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# BMJ Open Burden of gastric and digestive cancers in the French Caribbean: perspectives from population-based cancer registries of Martinique, Guadeloupe and French Guiana (2007–2014)

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## ABSTRACT

**Objectives** Data from population-based cancer registries contribute to improving our knowledge of digestive cancer trends worldwide. In this study, we present cancer incidence and mortality in Guadeloupe, French Guiana and Martinique for the periods 2008–2014, 2010–2014 and 2007–2014, respectively.

**Design** Data were extracted from population-based cancer registries. World-standardised incidence (WSI) and mortality (WSM) rates were calculated. Main digestive cancers were analysed, including oesophagus, stomach, colorectum, liver and pancreas cancers.

**Setting** This study was performed based on data from French Territories in the Caribbean.

**Results** We observed a lower-incidence compared with mainland France, except for stomach cancer for which the incidence is high, with significant standardised incidence ratios in men and women at 1.90 vs 2.29 for Guadeloupe and French Guiana and 1.58 vs 2.31 for Martinique. We found a lower-mortality, except for stomach cancer for which the mortality remains high, with significant mortality ratios in men and women at 2.10 vs 2.74 for Guadeloupe, 1.64 vs 1.79 for French Guiana and 2.05 vs 2.53 for Martinique. Overall, these three regions have similar WSI and WSM rates which remain lower than those in mainland France. We noticed an overall high incidence and high mortality in men compared with women as in France.

**Conclusions** There is a high incidence of stomach cancer in French overseas territories. Publication of these data contributed to expanding knowledge on the epidemiology of world cancers with data from the Caribbean zone.

## INTRODUCTION

A total number of 111 933 new cancer cases were estimated in the Caribbean in 2018 according to GLOBOCAN database. The most common cancer types were prostate, breast, lung and colorectum cancers; cervical and stomach cancers had higher incidence rates compared with mainland France.

## Strengths and limitations of this study

- The purpose of this project is to present incidence and mortality for digestive cancer in Guadeloupe, French Guiana and Martinique for the 2007–2014 period.
- This study will contribute to expanding knowledge on the epidemiology of world cancers with data from the Caribbean zone.
- Potential limitations include the fact that comorbidities and risk factors are not recorded and thus cannot be taken into account in statistical analyses.

Digestive cancer represented 20.6% of these incident cases in both sexes.<sup>1</sup>

Main identified risk factors of digestive cancers include socioeconomic status, chronic tobacco smoking and alcoholism. Conversely, a diet rich in fruit and vegetables has been shown to have a protective effect.<sup>2</sup> Other risk factors of oesophageal adenocarcinoma include gastro-oesophageal reflux and obesity.<sup>3</sup> For stomach cancer, *Helicobacter pylori* infection, high intake of salt, exposure to N-nitroso compounds (through diet, tobacco and endogenous synthesis) have been identified as major causes of cancer development.<sup>4</sup>

The French West Indies have a particular sociodemographic profile compared with the Caribbean, with high life expectancy and favourable health indicators. Nevertheless, certain digestive cancers appear in overincidence such as stomach cancer<sup>4</sup> and underline the need for a study of the evolution of cancers over time from the cancer registries.

The cancer control strategy implemented with the various cancer plans in France<sup>5</sup> has enabled the deployment of significant

resources to reduce disparities in the face of cancer. Through the development of health promotion policies, the general population is made aware of the impact of certain risk factors on the development of cancer. Studies are, therefore, necessary in order to explore the evolution of digestive cancers in our regions.<sup>6–9</sup>

Data from population-based cancer registries contribute to improving our knowledge of cancer trends worldwide. The cancer indicators generated are useful for the general population, for researchers, clinicians and local and governmental organisations, and to decision-makers in public health. Pooling of data from the three registries of the French overseas departments will make it possible to identify clinical and epidemiological characteristics of digestive cancers. In this study we present incidence and mortality for digestive cancer in Guadeloupe, French Guiana and Martinique for the 2008–2014, 2010–2014 and 2007–2014 periods, respectively.

