnosed before an age of 60 (5). The risk of developing the disease increases from the age of 50 and is more common in men with a male/female ratio of 1.5 (5). Its most common histological type is pancreatic adenocarcinoma, representing 85% of cases (6). Risk factors are classified as: high risk (history of chronic pancreatitis), moderate risk (tobacco, type 2 diabetes mellitus, family history) and low risk (obesity, alcohol intake) (7).

Pancreatic cancer screening is not recommended for the general population because it is a low-risk condition and is indicated for specific population groups, including individuals with a family history of pancreatitis, in first-degree relatives (8).

Like other less developed regions, Latin America is struggling to meet an ongoing commitment agenda, with adequate financial incentives and effective approaches to cancer control. Understanding the geographical distribution of pancreatic cancer and the behavior of rates over time is extremely important, as the analysis of the epidemiological situation in this region is necessary as a tool to support the planning of public health measures for the most vulnerable groups (9,10).

Therefore, the aim of this study was to analyze trends in pancreatic cancer incidence and mortality in Latin America.

METHODS

This is a time-series ecological study based on secondary data available from the International Agency for Research on Cancer (IARC) and World Health Organization (WHO) databases (11,12). Trends in incidence and mortality of malignant pancreatic neoplasia that occurred in Latin American countries were analyzed.

Incident cases of pancreatic malignancy during the 22-year period (1990–2012) were taken from the Cancer Incidence in Five Continents - CI5 PLUS, which included five Population-Based Cancer Registries (PBCRS): four regional registries; Cali (Colombia), Goiania (Brazil), Quito (Ecuador) and Valdivia (Chile) and a national registry; Costa Rica (11). For mortality data, the available information from 17 Latin American countries was analyzed, representing about 90% of the population between 1995 and 2013 (12).

The number of cases was extracted and age-adjusted specific rates were calculated for three age groups (0-39, 40-59, 60-74 and above 75 years) and for all ages. Specific age-adjusted rates were calculated using the world standard population according to gender and countries with available data.

Incidence rates and standardized mortality rates were calculated by gender. The ratio of incidence and mortality rates by sex were also calculated. The average annual percent change (AAPC) was estimated for incidence and mortality with a 95% confidence interval (95% CI) in the period. The exception to these analyzes was the 0-39 age group for incidence, as well as Belize, Suriname and Uruguay for mortality due to lack of data in the historical series. Statistical analyzes were performed using the Joinpoint Regression Program software, version 4.5.0.0 (13,14).

RESULTS

Between 1990 and 2012, for males, the highest incidence rates for pancreatic cancer were observed in Costa Rica, Valdivia (Chile) and Cali (Colombia), in the age group 75- 85+ years, with rates of 58.7, 57.2 and 48.1 new cases per 100.000 inhabitants, respectively. For females, the highest rates were found in Costa Rica and Cali (Colombia), 55.8 and 50.8 new cases per 100.000 inhabitants, for the age group 75-85+ years respectively, as shown in Table 1.

According to Table 1, increasing trends in incidence of pancreatic cancer occurred in Goiania (Brazil), for males aged 40-59 years (AAPC: 4.7% *; 95% CI:1.0; 8.6) and total (AAPC: 3.5%*; 95% CI: 0.1; 7.1). In females, there was stability in all age groups. Figures 1 and 2 complement the observed trends.

Between 1995 and 2013, the highest pancreatic cancer mortality rates were observed in Uruguay in the age group 75-85+ years (103.3/100.000 in men and 83.8/100.000 in women) and in Argentina, in the same age group (94.0/100.000 in men and 76.4/100.000 in women). Belize also stands out, with (88.0/100.000 in women) for the same previous age group. According to the age-standardized mortality rate (ASMR), mortality was higher in men in most countries, as shown in Table 2.