## METHODS

### Data sources for incidence and mortality

The population-based cancer registries of Martinique, Guadeloupe and French Guiana use patient records which are reviewed actively. The data quality control procedures are performed according to the French Network of cancer registries FRANCIM and the International Agency for Research cancer. The control of all available cancer data sources guarantees high quality cancer registration data for international comparisons.

### Incidence data

Data were extracted for Guadeloupe, French Guiana and Martinique for the periods 2008–2014, 2010–2014 and 2007–2014, respectively. They are coded according to the International Classification of Diseases for Oncology, Third Edition. For mainland France, incidence data (2007–2016 period) were estimated from healthcare and registry data, using a dedicated method described elsewhere.<sup>10</sup>

### Mortality data

Mortality data cover the period 2007–2014. All the data were extracted from the Centre for Epidemiology of the medical causes of death. Data for the year 2012 were not exploitable for Martinique.

### Statistical methods

Standardised rates were calculated using the world standard population of the WHO as standard.<sup>11</sup> The standardised incidence ratio (SIR) or standardised mortality ratio (SMR) were calculated in this study, using incidence and mortality rates from mainland France as references. We present the average annual number of cases and deaths observed and the world-standardised incidence and mortality rates by regions, and at national level. The SIR and SMR for these three regions are also presented, with 95% CIs.

## Patient and public involvement

Our study did not involve direct patient contact. Patients were not involved in the design of this study. Regarding patient involvement, cancer cases are identified through multidisciplinary team meetings, through medical records and the registry, according to the Registry procedures (French National authority for the protection of privacy and personal data).

## RESULTS

Main digestive cancers were analysed, including oesophagus, stomach, colorectum, liver and pancreas cancers. In our study, we observed a lower-incidence in all digestive cancer, except for stomach cancer.

### Oesophagus

In Martinique, Guadeloupe and French Guiana, oesophageal cancer affects on average 34 men and 6 women per year (tables 1 and 2), that is, 1.6% of incident cancer cases in men and 0.4% in women. It was responsible for 26 deaths per year in men between 2007 and 2014 (table 1), representing 3.0% of cancer deaths, and four deaths per year in women (0.6%).

### Stomach

In the French West Indies, 80 individuals were diagnosed with stomach cancer each year, respectively, in Guadeloupe and Martinique, and 20 in French Guiana. Stomach cancer is more common in these Departments than in mainland France, and represents 4.5% of cancers in men in Martinique, 5.3% in Guadeloupe and 5.7% in French Guiana.

In men, it is the third most common malignancy in Martinique and Guadeloupe, and fourth most common in French Guiana. In women, it is the third most common malignancy in Martinique and fourth most common in Guadeloupe, whereas it is eighth in French Guiana.

Observed incidence is comparable in men in Guadeloupe and French Guiana (respectively, 14.3 and 14.6 per 100 000 person-years), and lower in Martinique (12.1). In women, world-standardised incidence rates are 6.9 in Martinique, 7.2 in French Guiana and 7.3 in Guadeloupe. This higher incidence of stomach cancer, with significant SIRs at 1.90 for Guadeloupe and French Guiana and 1.58 for Martinique, place these 3 Departments at the top 3 of French regional incidence for this cancer.

In line with incidence data, mortality is also higher than in mainland France. In men, the world-standardised mortality rate, which reached 9.3 per 100 000 person-years in Guadeloupe, 8.9 in Martinique and 7.3 in French Guiana, is between 1.6 and 2.1 times higher than the corresponding rate in mainland France (4.5) and in most French regions with the exception of Corsica. These differences are also evident for stomach cancer mortality in women, where the world-standard mortality rate of 4.4 per 100 000 person-years in Guadeloupe is more than 2.7 times higher than that of mainland France (1.7). Among

**Table 1** Annual number of new cases and deaths for digestive cancers in men, standardised incidence and mortality rates, SIR and SMR, with 95% CI