Figure 1. Age-adjusted incidence rate of pancreatic cancer (95% confidence interval) by sex, age 0-39 and 40-59 years, for Cali (Colombia), Costa Rica, Goiania (Brazil), Quito (Ecuador) and Valdivia (Chile) for the period 1990-2012, 95% confidence interval. The gray line represents the trends of the period
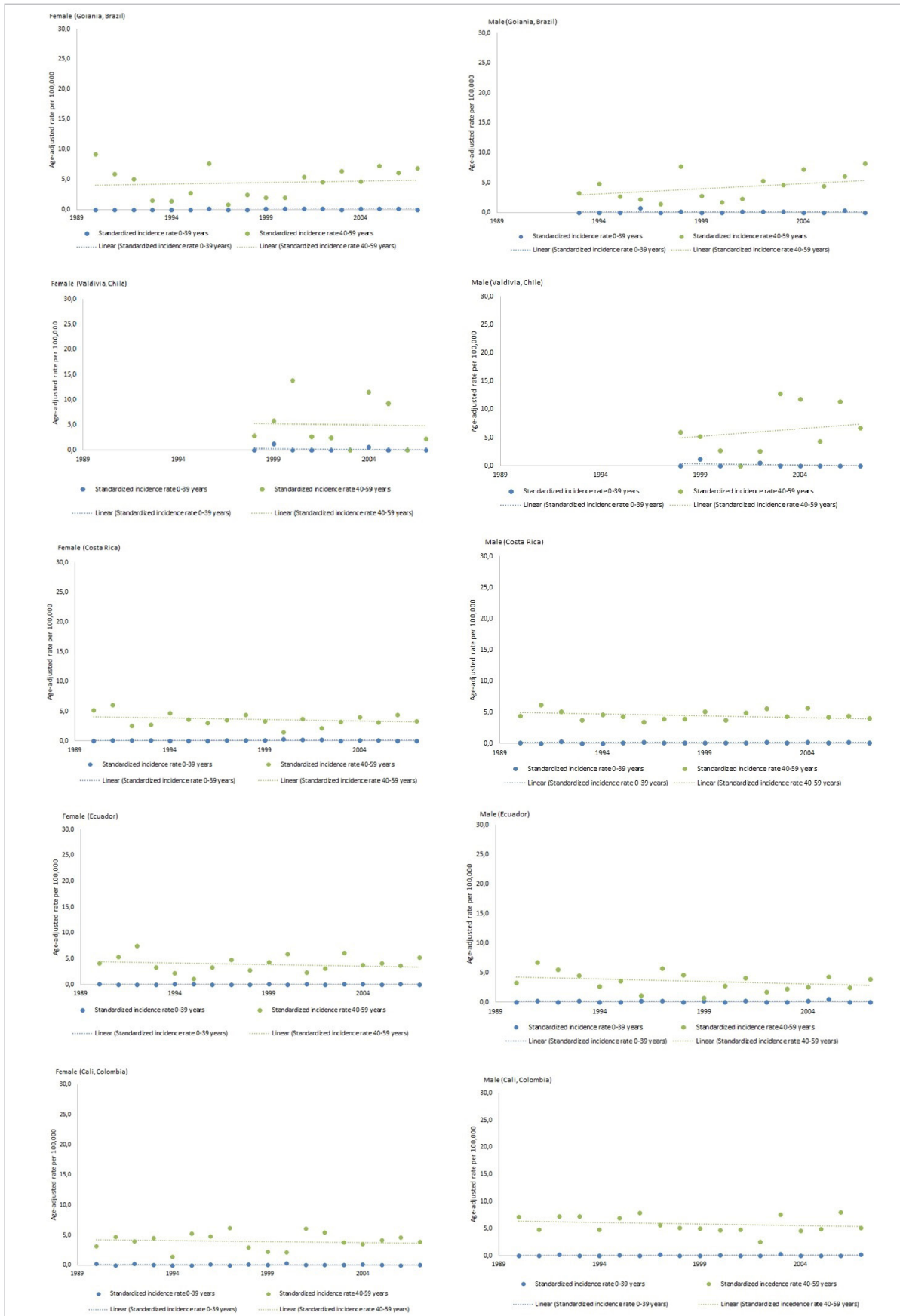

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Figure 2. Age-adjusted incidence rate of pancreatic cancer (95% confidence interval) by sex, age 60-74 years, 75-85+ and total for Cali (Colombia), Costa Rica, Goiania (Brazil), Quito (Ecuador) and Valdivia (Chile) for the period 1990-2012, 95% confidence interval. The gray line represents period trends
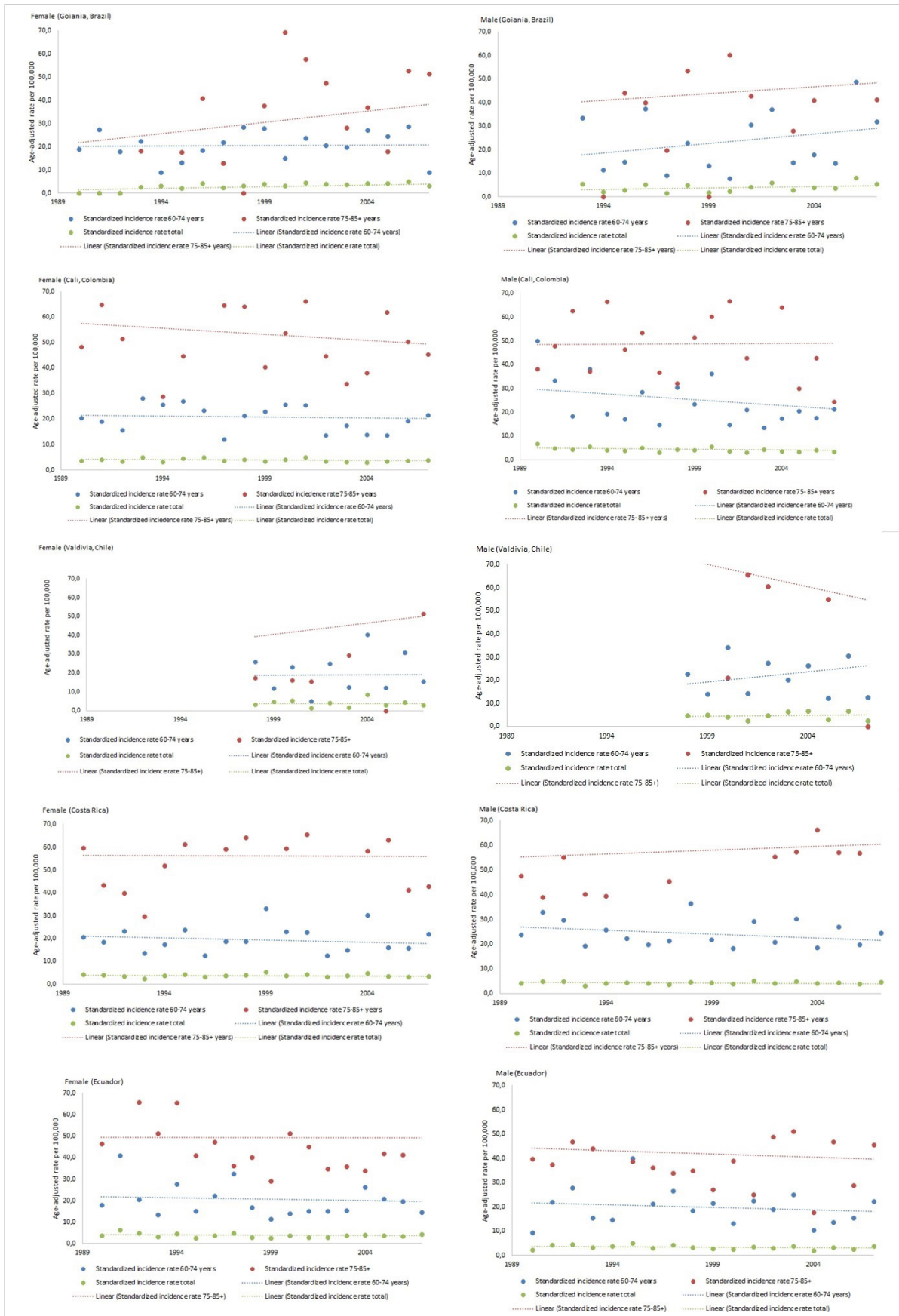
Table 1. Age-standardized incidence rate (ASIR), number of cases (N), average annual percent change (AAPC), and standardized incidence ratio (SIR) for pancreatic cancer by age and gender in Cali (Colombia), Valdivia (Chile), Costa Rica, Goiania (Brazil) and Quito (Ecuador) for the period 1990-2012