	Incidence		Mortality			
	New cases*	WSR†	SIR‡	Deaths	WSR†	SMR‡
<b>Oesophagus</b>						
Guadeloupe	18 (15 to 21)	6.1 (5.1 to 7.4)	0.78 (0.65 to 0.93)	14 (12 to 17)	4.8 (4.0 to 5.9)	0.89 (0.73 to 1.07)
Martinique	12 (10 to 15)	3.8 (3.1 to 4.8)	0.52 (0.42 to 0.63)	10 (7 to 12)	2.8 (2.2 to 3.8)	0.56 (0.43 to 0.71)
French Guiana	4 (2 to 6)	4.5 (2.7 to 7.2)	0.56 (0.34 to 0.88)	2 (1 to 4)	2.8 (1.6 to 4.6)	0.52 (0.31 to 0.82)
Mainland France	3998 (3851 to 4153)	7.23 (6.95 to 7.51)		3031 (2993 to 3070)	5.18 (5.11 to 5.25)	
<b>Stomach</b>						
Guadeloupe	50 (44 to 55)	14.3 (12.8 to 16.1)	1.9 (1.70 to 2.11)	32 (29 to 37)	9.3 (8.2 to 10.7)	2.1 (1.85 to 2.37)
Martinique	43 (39 to 48)	12.1 (10.8 to 13.7)	1.58 (1.42 to 1.76)	33 (29 to 38)	8.9 (7.7 to 10.3)	2.05 (1.79 to 2.33)
French Guiana	14 (11 to 17)	14.6 (11.2 to 18.7)	1.9 (1.48 to 2.41)	6 (5 to 8)	7.3 (5.3 to 9.8)	1.64 (1.21 to 2.17)
Mainland France	4707 (4561 to 4859)	7.88 (7.62 to 8.14)		2952 (2914 to 2990)	4.54 (4.48 to 4.61)	
<b>Colon-rectum</b>						
Guadeloupe	81 (74 to 88)	26.2 (24.0 to 28.6)	0.66 (0.61 to 0.72)	34 (30 to 39)	10.1 (8.9to 11.5)	0.74 (0.66 to 0.84)
Martinique	90 (83 to 97)	26.9 (24.8 to 29.2)	0.7 (0.65 to 0.76)	39 (35 to 44)	10.8 (9.5 to 12.4)	0.8 (0.71 to 0.90)
French Guiana	23 (19 to 27)	25 (20.4 to 30.3)	0.7 (0.57 to 0.84)	5 (3 to 6)	6.3 (4.4 to 8.7)	0.46 (0.33 to 0.64)
Mainland France	22828 (22442 to 23222)	37.8 (37.2 to 38.5)		8976 (8910 to 9041)	12.7 (12.6 to 12.8)	
<b>Liver</b>						
Guadeloupe	10 (8 to 13)	3.6 (2.8 to 4.7)	0.27 (0.21 to 0.33)	15 (12 to 18)	4.8 (3.9 to 5.8)	0.5 (0.41 to 0.59)
Martinique	11 (9 to 13)	3.3 (2.6 to 4.3)	0.27 (0.22 to 0.33)	18 (15 to 22)	5.4 (4.5 to 6.7)	0.57 (0.48 to 0.68)
French Guiana	9 (7 to 12)	10.5 (7.6 to 14.3)	0.85 (0.62 to 1.13)	5 (3 to 7)	5.9 (4.2 to 8.2)	0.66 (0.47 to 0.91)
Mainland France	6989 (6730 to 7261)	12.38 (11.91 to 12.87)		5739 (5686 to 5791)	9.25 (9.16 to 9.34)	
<b>Pancreas</b>						
Guadeloupe	15 (13 to 19)	4.8 (3.9 to 6.0)	0.51 (0.42 to 0.62)	24 (20 to 27)	7 (6.0 to 8.2)	0.94 (0.81 to 1.08)
Martinique	24 (20 to 27)	7 (6.0 to 8.2)	0.75 (0.65 to 0.87)	25 (22 to 29)	6.9 (5.8 to 8.2)	0.94 (0.80 to 1.09)
French Guiana	5 (3 to 7)	5.5 (3.4 to 8.3)	0.58 (0.37 to 0.86)	4 (3 to 6)	5.8 (4.0 to 8.3)	0.69 (0.48 to 0.96)
Mainland France	5581 (5460 to 5705)	9.52 (9.30 to 9.74)		4808 (4760 to 4857)	7.7 (7.62 to 7.79)	

\*Incidence mainland France: 2007–2016; Guadeloupe: 2008–2014; Martinique: 2007–2014; French Guiana: 2010–2014.