PBCR	Data availability	Age-groups	Male ASIR (N)	Male AAPC (95% CI[1])	Female ASIR (N)	Female AAPC (95% CI[1])	SIR
Cali (Colombia)	1990-2012	0-39	0.1 (12)	-	0.1 (22)	-	1
		40-59	5.6 (212)	-1.3 (-3.2; 0.7)	3.8 (175)	-0.8 (-3.4;1.8)	1.4
		60-74	23.7 (302)	-1.4 (-3.5; 0.7)	20.6 (346)	-0.3 (-2.0; 1.3)	1.1
		75-85+	48.1(199)	-0.6 (-3.2; 2.1)	50.8 (322)	-0.7 (-2.4; 1.0)	0.9
		Total	4.3 (728)	-1,1 (-2.3; 0.1)	3.7 (870)	-0.7 (-1.6; 0.3)	1.1
Costa Rica	1990-2011	0-39	0.1 (40)	-	0.1 (42)	-	1
		40-59	4.2 (319)	-1.7 (-3.5; 0.1)	3.4 (260)	-1.2 (-3.2; 0.9)	1.2
		60-74	22.7 (560)	-1.4 (-2.9 ;0.1)	18.6 (492)	-1.2 (-3.2; 0.9)	1.2
		75-85+	58.7 (508)	0.5 (-1.4; 2.5)	55.8 (580)	-0.5 (-3.0; 2.0)	1
		Total	4.2 (1427)	-0.8 (-1.9; 0.2)	3.6 (1376)	-0.9 (-2.4; 0.6)	1.1
Goiania (Brazil)	1993-2012	0-39	0.1 (11)	-	0.1 (15)	-	1
		40-59	4.8 (95)	4.7* (1.0; 8.6)	4.6 (105)	2.6 (-1.5; 6.8)	1
		60-74	26.8 (152)	4.0 (-0.2; 8.4)	20.5 (151)	0.2 (-2.0; 2.5)	1.3
		75-85+	46.5 (70)	-	37.0 (85)	-	1.2
		Total	4.4 (328)	3.5* (0.1; 7.1)	3.6 (356)	-	1.2
Quito (Ecuador)	1990-2012	0-39	0.1 (3)	-	0.1 (3)	-	1
		40-59	7.0 (45)	-1.9 (-5.2; 1.5)	5.0 (32)	-1.4 (-4.1; 1.5)	1.4
		60-74	25.0 (60)	-0.9 (-3.4; 1.6)	19.0 (53)	-0.2 (-2.2; 1.9)	1.3
		75-85+	40.4 (130)	-0.6 (-2.7; 1.6)	48.0 (217)	-0.1 (-1.9; 1.8)	0.8
		Total	3.3 (386)	-1.1 (-2.6; 0.4)	3.6 (542)	-0.4 (-1.8; 1.0)	0.9
Valdivia (Chile)	1998-2012	0-39	0.1 (3)	-	0.1 (3)	-	1
		40-59	7.0 (45)	-	5.0 (32)	-	1.4
		60-74	25.0 (60)	3.2 (-2.1; 8.8)	19.0 (53)	-0.5 (-9.3; 9.2)	1.3
		75-85+	57.2 (47)	-	48.6 (54)	-	1.1
		Total	5.0 (155)	1.6 (-2.6; 6.0)	3.8 (142)	-0.1 (-7.4; 7.9)	1.3

[1]95% confidence interval.

Table 2. Age-standardized mortality rate (ASMR) per 100.000, number of deaths (N) and pancreatic cancer mortality rate (SMR) ratio by sex and age group for 17 Latin American populations in the period 1995-2013

Population	Data availability	Age-groups	ASMR (N) Male	ASMR (N) Female	SMR
Argentina	1997-2013	0-39	0.1 (345)	0.1 (252)	1
		40-59	8.5 (5867)	5.6 (4150)	1.5
		60-74	43.2 (12836)	30.2 (11257)	1.4
		75-85+	94.0 (9459)	76.4 (14409)	1.2
		Total	7.6 (28507)	5.5 (30068)	1.3
Belize	1997-2013	0-39	0.2 (4)	0.1 (1)	2
		40-59	5.8 (18)	4.3 (14)	1.3
		60-74	16.3 (17)	26.2 (26)	0.6
		75-85+	46.2 (13)	88.0 (29)	0.5
		Total	3.7 (52)	5.1 (70)	0.7
Brazil	1996-2013	0-39	0.1 (1285)	0.1 (909)	1
		40-59	4.4 (14326)	3.1 (10783)	1.4
		60-74	21.7 (22354)	16.2 (20409)	1.3
		75-85+	56.7 (14090)	48.9 (19770)	1.1
		Total	4.1 (52055)	3.1 (51871)	1
Chile	1997-2013	0-39	0.1 (102)	0.1 (85)	1
		40-59	5.0 (1589)	4.4 (1449)	1.1
		60-74	27.4 (3053)	24.4 (3306)	1.1
		75-85+	59.2 (2247)	60.4 (3729)	0.9
		Total	4.8 (6991)	4.4 (8569)	1
Colombia	1997-2013	0-39	0.1 (252)	0.1 (209)	1
		40-59	3.2 (2147)	2.7 (2001)	1.1
		60-74	17.7 (3559)	16.9 (4094)	0.4
		75-85+	44.1 (2609)	44.6 (3814)	0.9
		Total	3.2 (8567)	3.0 (10118)	1
Costa Rica	1997-2013	0-39	0.1 (30)	0.1 (17)	1
		40-59	4.1 (306)	3.3 (250)	1.2
		60-74	20.3 (518)	17.6 (482)	1.1
		75-85+	68.0 (531)	60.6 (626)	1.1
		Total	4.1 (1385)	3.5 (1375)	1.1

Population	Data availability	Age-groups	ASMR (N)		SMR
			Male	Female	
Ecuador	1997-2013	0-39	0.1 (84)	0.1 (67)	1
		40-59	2.5 (484)	2.2 (450)	1.1
		60-74	12.8 (854)	13.6 (990)	0.9
		75-85+	34.2 (801)	36.0 (1047)	0.9
		Total	2.4 (2223)	2.5 (2554)	0.9
El Salvador	1997-2013	0-39	0.1 (29)	0.1 (31)	1
		40-59	2.2 (171)	2.0 (188)	1,1
		60-74	9.3 (302)	9.5 (371)	0.9
		75-85+	25.1 (236)	27.0 (356)	0.9
		Total	1.9 (738)	1.9 (946)	1
Guatemala	2000-2013	0-39	0.1 (64)	0.1 (43)	1
		40-59	2.4 (263)	2.3 (312)	1
		60-74	9.5 (413)	10.7 (519)	0.8
		75-85+	23.9 (310)	26.0 (424)	0.9
		Total	1.9 (1050)	2.0 (1298)	0.9
Mexico	1998-2013	0-39	0.1 (718)	0.1 (595)	1
		40-59	4.1 (5958)	4.0 (6008)	1
		60-74	21.3 (10343)	20.2 (10965)	1
		75-85+	43.1 (6976)	42.0 (9620)	1
		Total	3.7 (23995)	3.5 (27188)	1
Nicaragua	1997-2013	0-39	0.1 (28)	0.0 (15)	0
		40-59	2.3 (136)	2.3 (155)	1
		60-74	10.2 (201)	11.5 (265)	0.8
		75-85+	28.8 (172)	26.6 (230)	1
		Total	2.0 (537)	2.1 (665)	0.9
Panama	1998-2013	0-39	0.1 (13)	0.1 (11)	1
		40-59	3.0 (147)	2.6 (132)	1.1
		60-74	15.3 (273)	13.4 (247)	1.1
		75-85+	45.0 (281)	43.3 (320)	1
		Total	3.0 (714)	2.7 (710)	1.1
Paraguay	1996-2013	0-39	0.1 (34)	0.1 (18)	1
		40-59	3.1 (257)	2.7 (213)	1.1
		60-74	13.6 (374)	13.4 (383)	1
		75-85+	38.0 (307)	36.3 (376)	1
		Total	2.7 (972)	2.5 (990)	1
Peru	1999-2013	0-39	0.1 (139)	0.1 (116)	1
		40-59	2.3 (828)	2.6 (983)	0.8
		60-74	13.8 (1757)	13.8 (1908)	1
		75-85+	40.5 (1507)	37.4 (1927)	1
		Total	2.6 (4231)	2.6 (4934)	1
Suriname	1995-2013	0-39	0.2 (6)	0.1 (3)	2
		40-59	4.9 (42)	2.7 (24)	1.8
		60-74	18.7 (56)	11.9 (42)	1.5
		75-85+	31.6 (23)	29.2 (32)	1
		Total	3.5 (127)	2.3 (101)	1.5
Uruguay	1997-2013	0-39	0.2 (33)	0.1 (23)	2
		40-59	10.3 (615)	6.6 (434)	1.5
		60-74	50.4 (1465)	32.6 (1225)	1.5
		75-85+	103.3 (1164)	83.8 (1812)	1.2
		Total	8.9 (3277)	6.1 (3494)	1.4
Venezuela	1996-2013	0-39	0.0 (53)	0.0 (52)	0
		40-59	4.3 (1787)	3.3 (1436)	1.3
		60-74	18.7 (2423)	17.3 (2510)	1
		75-85+	46.8 (1570)	43.4 (2134)	1
		Total	3.6 (5971)	3.2 (6241)	1.1

Finally, Table 3 shows there were increasing trends in the age group 75-85+ years in Chile's male mortality rates (AAPC: 0.88%; 95% CI: 0.00; 1.77), El Salvador (AAPC: 4.03%; 95% CI: 0.60; 7,57), Paraguay (AAPC: 4.23%; 95% CI: 0.73; 7.85) and Peru (AAPC: 1.76%; 95% CI: 0.21; 3.33). For Mexico, there was a trend towards a reduction in mortality (AAPC: -0.98%; 95% CI: -1.53; -0.43). In females, there were increasing trends in mortality rates for Brazil (AAPC: 1.05%; 95% CI: 0.72; 1.37), El Salvador (AAPC: 2.69%; 95% CI: 0.03; 5.42), Chile (AAPC: 1.01%; 95% CI: 0.59; 1.44), Ecuador (AAPC: 1.98%; 95% CI: 0.47; 3.52) and Colombia (AAPC: 1.28%; 95% CI: 0.70; 1.86). There was a downward trend only for Costa Rica (AAPC: -2.46%; 95% CI: -3.77; -1.13).