†WSR: rates are standardised to the age structure of the world standard population and expressed per 100000 person-years.

‡Ratios standardised to mainland France.

SIR, standardised incidence ratio; WSR, world-standardised rates.

**Table 2** Annual number of new cases and deaths for digestive cancers in women, standardised incidence and mortality rates, SIR and SMRs, with 95% CI

	Incidence				Mortality				
	New cases*				Deaths				
	WSR†	SIR‡	WSR†	SMR‡	WSR†	SIR‡	WSR†	SMR‡	
<b>Oesophagus</b>									
Guadeloupe	3 (2.0 to 5.0)	0.9 (0.5 to 1.5)	0.52 (0.33 to 0.79)	2 (1 to 3)	0.4 (0.2 to 0.9)	0.45 (0.25 to 0.75)			
Martinique	2 (2.0 to 4.0)	0.6 (0.3 to 1.1)	0.4 (0.24 to 0.61)	2 (1 to 4)	0.6 (0.3 to 1.2)	0.55 (0.32 to 0.88)			
French Guiana	1 (0.0 to 3.0)	1.2 (0.4 to 2.8)	0.82 (0.30 to 1.79)	0 (0 to 1)	0.4 (0.1 to 1.4)	0.43 (0.09 to 1.27)			
Mainland France	1072 (1018 to 1130)	1.49 (1.41 to 1.58)		794 (774 to 813)	0.96 (0.93 to 0.98)				
<b>Stomach</b>									
Guadeloupe	32 (28 to 37)	7.3 (6.3 to 8.6)	2.29 (2.00 to 2.61)	23 (19 to 26)	4.4 (3.7 to 5.3)	2.74 (2.35 to 3.16)			
Martinique	34 (30 to 39)	6.9 (6.0 to 8.0)	2.31 (2.04 to 2.60)	22 (19 to 26)	3.7 (3.1 to 4.7)	2.53 (2.15 to 2.94)			
French Guiana	8 (5 to 10)	7.2 (5.0 to 10.1)	2.29 (1.62 to 3.15)	3 (2 to 4)	3.3 (2.1 to 5.1)	1.79 (1.15 to 2.66)			
Mainland France	2587 (2508 to 2670)	3.22 (3.11 to 3.34)		1665 (1637 to 1694)	1.71 (1.68 to 1.75)				
<b>Colon-rectum</b>									
Guadeloupe	70 (64 to 76)	17.3 (15.7 to 19.2)	0.68 (0.62 to 0.75)	29 (26 to 33)	6.2 (5.4 to 7.3)	0.76 (0.66 to 0.86)			
Martinique	85 (79 to 92)	20.4 (18.8 to 22.3)	0.8 (0.74 to 0.86)	41 (36 to 46)	7.8 (6.8 to 9.0)	0.98 (0.87 to 1.10)			
French Guiana	18 (14 to 22)	17.4 (13.8 to 21.7)	0.75 (0.60 to 0.92)	4 (3 to 6)	3.8 (2.5 to 5.5)	0.54 (0.37 to 0.77)			
Mainland France	19174 (18895 to 19458)	24.4 (24.0 to 24.8)		7938 (7877 to 8000)	7.5 (7.4 to 7.6)				
<b>Liver</b>									
Guadeloupe	4 (3 to 6)	1.1 (0.7 to 1.8)	0.44 (0.30 to 0.63)	9 (7 to 11)	2 (1.5 to 2.7)	0.84 (0.65 to 1.06)			
Martinique	7 (5 to 9)	1.8 (1.3 to 2.7)	0.64 (0.48 to 0.84)	12 (9 to 15)	2.5 (1.9 to 3.4)	1.04 (0.83 to 1.29)			
French Guiana	3 (2 to 5)	2.7 (1.5 to 4.8)	1.21 (0.66 to 2.02)	2 (1 to 3)	1.8 (1.0 to 3.2)	0.86 (0.47 to 1.43)			
Mainland France	Not Available			2118 (2087 to 2151)	2.24 (2.20 to 2.29)				
<b>Pancreas</b>									
Guadeloupe	12 (9 to 15)	3 (2.3 to 3.9)	0.43 (0.34 to 0.53)	22 (19 to 26)	4.8 (4.0 to 5.7)	0.98 (0.84 to 1.13)			
Martinique	22 (19 to 25)	4.4 (3.7 to 5.4)	0.75 (0.64 to 0.87)	24 (21 to 28)	4.4 (3.6 to 5.3)	0.97 (0.83 to 1.13)			
French Guiana	5 (3 to 7)	4.8 (3.0 to 7.4)	0.76 (0.48 to 1.13)	3 (2 to 5)	3.2 (2.0 to 5.0)	0.72 (0.47 to 1.06)			
Mainland France	5278 (5152 to 5407)	6.46 (6.29 to 6.63)		4601 (4554 to 4648)	4.83 (4.77 to 4.89)				