Table 3. Pancreatic cancer mortality trends by sex and age group for 17 Latin American populations from 1995 to 2013

Population	Data availability	Age-groups	AAPC (95% CI) Male	AAPC (95% CI) Female
Argentina	1997-2013	0-39	-0.82 (-2.82; 1.24)	1.14 (-1.42; 3.77)
		40-59	-0.78 (-1.27; -0.30)	0.18 (-0.47; 0.82)
		60-74	0.01 (-0.46; 0.48)	0.29 (-0.12; 0.69)
		75-85+	0.04 (-0.40; 0.49)	0.04 (-0.37; 0.45)
		Total	-0.18 (-0.47; 0.10)	0.20 (-0.08; 0.49)
Belize	1997-2013	0-39	-	-
		40-59	-	-
		60-74	-	-
		75-85+	-	-
		Total	-	-5.88 (-11.80; 0.44)
Brazil	1996-2013	0-39	0.34 (-0.77; 1.45)	0.78 (-0.86; 2.45)
		40-59	0.93 (0.57; 1.29)	2.32 (1.94; 2.71)
		60-74	1.09 (0.76; 1.42)	1.38 (1.07; 1.69)
		75-85+	0.27 (-0.21; 0.75)	1.05 (0.72; 1.37)
		Total	0.81 (0.56; 1.06)	1.46 (1.25; 1.66)
Chile	1997-2013	0-39	2.64 (-1.42; 6.88)	-0.09 (-4.47; 4.48)
		40-59	0.64 (-0.49; 1.77)	0.72 (-0.26; 1.71)
		60-74	0.52 (-0.11; 1.16)	1.17 (0.37; 1.98)
		75-85+	0.88 (0.00; 1.77)	1.01 (0.59; 1.44)
		Total	0.62 (0.14; 1.10)	0.98 (0.46; 1.51)
Colombia	1997-2013	0-39	-0.68 (-2.75; 1.44)	-2.08 (-5.62; 1.60)
		40-59	0.34 (-0.59; 1.29)	-0.59 (-1.63; 0.46)
		60-74	-0.51 (-1.06; 0.05)	-0.90 (-1.39; -0.42)
		75-85+	0.51 (-0.38; 1.42)	1.28 (0.70; 1.86)
		Total	0.01 (-0.38; 0.40)	-0.24 (-0.58;0.11)
Costa Rica	1997-2013	0-39	-	-
		40-59	-0.70 (-2.28; 0.92)	0.33 (-2.49; 3.24)
		60-74	-0.43 (-2.21; 1.39)	-0.77 (-2.95; 1.46)
		75-85+	-1.62 (-3.37; 0.16)	-2.46 (-3.77; -1.13)
		Total	-0.87 (-2.08; 0.36)	-1.19 (-2.70; 0.34)
Ecuador	1997-2013	0-39	-2.63 (-9.02; 4.21)	-0.97 (-5.82;4.12)
		40-59	0.16 (-1.41; 1.76)	-1.64 (-3.43;0.17)
		60-74	-0.49 (-1.86; 0.89)	-1.52 (-2.89;-0.13)
		75-85+	0.64 (-0.06; 1.34)	1.98 (0.47;3.52)
		Total	-0.10 (-0.97; 0.78)	-0.55 (-1.57;0.48)
El Salvador	1997-2013	0-39	-	-
		40-59	3.77 (0.34; 7.33)	5.83 (1.81;10.02)
		60-74	2.88 (0.38; 5.43)	2.32 (-0.18;4.88)
		75-85+	4.03 (0.60; 7.57)	2.69 (0.03;5.42)
		Total	3.50 (1.39; 5.65)	3.27 (1.41; 5.17)
Guatemala	2000-2013	0-39	-	-5.93 (-12.78; 1.45)
		40-59	-0.50 (-3.18; 2.24)	-0.57 (-2.40; 1.29)
		60-74	-0.18 (-3.47; 3.22)	2.48 (-0.02; 5.04)
		75-85+	0.93 (-2.47; 4.44)	-0.45 (-2.70; 1.85)
		Total	-0.30 (-2.41; 1.86)	0.71 (-0.65; 2.10)
Mexico	1998-2013	0-39	-0.67 (-1.78; 0.45)	-1.20 (-2.75; 0.36)
		40-59	-0.74 (-1.45; -0.03)	-1.45 (-2.01; -0.88)
		60-74	-0.73 (-1.35; -0.12)	-0.17 (-0.64; 0.30)
		75-85+	-0.98 (-1.53; -0.43)	-0.41 (-0.83; 0.01)
		Total	-0.80 (-1.30; -0.30)	-0.55 (-0.83; -0.27)
Nicaragua	1997-2013	0-39	-	-
		40-59	4.00 (-0.95; 9.19)	1.91 (-1.78; 5.74)
		60-74	2.09 (-1.68; 6.00)	2.51 (0.36; 4.71)
		75-85+	1.38 (-3.38; 6.37)	3.86 (-0.44; 8.34)
		Total	1.82 (-0.82; 4.53)	2.66 (0.47; 4.90)