\*Incidence mainland France: 2007–2016; Guadeloupe: 2008–2014; Martinique: 2007–2014; French Guiana: 2010–2014

†WSR: rates are standardised to the age structure of the world standard population and expressed per 100000 person-years.

‡Ratios standardised to mainland France.

§FRANCIM, Réseau Français des Registres des Cancers; GLOBOCAN, From the Global Cancer Observatory; SIR, standardised incidence ratio; WSR, world-standardised rates.



the French West Indies, Guadeloupe has the highest world-standard mortality rates, in both men and women.

### Colon-rectum

In the regions of Guadeloupe, Martinique and French Guiana, on average, 194 men and 173 women per year are diagnosed with colorectal cancer (CRC) (tables 1 and 2), that is, 9.0% of incident cancer cases in men and 12.2% in women. CRC was responsible for 78 deaths per year in men from 2007 to 2014, representing 9.1% of all cancer-related deaths, and 74 deaths per year in women (11.2%).

Overall, these three regions have similar world-standardised incidence rates, which remain lower than incidence in France as a whole; CRC mortality is also lower.

### Liver

In Guadeloupe, Martinique and French Guiana, liver cancer is diagnosed in an average of 30 men and 14 women per year, accounting for 1.4% of incident cancer cases in men, and 1.0% in women. It was responsible for 38 deaths per year in men from 2007 to 2014, representing 4.4% of cancer-related deaths, and 23 deaths per year in women (3.5% of cancer-related deaths).

### Pancreas

In Martinique, Guadeloupe and French Guiana, pancreatic cancer is diagnosed in an average of 44 men and 39 women per year, accounting for 2.0% of incident cancers in men and 2.7% in women. It was responsible for 53 deaths per year between 2007 and 2014, corresponding to 6.2% of cancer deaths in men and 49 deaths per year (7.4% of cancer-related deaths) in women.

## DISCUSSION

Overall, Martinique, Guadeloupe and French Guiana present world-standardised incidence rates that vary somewhat between the three regions, but that are in general lower than overall rates for the whole of France; there is also lower mortality related to oesophageal cancer.

The incidence of oesophageal cancer has been declining for several years in men, whereas it is increasing in women.

The majority of oesophageal cancers can be classed into two histological groups. Epidermoid cancers are the most frequent in France in both men and women.<sup>12</sup> Furthermore, WHO has established that X-rays and gamma radiation can contribute to oesophageal cancer. The second histological type is adenocarcinoma; the majority of adenocarcinomas of the oesophagus develop in the context of endobrachyoesophagus (Barrett's oesophagus), following the metaplasia–dysplasia–carcinoma sequence.