Population	Data availability	Age-groups	AAPC (95% CI)	
			Male	Female
Panama	1998-2013	0-39	-	-
		40-59	3.18 (-3.18; 9.96)	0.04 (-2.56; 2.71)
		60-74	-1.21 (-4.19; 1.86)	1.19 (-0.92; 3.35)
		75-85+	1.20 (-1.59; 4.08)	1.00 (-2.06; 4.15)
		Total	0.33 (-2.01; 2.72)	0.90 (-0.91; 2.74)
Paraguay	1996-2013	0-39	-	-
		40-59	1.45 (-0.82; 3.76)	2.48 (0.07; 4.95)
		60-74	1.30 (-0.88; 3.54)	3.62 (1.96; 5.31)
		75-85+	4.23 (0.73; 7.85)	1.76 (-0.15; 3.70)
		Total	2.06 (0.65; 3.48)	2.78 (1.81; 3.77)
Peru	1999-2013	0-39	-2.34 (-5.64; 1.08)	0.51 (-4.44; 5.72)
		40-59	1.30 (0.28; 2.33)	1.61 (0.15; 3.09)
		60-74	1.76 (0.36; 3.17)	2.25 (0.68; 3.85)
		75-85+	1.76 (0.21; 3.33)	1.37 (-0.25; 3.03)
		Total	1.56 (0.53; 2.61)	1.82 (0.65; 3.00)
Suriname	1995-2013	0-39	-	-
		40-59	-	-
		60-74	-	-
		75-85+	-	-
		Total	3.74 (-0.43; 8.08)	-
Uruguay	1997-2013	0-39	-	-
		40-59	-	-
		60-74	-	-
		75-85+	-	-
		Total	-	-
Venezuela	1996-2013	0-39	-2.81 (-5.61;0.08)	-2.13 (-5.42;1.26)
		40-59	0.52 (-0.39;1.44)	0.30 (-0.44;1.05)
		60-74	-0.12 (-1.12;0.89)	0.00 (-0.65;0.66)
		75-85+	0.42 (-0.26;1.10)	0.17 (-0.57;0.92)
		Total	0.12 (-0.49; 0.74)	0.06 (-0.33; 0.46)

In the age group 40-59 years, there was a tendency for the mortality rate to increase in El Salvador (AAPC: 3.77%; 95% CI: 0.34; 7.33) and (AAPC: 5.83%; 95% CI: 1.81; 10.02) for male and female, respectively. While in Argentina there was a tendency to reduce the mortality rate (AAPC: -0.78%; 95% CI: -1.27; -0.30) for males aged 40-59 years.

DISCUSSION

The present study is a precursor in analyzing the trends of incidence and mortality from pancreatic cancer in Latin America. It is also the most complete one, considering the largest number of countries in this continent and demonstrating the relevance of this disease by age groups and sex. Thus, it was found that the highest incidence for pancreatic cancer was recorded for the age group 60-74 years. This rate was higher in males, similar in other studies, such as in Brazil (15), China (4.01 and 2.72 new cases per 100.000 inhabitants), for men and women, respectively (16) and for Europe (17). Regarding incidence trends, non-significant variations were found for both sexes. This result is opposite to the found for the United States (male: AAPC: 0.8%; p <0.05 and female: AAPC: 0.9%; p0.05) (18).

Several modifiable and non-modifiable risk factors have been associated with pancreatic cancer such as smoking, considered the main environmental factor for this cancer worldwide, present in 30% of those affected which, when associated with alcohol, potentiates this risk; chronic pancreatitis; diabetes mellitus; genetic factors, obesity and physical inactivity (19-21). Moreover, the increase in the senile population further increases the incidence of this cancer in the population.

Concerning smoking, a meta-analysis study points out that the use of tobacco, with or without smoke, increases the risk of pancreatic cancer, as it presents toxic and carcinogenic substances which are associated with disordered celular growth and transformation, reduction of cell cycle repair and defective cell apoptosis (22). Moreover, authors (23) emphasize that the amount of daily cigarettes and duration of smoking also influence, as the relative risk increased from 1.6 per 10 cigarettes/day to 2.2 per 30 cigarettes/day and 1.3 per 10 years of smoking to 1.8 per 30 years of smoking. However, there are positive effects when smoking decreases. Therefore, the adoption of harm reduction policies as a strategy for the prevention of this cancer becomes evident.

Regarding the chronic pancreatitis relationship, the influence of this pathology is due to the local inflammatory

process (24), besides, mutations in genes such as: cationic trypsinogen (PRSS1); serine protease inhibitor Kazal type 1 (SPINK1); chymotrypsin C (CTRC) or transmembrane conductance regulatory genes (CFTR), as well as alcohol abuse has also been reported in countries such as Australia, Japan, China and India as one of the most common factors that increase susceptibility to pancreatic cancer (25,20). Concerning diabetes, epidemiological evidence shows an association with cancer suggested by a tumorigenic effect of hyperglycemia and the mitogenic effect of hiperinsulinemia, causing pancreatic metastasis and proliferation. Due to the glucose dependence of cancer cells, individuals with high glycemic indexes can present a fast growth of these cells, increasing the aggressiveness and mortality (26-28).

The worldwide prevalence of type 2 diabetes mellitus in 2013 was 8.3% of adults, with a rate of 9.9% for 2030 (29). In the Americas, the number of individuals with diabetes was estimated at 35 million for the year 2000 and projected to 64 million by 2025 (30). The prevalence of this disease in Chile was 9.4% in 2009 (30), and in Brazil, according to the 2013 National Health Survey, the prevalence was 6.2%, with an estimated 9 million people with diabetes in the country (31). Given this scenario, there is a need for effective actions aimed at controlling and preventing this disease, especially in primary care, since DM is considered a sensitive condition for primary care, which is the main articulator of care (32).

Pancreatic cancer has a median survival of 3 to 6 months (16), and a relative 5-year survival rate of only 8.2% (33), so it has a high lethality rate. Mortality trends for Brazil, Peru, El Salvador, Paraguay, Nicaragua, and Chile have changed significantly. These results corroborate those of European Union countries, which showed a significant upward trend for both sexes between 1998 and 2012 (AAPC = 0.4% for males and AAPC = 0.8% for females) (34). In Canada, on the other hand, the analysis of mortality trends from 1992 to 2005 found that there was a decrease in age-standardized mortality rates from 7% for men (from 11.18 per 100.000 in 1992 to 10.38 per 100.000 in 2004) and a slight increase of 3% for women (from 7.98 per 100.000 in 1992 to 8.23 in 2004) (35).

In a population-based study conducted in Brazil from 2001 to 2015, stability in female mortality rates was observed (AAPC=0.4%; 95% CI: -0.2; 1.0). It also presented a significant increase in the mortality trend for men (AAPC=3.7%; 95% CI: 0.6-7.0) (15), differing from our study, which showed an increase for both sexes. Accordingly, a study that sought to examine global trends in incidence and mortality demonstrated increased mortality in many countries, with a higher incidence among men. However, it has been elucidated that in some countries, such as Finland, Denmark and North American countries, this increase affects both sexes (36). Given this, it may be inferred the relationship of the adoption of different methodologies of correction of sub-registration of the data used by the studies, differing the results.

From this perspective, pancreatic cancer is a major challenge for Latin America. The epidemiological, nutritional and demographic transitions observed in recent decades have resulted in increased morbidity and mortality from chronic noncommunicable diseases such as diabetes and obesity, which may impact future rates of pancreatic cancer. Consequently, there is a need for the organization of strategies for coping with noncommunicable chronic diseases, as well as for modifiable risk factors such as overweight, physical inactivity, smoking and excessive alcohol consumption (3).

Regarding the mortality profile observed in these countries, it may represent a reflection of the fragmentation of health systems, which provide minimal care, with delays in the diagnosis and treatment of cancer (3). To change this situation, it is necessary to increase investment to understand this disease, promote the search for therapeutic targets that can be tested in clinical trials, and identify early detection strategies (15).

Regarding the availability of incidence data, there was a lack of data for the age group from 0 to 39 years old for all countries, making it impossible to analyze this age group. Regarding mortality, there were no data available from Belize and Uruguay. Nevertheless, despite these limitations, the data used in this study were validated by the International Agency for Research on Cancer (IARC) and World Health Organization (WHO), thus being able to describe mortality in Latin American countries.

This study analyzed the incidence of pancreatic cancer in four Latin American cities and one country (Costa Rica) and the mortality trends for pancreatic cancer in 17 Latin American countries. There were trends of stable incidence for females in all countries and age groups. Regarding mortality, there were stability trends in most Latin American countries for both sexes, but it has been highlighted those with an increasing trend, such as Brazil, El Salvador, Peru, Paraguay, Nicaragua and Chile ♣

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