In the Caribbean, few data are available on oesophagus cancers incidence and mortality; data available from Global Cancer Observatory (GLOBOCAN) Observatory show that incidence cancer of oesophagus cancer was

below 4.0 per 100 000 person-years in men and below 1.0 in women. Latin America and the Caribbean (LAC) region had the lowest incidence rates for this cancer compared with Europe (1.3 per 100 000 in women and 5.8 in men) or Asia (5.3 per 100 000 in women and 12.1 in men). Mortality data in the LAC was 0.91 per 100 000 person-years in women and 3.7 in men. In our study, our rates are similar to those observed in the LAC.<sup>13 14</sup>

We observed incidence and mortality rates of 6.0 and 4.5 per 100 000 person-years in women for stomach cancer. In men these rates were respectively 11.0 and 8.8 per 100 000 person-years. In our study, we observed higher incidence and mortality rate compared with mainland France, especially in men.<sup>14</sup> The estimated incidence of stomach cancer in France is among the lowest of all the estimates provided by the WHO.<sup>15</sup> Incidence of stomach cancer is on the decline over the long term, and this is confirmed by the observations between 2005 and 2012 in mainland France.<sup>16</sup> Mortality has also been declining persistently since the 1990s.<sup>16</sup>

The risk of stomach cancer is increased in first-degree relatives of a patient with stomach cancer, in individuals who have undergone partial gastrectomy for cancer, or in those who have undergone endoscopic treatment for gastric cancer, as well as in case of precancerous lesions of the stomach and in persons originating from regions with high stomach cancer incidence. Obesity and gastro-oesophageal reflux are risk factors for cardia cancer.<sup>17–19</sup> In Guadeloupe, prevalence of *H. pylori* infection, the main risk factor for this type of cancer, was estimated to be 55% in blood donors. Further studies are required to estimate the prevalence in the general population, and among patients with cancer. Environmental risk factors, as well as high intake of salt, and smoked meat and fish in the French West Indies, as in certain Asian countries, could also contribute to the high incidence of stomach cancer. Consumption of fruit and vegetables has a protective effect against stomach cancer.

In the LAC regions, CRC incidence rates in women was 15.1 per 100 000 person-years in women and 18.5 in men. Mortality rates were, respectively, 7.3 per 100 000 person-years in women and 9.4 in men.<sup>14</sup> In our study, we observed that our incidence and mortality rates were higher compared with Caribbean rates. This could be explained by the development of organised CRC screening since 2008 in Martinique and Guadeloupe, and in 2009 in French Guiana, that could help to detect more cancer cases. Furthermore, we observed that western lifestyle impacts the incidence and mortality rates in our regions.

CRC is also a cancer among those requiring a policy of care, from the stage of organised or individual cancer screening to follow-up as part of the various treatments delivered. Several studies have been carried out in Martinique by the Martinique Cancer Registry, on the evolution of this cancer but also on the factors conditioning survival by age at diagnosis.<sup>6 8 9</sup> Additional studies are underway to analyse regional survival within the French

West-Indies and should allow a better understanding of the profile of cancer patients in our region. In France, this cancer benefits from a prevention programme which involves health actors from the general practitioner to integration within the framework of the hospital care pathway.

Liver cancer includes primary carcinoma of the liver or hepatocellular carcinoma (HCC, which represents more than 80% of all liver cancers), as well as cancer of the intrahepatic bile ducts. It is more frequent in France than in Europe as whole or in developed countries.<sup>15</sup>

In men, mortality has been declining since 1995 in mainland France, but the opposite trend has been observed in women.<sup>16</sup>

There is also a lower mortality from liver cancer in men in our study for the three regions. Conversely, in women, world-standardised mortality rates show no significant excess or a lower mortality compared with the rates observed in mainland France.

There are numerous established risk factors for primary liver cancer<sup>20</sup> namely: alcohol consumption, hepatitis B and C viruses, obesity,<sup>20</sup> diabetes and tobacco smoking. Bile duct cancer risk factors include liver fluke, biliary tract diseases (primary sclerosing cholangitis and Caroli's disease), and exposure to certain chemical compounds such as dichloropropane or dichloromethane.<sup>21</sup>

Geographical variations in incidence observed over the study period could be explained by heterogeneity in the prevalence of chronic diseases linked to alcohol use, hepatitis B and C, or steatosis.<sup>22</sup> Progress in the management of patients with cirrhosis enables carcinogenesis to continue, and also contributes to the increased number of liver cancer cases,<sup>22</sup> notably cancer of the intrahepatic bile ducts, whereas other histological types, such as HCC, are on the decline.<sup>23</sup> The distinct geographical distribution of the main risk factors for liver cancer, particularly alcohol consumption, may explain the disparities between Departments in terms of incidence and mortality.

In women, liver cancer incidence and mortality were respectively 4.0 and 3.7 per 100 000 person-years; in men these rates were respectively 5.9 and 5.6 per 100 000 person-years in the LAC.<sup>14</sup> In our study, our incidence and mortality rates were lower except for French Guiana with an incidence rate of 10.5 per 100 000 person-years in men.

We observed incidence and mortality rates of 4.0 and 3.8 per 100 000 person-years in women in the LAC. In men, these rates were, respectively, 5.0 and 4.9 per 100 000 person-years.<sup>14</sup> In our study, our incidence and mortality rates were higher compared with the LAC.

The incidence of pancreatic cancer is the highest in Eastern Europe, France and Japan.<sup>24</sup> In France, the incidence rate for pancreatic cancer is higher than the average of the 28 EU countries.<sup>16</sup> Pancreatic cancer is one of the 10 most frequent types of cancer, and its incidence increased in both sexes between 2005 and 2012, whereas mortality has remained practically unchanged since the 1980s.<sup>16</sup>

Overall, the three regions have world-standardised incidence rates that remain lower than those of France as a whole; mortality from pancreatic cancer is also lower. According to Globocan data for LAC (5.0), in men, the incidence rates were similar than the incidence rates in our study except in Martinique (7.0) where it was higher. In women we observed the results between our study (Guadeloupe: 3.0, Martinique: 4.4, French Guiana: 4.8) and LAC (4.0). However, the mortality rates were higher in our study compared with LAC (4.9) in men. In women the mortality rates were similar between LAC (3.8) and data from our study.

Tobacco smoking and obesity are established environmental risk factors for pancreatic cancer. Low-calorie diets, high alcohol consumption and increased abdominal fat have also been reported to be precipitating factors, while a diet rich in fruit, vegetables and folates, and regular physical exercise are reported to have a protective effect.<sup>22</sup>

## CONCLUSION

Collaborative projects to promulgate this expertise will help to improve knowledge of the clinical, demographic, socioeconomic or organisational factors that contribute to the heterogeneity of cancer burden in the region. Our results are not sufficient to allow trend analysis, but our important to monitor these first results in the future. The next projects of analysis will allow the carrying out of cancer mapping studies as well as the implementation of studies on the risk factors of stomach cancer and the prevalence of *H. Pylori* infection in the Antilles. The study of environmental and behavioural factors is therefore an important issue for a better understanding of the determinants of health and cancer survival.

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#### REFERENCES

- 1 Cancer IAfRo. Population fact sheets. secondary population fact sheets, 2019. Available: <https://gco.iarc.fr/today/data/factsheets/populations/915-caribbean-fact-sheets.pdf>
- 2 Abnet CC, Arnold M, Wei W-Q. Epidemiology of esophageal squamous cell carcinoma. *Gastroenterology*. In Press 2018;154:360–73.
- 3 Thrift AP. The epidemic of oesophageal carcinoma: where are we now? *Cancer Epidemiol* 2016;41:88–95.
- 4 Curado MP, de Oliveira MM, de Araújo Fagundes M. Prevalence of Helicobacter pylori infection in Latin America and the Caribbean populations: a systematic review and meta-analysis. *Cancer Epidemiol* 2019;60:141–8.
- 5 INCa. Plan cancer 2014–2019. secondary plan cancer 2014–2019, 2014. Available: <http://www.e-cancer.fr/Expertises-et-publications/Catalogue-des-publications/Plan-cancer-2014-2019>
- 6 Joachim C, Godaert L, Dramé M, et al. Overall survival in elderly patients with colorectal cancer: a population-based study in the Caribbean. *Cancer Epidemiol* 2017;48:85–91.
- 7 Joachim C, Veronique-Baudin J, Ulric-Gervaise S, et al. Cancer burden in the Caribbean: an overview of the Martinique cancer registry profile. *BMC Cancer* 2019;19:239.
- 8 Joachim C, Véronique-Baudin J, Razanakaivo M, et al. Trends in colorectal cancer in the Caribbean: a population-based study in Martinique, 1982–2011. *Rev Epidemiol Sante Publique* 2017;65:181–8.
- 9 Joachim C, Macni J, Drame M, et al. Overall survival of colorectal cancer by stage at diagnosis: data from the Martinique cancer registry. *Medicine* 2019;98:e16941.
- 10 Chatignoux Édouard, Remontet L, Iwaz J, et al. For a sound use of health care data in epidemiology: evaluation of a calibration model for count data with application to prediction of cancer incidence in areas without cancer registry. *Biostatistics* 2019;20:452–67.
- 11 Segi M. *Cancer mortality for selected sites in 24 countries (1950–57)*. Sendai: Department of Public Health, Tohoku University of Medicine, 1960.
- 12 Arnold M, Soerjomataram I, Ferlay J, et al. Global incidence of oesophageal cancer by histological subtype in 2012. *Gut* 2015;64:381–7.
- 13 Bray F, Ferlay J, Soerjomataram I, et al. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin* 2018;68:394–424.
- 14 Cancer IAfRo. GLOBOCAN cancer OBSERVATORY 2020. secondary GLOBOCAN cancer OBSERVATORY, 2020. Available: <https://gco.iarc.fr/>
- 15 Ferlay J, Soerjomataram I, Dikshit R, et al. Cancer incidence and mortality worldwide: sources, methods and major patterns in GLOBOCAN 2012. *Int J Cancer* 2015;136:E359–86.
- 16 Binder-Foucard F, Bossard N, Delafosse P, et al. Cancer incidence and mortality in France over the 1980–2012 period: solid tumors. *Rev Epidemiol Sante Publique* 2014;62:95–108.
- 17 Sitarz R, Skierucha M, Mielko J, et al. Gastric cancer: epidemiology, prevention, classification, and treatment. *Cancer Manag Res* 2018;10:239–48.
- 18 Fock KM. Review article: the epidemiology and prevention of gastric cancer. *Aliment Pharmacol Ther* 2014;40:250–60.
- 19 Karimi P, Islami F, Anandasabapathy S, et al. Gastric cancer: descriptive epidemiology, risk factors, screening, and prevention. *Cancer Epidemiol Biomarkers Prev* 2014;23:700–13.
- 20 El-Serag HB. Hepatocellular carcinoma. *N Engl J Med* 2011;365:1118–27.
- 21 Lauby-Secretan B, Scoccianti C, Loomis D, et al. Body Fatness and Cancer—Viewpoint of the IARC Working Group. *N Engl J Med* 2016;375:794–8.
- 22 IARC. List of classifications by cancer sites with sufficient or limited evidence in humans VT. secondary. Available: <https://monographs.iarc.fr/wp-content/uploads/2018/07/Table4.pdf>
- 23 Petrick JL, Braunlin M, Laversanne M, et al. International trends in liver cancer incidence, overall and by histologic subtype, 1978–2007. *Int J Cancer* 2016;139:1534–45.
- 24 Ferlay J. GLOBOCAN 2012 - Cancer Incidence and Mortality Worldwide: IARC CancerBase Secondary GLOBOCAN 2012 - Cancer Incidence and Mortality Worldwide: IARC CancerBase, 2012. Available: [http://globocan.iarc.fr/Pages/fact\\_sheets\\_cancer.aspx](http://globocan.iarc.fr/Pages/fact_sheets_cancer.aspx)